APPENDIX A • TECHNICAL SPECIFICATIONS OF THE INCINERATOR

AGNICO EAGLE

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1 ☐ **Proceed to next submission and status.**

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By: Dominique Richard — Signature numérique de Dominique Richard Date : 2017.09.25 11:37:18 -04'00' **Date:**

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Agnico Eagle No. 6515-S-265-008-154-MNL-0002 **R:** Sub002

DOCUMENT FOR INFORMATION

Bolts and torques for breech and stack installation pg.33 & pg.35
Capacity typo corrected pg.47
Table of content added
Parts list added pg.123-128
Stack erection revised pg.35&36

ECO WASTE SOLUTIONS

Meliadine Incinerator
ECO 1.75TN 1PVC100L
16-1MS

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ECO WASTE SOLUTIONS

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SECTION 1

HEALTH & SAFETY PRECAUTIONS

Health and Safety Precautions

This machine has a number of energy sources:

e.g. Electricity
Heavy mechanical parts which may move due to gravity
High Temperature
Explosive Gases
Flammable Liquids

- **THE INCINERATOR HAS THE POWER TO CAUSE SERIOUS INJURY OR DEATH**
- **KEEP CLEAR OF ANY MOVING PARTS AT ALL TIMES**
- **BEFORE STARTING THE CYCLE ENSURE THAT ALL PERSONNEL ARE CLEAR OF THE INCINERATOR**
- **DO NOT ATTEMPT TO START OR OPERATE THIS EQUIPMENT UNTIL THIS MANUAL IS READ THOROUGHLY AND IS UNDERSTOOD**.
- **RESPONSIBILITY FOR THE SAFE OPERATION AND MAINTENANCE OF THE EQUIPMENT SUPPLIED RESTS SOLELY ON THOSE OPERATING IT.**

OBEY THE FOLLOWING SAFETY INSTRUCTIONS:

A qualified person is a person whom the owner of the equipment deems as having the required experience, training and skills to perform the required work.

1. Keep the electrical panel doors closed at all times except when doing electrical trouble-shooting.
2. Allow only qualified people to perform maintenance and troubleshooting on the machine.
3. Open and lockout the Main Disconnect Switch on the electrical control panel while working on the machine.
4. Do not bypass or tie down any of the door safety switches.
5. Do not open any of the doors while the Primary or Secondary Chambers are above 90^0C
6. Do not enter the chamber unless the Emergency Stop Button is pushed in
7. When opening or closing the chamber door keep clear of the door and ensure that the path for the door is clear.
8. Secure the chamber door when it is open so it cannot move accidentally.
9. Immediately correct any fuel leaks.
10. Do not fill the Primary Chamber more than ¾ full. Overfilling can result in poor burning and damage to the oxidizer.
11. Use proper tools, wear goggles, dust mask and gloves while loading and cleaning the oxidizer.
12. This unit is a confined space. Follow the safety rules for working in a confined space.
13. Ensure that all personnel who are going to operate or work on the machine read and understand the above points and are trained in the operation and maintenance of the machine.

SECTION 2

GENERAL DESCRIPTION

General Description - Thermal Oxidation Concept

The **ECO 1.75 TN 1PVC100L Incinerator system** consists of a **Primary Chamber** and a **Secondary Chamber** (also known as the Afterburner). Both chambers are vessels constructed of steel with a special insulating liner known as refractory.

The **Primary Chamber** has **Hydraulic Roof Lifters** installed for loading of the waste material from the top of the **Primary Chamber** and the front door is used for the removal of residual ash.

The waste material is loaded into the **Primary Chamber** until it is ¾ full. Once ¾ full the **Primary Chamber** is sealed and the combustion cycle begins. This type of system is known as *batch-fed* processing.

Primary Chamber

In the first stage, a burner is used to elevate the temperature of the **Primary Chamber** to ignite the waste. Once the **Primary Chamber** reaches a temperature of approximately 650-850°C, the burn process becomes self-fuelling and the burner will shut off. To save fuel and control temperatures, only when the energy contained within the waste is depleted, will the burner periodically turn on. At these operating temperatures, waste is allowed to fully combust and is rendered sterile.

The **Primary Chamber** operates under *controlled temperature* conditions. The amount of heat released, from the burning of the waste, is controlled by limiting the air into the **Primary Chamber** to less than what is required to complete combustion. This is described as *starved air* conditions. With controlled air and temperature the waste is dried, heated and burned thereby releasing moisture and volatile components. The non-volatile, combustible portion of the waste is burned in the **Primary Chamber** to provide heat while the non-combustible portion accumulates as ash.

In the end, the waste volume is reduced by over 90%. Independent tests have shown that the residual ash is non-hazardous, non-leaching and essentially inert. After enduring the combustion process, metals and glass remain intact. Preservation of metals and glass not only protects the refractory lining from damage caused by melted and fused metals and glass, but also allows for post-combustion recycling where possible.

Remaining in the **Primary Chamber** are non-combustibles, such as metal and glass, and carbonaceous residue. The incoming air, subjecting the non-combustibles to high temperatures, further burns the carbonaceous residue. The result is an oxidized ash product.

Controlling the gas velocity through the system is an important factor in limiting pollution. The gases flowing from the **Primary Chamber** are a result of the interaction of the air with the waste during the controlled burning process. Both the quantity and velocity of the gas product vary according to chamber temperature conditions and the type of waste being burned. The integrated controls for the **Primary** and **Secondary Chamber** act to minimize peaking activity thus controlling pollution automatically.

The combustion gases released in the **Primary Chamber** then pass into the **Secondary Chamber** through a turbulent mixing zone where ignition takes place and additional combustion air is provided to complete the burning process.

Secondary Chamber

As waste burns in the **Primary Chamber**, gases containing the products of combustion enter the high temperature zone of the **Secondary Chamber** for cleansing. The **Secondary Chamber** is sized to retain the incoming gases for a minimum of 2 seconds at 1000°C. This chamber utilizes a high output, fully modulating dual fuel (diesel & waste oil) burner to maintain the required temperature (even in the absence of energy input from the first stage which is important when processing wet or low energy waste). This stage employs a large blower, tightly controlled by the control system using a variable frequency drive on the motor. The blower creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour.

The **Secondary Chamber Blower** air is introduced into the **Secondary Chamber** by an air ring manifold that surrounds the **Secondary Chamber**. The manifold has small air jets called tweers that open into the **Secondary Chamber** at the side walls and create a powerful vortex of excess air to mix the incoming gases and ensure complete combustion. The flow of air is tightly managed by the control system using a Variable Frequency Drive (VFD) by controlling the speed of the fan and modulating motors on the blower inlet dampers.

The **Secondary Chamber Blower** is extremely important as it creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour. It also acts to cool the **Primary Chamber** and prevent temperature overruns.

The **Secondary Chamber** burner is a high output burner and its output is self modulated over a broad range for very precise temperature control.

The **Secondary Chamber** is sized to allow two seconds of retention time. This is the time that the gases from the **Primary Chamber** are retained in the **Secondary Chamber** before they exit to the next stage. Two seconds of retention is considered to be ideal to destroy any harmful organic hydrocarbons produced from the **Primary Chamber**.

Main Control Panel

There is one **Main Control Panel** that controls all of the interconnecting modules. The Operator has one simple **Human Machine Interface (HMI)** to start the equipment, view system status and change control settings if required. The system utilizes a PLC (programmable logic controller) to automate its functions. All critical process parameters such as temperature, combustion airflow and burner output are operated using EWS' patented system control program to maintain optimal combustion and air pollution abatement.

Protecting the Environment

Why Incinerate?

As society becomes more environmentally conscious, environmental regulations on the proper disposal of solid waste have become more stringent. As a result, incineration has become an environmentally responsible and socially acceptable alternative for handling waste at the point of need. However, incineration does not eliminate the need to landfill waste but it does reduce the amount of waste that must be placed in landfills.

Primary advantages of incineration are:

- It greatly reduces the weight and volume of waste material that must be disposed of in landfills
- It destroys organic materials that may be harmful or that may be degradable to harmful materials in landfills
- The incinerator sterilizes the waste; that is, the high temperatures in incinerators can destroy any pathogens that may be in infectious waste materials
- The incinerator destroys animal or human pathological wastes that the general public finds objectionable to handle or see.

Environmental Concerns

The general public will not accept incineration as an option for treating waste of any kind, if they do not believe that it is safe environmentally. The primary concerns are about air pollutants produced by the incinerator and the toxicity of the residual ash. This section will present some of the terminology that is important to understanding these concerns. The remainder of the manual will describe how an incineration system can be operated and maintained in a way that keeps environmental releases at an acceptable level.

Air Pollutants of Concern

Particulate matter may be defined as fine liquid or solid matter such as dust, smoke, mist, or fumes found in the gaseous emissions from the incinerator. Particulate matter emissions may have a dark or light color. Particulate matter emissions can be described in terms of opacity. Opacity is the degree to which light is obscured by a polluted gas (a clear window has 0 percent opacity while black paper has 100 percent opacity). Opacity may be measured with the naked eye or using an opacity monitor. Particulate matter is a problem because it can cause or aggravate respiratory problems in humans. It also creates aesthetic problems since it is readily noticed and is a nuisance because of soiling of exposed surfaces on houses and cars.

Hydrochloric (HCl) acid is generated when polyvinyl chloride (PVC) plastic (usually clear plastic) material is burned in the incinerator. The appearance of a white plume or cloud a short distance above the stack indicates that HCl is condensing. The major concerns about HCl are that it causes respiratory problems in humans, contributes to acid rain problems, and causes material damage to metals and concrete.

Toxic metals include cadmium, arsenic, beryllium, chromium, nickel, lead, and mercury. These metals may be found in municipal wastes. These metals are known to be hazardous to human health.

Organic compounds are compounds that contain primarily carbon and hydrogen and may also contain other elements such as oxygen, nitrogen, and chlorine in smaller amounts. Some organic compounds are known to cause or are suspected of causing cancer and are considered hazardous air pollutants. The public's primary concern is related to dioxin and furan emissions, but other organic compounds such as benzene and vinyl chloride may be emitted.

Carbon Monoxide (CO) also is generated during combustion if the combustor is not operated properly. (Your automobile generates some amount of CO.) CO is toxic to humans if concentrations are high enough, and it also is an indicator of combustion quality.

Solid Waste Ash Quality

One of the major objectives of incineration is to generate a high quality ash for land disposal. All pathogens should be destroyed, and almost all organic material should be completely burned. Ideally, no large chunks of unburned waste material (other than metals or glass) should remain in the waste. A measure of ash quality is "burnout," which is the percentage of organic material remaining in the waste. For example, a burnout of 95 percent means that the ash can contain only 5 percent organics. Adequately burned and quenched ash may be disposed of in a sanitary (municipal) landfill. The ash should be stored in covered containers or kept wet prior to transport to the landfill to prevent 'fugitive \ emissions.' Individual landfills may have requirements that must be followed in order for your waste to be accepted. You should familiarize yourself with these requirements to prevent refusal of the waste.

The Operator – Your Role

It is the operator's role and responsibility to protect the environment by:

1. Complying with all emission limits and operating practices specified in the permit to operate.
2. Minimizing emissions of particulate matter, HCl, toxic metals, carbon monoxide, and organic compounds through proper incineration;
3. Operating the incinerator to generate high quality ash that is sterile and can be disposed of in landfills;
4. Minimizing particulate matter emissions from ash handling;
5. Disposing of ash properly by sending it to appropriate disposal sites; and
6. Performing the regular maintenance inspections to catch any operational problems early.

Basic Combustion Principles

The Combustion Process

Combustion of Municipal Solid Waste (MSW) is a chemical reaction. In the incinerator, organic materials and oxygen react rapidly and violently to produce combustion gases and energy in the form of heat and light.

Organic Solid Material + Oxygen $\xrightarrow{\text{Heat}}$ Combustion Gas + Solid Residue + Energy(Heat)

For the reaction to begin and to keep going, all three elements - organic material, oxygen, and heat-must be present. The organic material used in the reaction comes from two sources, waste and auxiliary fuel. Some organic material is contained in most solid waste types. Depending on the fraction of organics and the specific organic composition, the waste may be adequate to sustain combustion. Auxiliary fuel may be used to maintain combustion if the waste material does not contain enough organic material to maintain high temperatures. The combustion reaction between the organic material and oxygen that causes the organics to burn will occur only after the temperature of the organic material is raised to the point that combustion can begin.

Energy in the form of heat is required to raise the temperatures of the incinerator chamber and organic material and O_2. This energy usually is supplied by the auxiliary fuel burners.

Rate of Combustion Air

The oxygen needed for the combustion reaction is supplied by the ambient combustion air. Combustion air is supplied to the combustion chambers through air ports by natural draft. In general, this air contains about 21 percent oxygen (O_2) and 79 percent nitrogen (N_2), so about 21 percent of the total combustion air fed to the incinerator is oxygen that is available to react with the organic material in the waste and fuel. The nitrogen passes through the chamber mostly unreacted; some nitrogen oxides are formed.

Oxygen Reaction

Solid waste contains two types of organic materials

1. Volatile Matter
2. Fixed Carbon

These two types of materials are involved in distinct types of combustion reactions, and the operating variables that control the two types of reaction are different.

Volatile matter is that portion of the waste that is vaporized (or evaporated) when the waste is heated. Combustion occurs after the material becomes a gas. The combustion variables that influence this reaction are gas temperature, residence time, and mixing.

- A minimum temperature is needed to start and sustain the chemical reaction.
- Residence time is the length of time, generally measured in seconds that the combustion gas spends in the high temperature combustion chamber. The residence time must be long enough for the reaction to be completed before it leaves the high temperature zone.
- Turbulent mixing of the volatile matter and combustion air is required to ensure that the organic material and oxygen are well mixed.

Fixed carbon is the nonvolatile organic portion of the waste. The combustion reaction is a solid-phase reaction that occurs primarily in the waste bed (although some materials may burn in suspension). Key operating parameters are bed temperature, solids retention time, and mechanical turbulence in the bed.

- The solids retention time is the length of time that the waste bed remains in the Primary Chamber.
- Mechanical turbulence of the bed is needed to expose all the solid waste to oxygen for complete burnout. Without mechanical turbulence, the ash formed during combustion can cover the unburned waste and prevent the oxygen necessary for combustion from contacting the waste.

Products of complete combustion are:

- Carbon dioxide
- Water

One example of volatile waste is backyard charcoal grill with starting fluid. The starting fluid is highly volatile. When put on the charcoal and ignited with a match, it rapidly volatilizes and burns. The charcoal contains less volatile matter and primarily burns slowly as a fixed carbon bed.

Operating Factors Related to Combustion

The three operating factors that have the greatest effects on the combustion reaction are:

- Combustion airflow rate and distribution,
- Operating temperatures, and
- Waste feed rate and characteristics.

These three factors are all related. Controlling them controls the combustion reaction.

Stoichiometric Air

In the chemical reaction between organic materials and oxygen, the amount of oxygen required under ideal or "perfect" conditions to burn all of the organic materials with no oxygen left over is called the stoichiometric (or theoretical) oxygen level. The amount of combustion air associated with that oxygen level is called the stoichiometric air level. At stoichiometric air level the combustion gas would contain no oxygen because it would all be used in the combustion reaction.

Substoichiometric Air

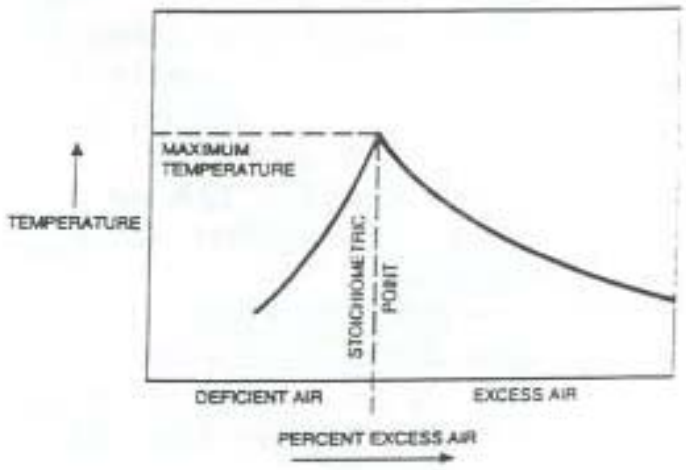
Airflows less than those required at stoichiometric levels are called deficient air or substoichiometric starved-air levels. Under starved-air conditions, the combustion gas would again contain no oxygen, but organics also would remain because combustion is not complete.

Excess Air

Air flows greater than those required at stoichiometric levels are called excess-air levels. Typically an incinerator operates with an overall 140 to 200 percent excess air level. That is, the incinerator operates with one and one-half to two times more air than required at stoichiometric levels. Excess air is used to assure that enough oxygen is available for complete combustion.

Control of Temperature as a Function of Air Level

Maximum combustion temperatures are always attained at stoichiometric conditions. As the amount of excess air is increased above the stoichiometric point, the temperature in the incinerator drops because energy is used to heat the combustion air. If the amount of combustion air is too great, the temperature drops below “good combustion temperature," and undesirable combustion products are generated as a result of incomplete combustion. As the amount of excess air is decreased, the combustion temperature increases until it becomes maximum at the stoichiometric point. Below the stoichiometric point, the temperature decreases because complete combustion has not occurred.



CONTROL OF TEMPERATURE AS A FUNCTION OF EXCESS AIR

The relationship of how combustion air level can affect temperature has just been shown. Temperature also plays an important role in the combustion of waste. Temperatures need to be maintained at levels high enough to ensure pathogen destruction and to sustain the combustion reaction. However, temperatures that are too high also cause problems. Continuous exposure of the combustor refractory to high temperatures is generally not desirable because it can cause the ash to fuse and can cause damage to the refractory.

Waste Characteristics

The primary characteristics of the waste that affect the combustion reaction are:

- The heating value
- The moisture content
- The chlorine content

Different wastes have different heating values and moisture contents. They will affect the combustion process.

The HEATING VALUE of a waste is a measure of the energy released when the waste is burned. It is measured in units of Btu/lb (J/kg). A heating value of about 5,000 Btu/lb ($11.6x10^{-6}$ J/kg) or greater is needed to sustain combustion. Wastes with lower heating values can be burned but they will not maintain adequate temperature without the addition of auxiliary fuel. The heating value of the waste can be used to calculate total heat input to the incinerator where:

Heat Input (Btu/h) = Feed Rate (lb/h) x Heating Value (Btu/lb)

Heat input to the incinerator will affect temperature. More heat input yields higher temperature. Heat input also will affect air requirements; more air is required (1 SCF/100 Btu).

MOISTURE is evaporated from the waste as the temperature of the waste is raised in the combustion chamber. It passes through the incinerator, unchanged, as water vapor. Evaporation of moisture uses energy and reduces the temperature in the combustion chamber.

CHLORINE in plastics or solvents in the waste feed will react to form hydrochloric acid (HCl). This HCl can be an emission problem. It can create corrosion problems of the equipment downstream from the incinerator.

The heating value (Btu value) and moisture varies widely. Compare plastics (high Btu, no moisture) to beddings, shavings, etc. to anatomical.

Summary of Key Operation Factors Affecting Combustion

1 Key factors are interrelated.
2 Air quality/distribution
3 Sufficient air for complete reaction
4 Distributed to promote mixing
5 Mixing
6 Assure contact of oxygen and organics
7 Temperature
8 High enough to sustain combustion
9 High enough to have complete reaction
10 Residence/retention time
11 Sufficient time to allow reaction to complete

Waste Characteristics are also important

12 Heating value
13 Measure of energy released

14 Heat input determines air required
15 Moisture content
16 Requires energy to vaporize water
17 Chlorine content
18 Affects HCl emissions

This summarizes the key parameters affecting combustion.

Products of Combustion Reaction

Complete Combustion

The primary products of waste incineration are:

- Combustion gases
- Solid residue (ash)
- Energy

The primary objectives of the combustion process are to generate an ash residue that is sterile (free of pathogens) and does not contain unburned, recognizable wastes; and to minimize air pollutants in the combustion gas stream.

The organic materials that enter the incinerator with the waste and fuel are primarily made up of carbon, hydrogen, and oxygen. Ideally, these organic materials react with oxygen in the combustion gas to form carbon dioxide and water vapor. The chemical reaction for this ideal situation is

$$\underset{(C,\ H,\ 0)}{\text{Organics}} + O_2 + \text{Heat} \longrightarrow CO_2 + H_2O + \text{Heat}$$

This ideal reaction represents complete combustion.

Incomplete Combustion

However, this ideal reaction does not occur in operating waste combustion systems. Factors that lead to a less than ideal reaction are poor mixing, too little combustion air, and low temperatures. Under those conditions products of incomplete combustion are emitted with the stack gases. The most common product of incomplete combustion is CO. Another product of incomplete combustion that often is emitted under poor mixing conditions or high temperature, low excess air conditions, is elemental carbon (or soot). The soot particles are very fine and generally result in high opacity at the combustion stack. Other products of incomplete combustion that cause concern because of their health impacts are hazardous organic compounds such as benzene, dioxins, and furans. Although these compounds are not found in the waste, under incomplete combustion conditions they can be formed as intermediate combustion products.

The waste feed also includes inorganic materials; generally, they are not involved in the combustion reaction. The inorganic materials in the waste feed (ash) are either retained in the ash or are emitted as particulate matter in the combustion gas. Air velocities in the combustion bed are controlled to reduce the amount of inorganic material entrained (picked up by) the combustion gas and emitted with the combustion gas. If combustion is not complete, organics

will remain in ash; this is typical…it is atypical to have 100 percent combustion of ash bed. Under poor conditions (low temperature, low turbulence in ash bed) may have pathogens remaining in ash; i.e., may not sterilize ash.

Combustion Indicators

The information presented in the above section suggests that the following indicators can be used to monitor combustion quality.

Opacity

The opacity of the combustion gas stream is a measure of the degree to which the stack gas plume blocks light.

- High opacities indicate high emissions.
- Opacity is primarily caused by noncombustible ash or uncombusted carbon (soot) in the flue gas.
- High opacities can indicate poor mixing or low levels of combustion air.
- High opacities also may be generated by high levels of HCl emissions or poor burner operation in the secondary chamber.

If a large amount of water vapor is present in the combustion gas, the water can condense when it cools as it leaves the stack forming a dense white "steam plume." This is not an indicator of poor combustion and should not be confused with a black or white smoke plume caused by soot or acid gases. Opacity can be visually determined by a person or measured by an instrument.

Other indicators which provide information about combustion conditions are measurements of the combustion gas oxygen and CO levels. However, these measurements require instruments and most facilities do not have those instruments.

Ash Quality

Visual appearance of ash can be an indicator of combustion problems. If an incinerator is operating properly, little organic material will remain in the ash. Whitish gray ash indicates better burnout and less carbon than black. The extent of organics combustion can be measured by the quantity of combustible materials remaining in the ash. Noted increases in combustibles in the ash indicate a combustion problem which may include bed temperatures that are too low, improper distribution of combustion air in the bed, or insufficient waste retention times.

SECTION 3

PHOTOS OF THE INCINERATOR

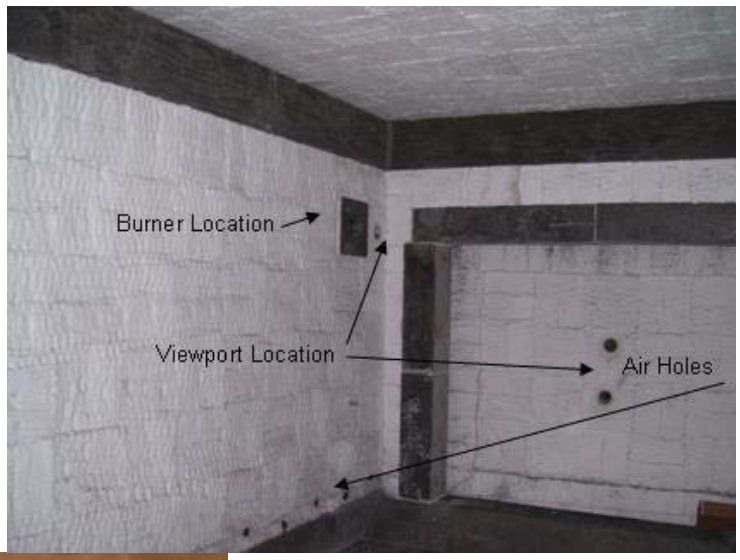
NOTE some of these are sample photos and may not depict the actual Incinerator components

Primary (right) & Secondary (left) Chambers

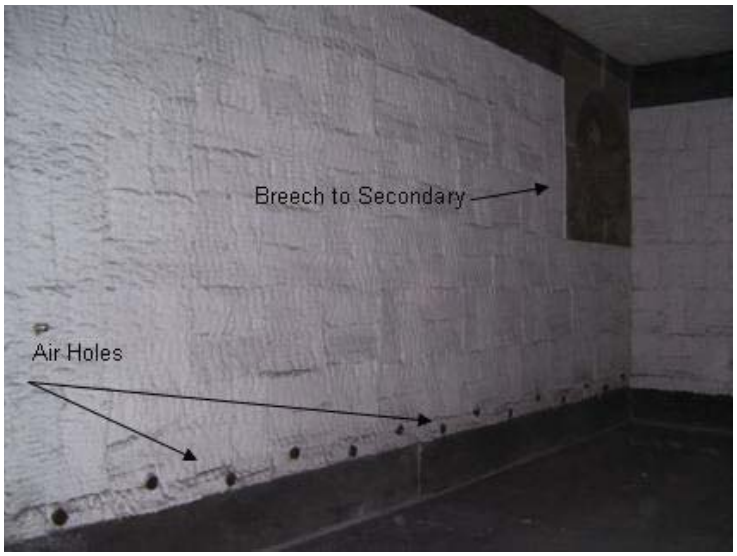
NOTE **Stack sections and breech have not been installed.**

Primary Chamber Access Door View

Primary Chamber Interior View (sample picture)



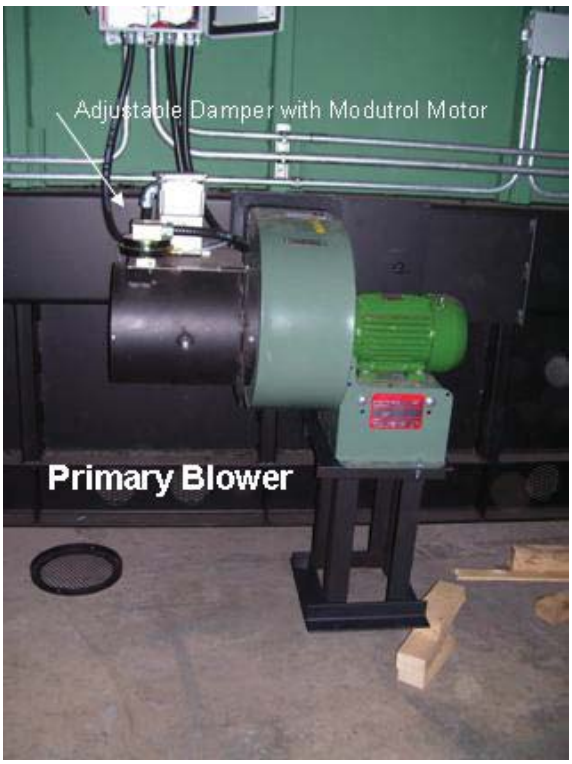
Floor and grate detail



Secondary Chamber Door View

Secondary Chamber / T-section View

Primary Chamber Blower



Secondary Chamber Blower

Adjustable Damper and Modutrol Motor

Primary Chamber Burner

NOTE **Burner is shown without cover installed.**

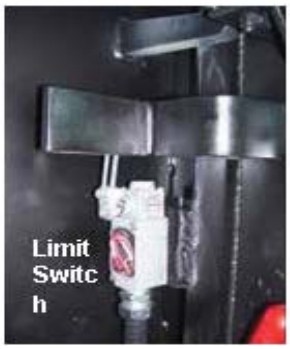
Diesel Tank (4,500lt)

Secondary Chamber Burner

Waste Oil Tank (5,000lt)

Main Control Panel

Thermocouple, Viewport and Limit Switch



T-Stack and Stack Sections

Spark Arrestor

SECTION 4

ASSEMBLY & INSTALLATION INSTRUCTIONS

General Assembly and Installation Overview

The incinerator is factory pre-assembled to ensure proper fit then shipped disassembled. On-site assembly by certified trade's people is required. Trades people (Riggers, Mechanical Contractors, Millwrights, Electricians, Gas Fitters, etc) are to be arranged by Purchaser and/or Contractor.

This is a **general overview**, therefore, project specific details must still be considered. Please refer to relevant data and drawings supplied by EWS.

Purchaser/Contractor Responsibilities

These responsibilities include, but are not limited to, the following:

1. Ensure all concrete and structural steelwork, as may be required, is adequate to support the incinerator and associated equipment. The Purchaser/Contractor is responsible for all concrete design such as slab thickness, footing depths and dimensions and any placement reinforcement so as to be consistent with all applicable building codes.

2. Supply of any anchor bolts when applicable.

3. Provide all utility services to the equipment including fuel, electrical, water, air, etc, as may be required.

4. Provide adequate air makeup to the incinerator room through forced air circulation blowers, air intakes and/or opened louvers to avoid the creation of negative pressures within the building.

5. Observe caution in the selection of materials and coating of building walls or other structural components to the incinerator area giving due consideration to high-localized temperatures of the incinerator.

6. Provide all external thermal insulation when required on steam piping, water piping, etc.

   NOTE External thermal insulation should never be applied to any surface of the incinerator or refractory lined stacks and breeching. If applied to these surfaces, structural damage may result.

7. Provide proper roof thimbles, clearances, flashing and counter flashing around all roof penetrations, including the incinerator stack.

8. Guying of all stacks (if required) is to be done by the Purchaser/Contractor. Guying should be at three points at 120° apart or four points at 90° apart. The Purchaser/Contractor provides design of guying and guying connection points to the stacks. Torque draw band bolts to 35 lbs. during stack assembly.

9. Provide proper protection of all equipment from damage, vandalism and weather, while on-site and/or when installation is in progress.

10. Provide all touch up painting and cleanup of equipment after erection.

11. Inspect and field weld miscellaneous flanges, when applicable.

12. Supply all main fuel line regulators at connection points to the Incinerator. Fuel lines should be sized for maximum pressures and instantaneous fuel flow at cold starting. Pressures should be based under flow conditions, not static. Static pressure should never exceed the design pressure of the pressure regulator. Gas volume includes burner pilot requirements.

13. General Arrangement drawings are normally provided by EWS. As soon as possible after acknowledgement of a Purchaser/Contractor's order, it is the responsibility of the Purchaser/Contractor to provide EWS with all applicable sketches, layouts, building drawings, roof and floor elevations and other pertinent information to allow preparation of the General Arrangement drawings. With this information, the Purchaser/Contractor's will provide desired orientation of the chambers.

14. The Purchaser/Contractor must recognize the importance of proper waste material descriptions concerning physical and chemical properties. Changes in waste composition to be incinerated should be made known to EWS, as soon as possible.

15. It is the Purchaser/Contractor's responsibility to obtain all construction, operating and environmental/air emissions permits as may be required in the area of jurisdiction for the incinerator equipment. EWS will assist in supplying all technical information required for these permits to the Purchaser/Contractor.

16. The Purchaser/Contractor must be aware that certain components will be broken down for shipment purposes and reassembly will be required in the field by the Purchaser/Contractor.

17. Locating and mounting the incinerator in a confined area should be avoided. The Purchaser/Contractor should maintain ample space around all equipment for maintenance, cleaning and safety considerations. A rule of thumb would be to provide a minimum of six feet from all major equipment surfaces and edges. Always allow proper space for the swing radius of loading doors, cleanout doors and electrical panel doors. If space limitations exist, it is the Purchaser/Contractor's responsibility to make EWS aware of these dimensional restraints so that modifications may be considered.

18. Do not scale drawings: If certain dimensions are required which are not shown on drawings, the Purchaser/Contractor should contact EWS Project Manager. EWS will not be responsible for any dimensional conflicts resulting from dimensions not shown on a certified drawing. Do not use general sales literature or other general equipment submittals for construction unless so indicated. EWS reserves the right to change equipment dimensions as required for design purposes.

19. All drawing dimensions are typically subject to ¼"tolerances.

20. If the refractory is shipped in the green condition, the refractory has not been heat cured. This curing process must be accomplished in the field after final erection and assembly. It is understood that the Purchaser/Contractor will provide all required utilities for this curing process and initial equipment operation for adjustments at no expense to EWS including but not limited to fuel, electrical, water, etc.

21. Due to the physical size of the incinerator, the unit is shipped partially dismantled and will, therefore, require reassembly in the field. Consult EWS for maximum component weights so that properly sized cranes are available at the site for unloading and erecting. Purchaser/Contractor may, also therefore, have to reinstall electrical components and control connections, burners, blowers, lifters, etc. These connections are normally of the flexible type with leads marked.

22. Lifting lugs are provided on chambers, stacks, and major accessories. These lugs should be used in setting the pieces into position. Do not attach lifting chains or cables to piping, control panel or mounting flanges as they may be damaged. Avoid dragging lifting gear across painted surfaces as this will cause damage to the high temperature paint. When placing the incinerator into position be extremely careful not to subject the refractory to mechanical shock as this may result in refractory damage.

Step by Step Assembly and Installation Instructions

The following **sequence** applies specifically to the Meliadine Waste Incinerator.

Trades-people required for the following steps:

Forklift Operator, Crane Operator, Riggers, Electrician and Mechanical Contractors (pipe and gas fitter)

Please refer to the supplied drawings and data.

Foundation Drawing: Anchor Bolt and Loading Diagram ECO1.75TN1PVC100L-00D rev.0

1. The incinerator and related components must be installed on a level concrete pad. It is recommended that appropriate consultation with civil engineers and/or architects is taken before designing an appropriate foundation for the equipment.

2. Please refer to General Arrangement Drawing ECO1.75TN1PVC100L-00A rev.1 and its Bill of Materials.

Place the Primary Chamber and Secondary Chamber on the Foundation

3. Locate leg extension for the Secondary Chamber and put into position.

4. Once the leg extensions have been put into place, using a crane, lift the **Secondary Chamber** into position and connect the leg extensions.

Leg extensions

5. Position the Secondary Chamber (item 2) beside the Primary Chamber (Item 1) on the level concrete pad. Ensure that the breech openings on each Chamber are facing each other.

6. Shim with steel shim plates to ensure the Secondary Chamber is level. This is required to prevent rocking, or any movement of the **Secondary Chamber.**

Connecting the Breech to the Secondary Chamber

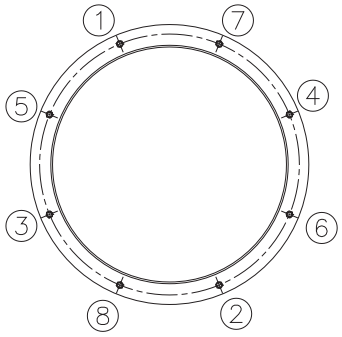
1. Install the **Secondary Breech Gasket,** by spraying the gasket adhesive on the Breech connecting flange and on the gasket material. Line up holes of the **Secondary Breech Gasket** to line up with the flange bolt holes. Press **Secondary Breech Gasket** onto flange securely.

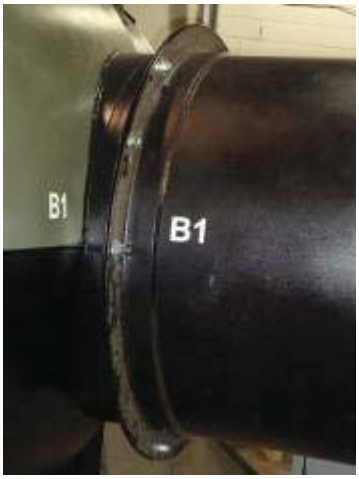
Gasket adhesive spray being applied

Correctly Installed Gasket

2. Raise the **Breech** (Item 7) with forklift and slings, once the **Breech** is 8 to 13 cm from the flange, use alignment bars to help with the final alignment of the two (2) breech flanges, as shown below.

3. Once breech flanges are aligned and together bolt flanges together using the numerical order described in the pattern below using hardware provided.





Correctly installed Breech on Secondary Chamber

Position the Primary Chamber

1. Install the **Primary Breech Gasket,** by spraying the gasket adhesive on the Breech connecting flange and on the gasket material. Line up holes of the **Primary Breech Gasket** to line up with the flange bolt holes. Press **Primary Breech Gasket** onto flange securely.

Gasket NOT installed

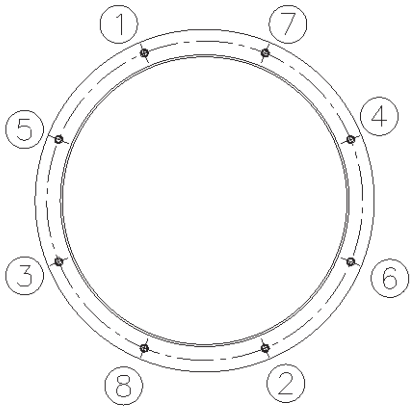
Correctly Installed Gasket

2. While constantly checking alignment of the **Breech** move **Primary Chamber** along the floor using the forklift and skates until the flanges are aligned.

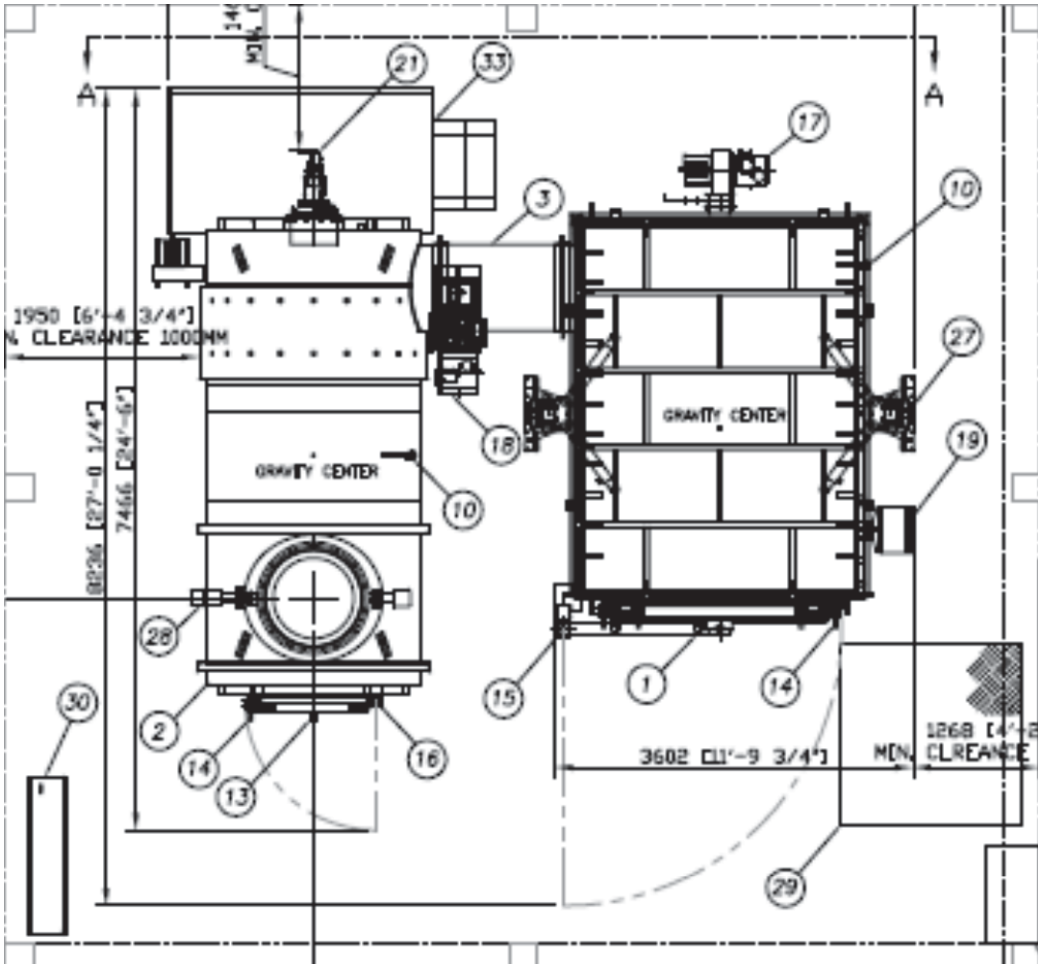
NOTE Do NOT pull the Primary Chamber closer to the Secondary Chamber with the flange bolts. Doing so will bow the steep plate, in turn damaging the breech refractory.

3. Once breech flanges are aligned bolt flanges together, shim and level the Primary Chamber with steel shim plates. Support pads should be shimmed as required to prevent rocking, or any movement of the Primary Chamber.

4. Using the numerical order described in the pattern below using hardware provided.



Correctly Installed Breech on Primary Chamber



NOTE The diagram above shows the burners and blowers already attached to the Primary and Secondary Chambers. When positioning the Primary Chamber, Breech and Secondary Chamber, these items will not be attached.

Installing the Stack

Install stack gaskets between stack sections.

Install refractory-lined *T-Stack Section* on top of the *Secondary Chamber* using the hardware provided. Then install the next four *Stack Sections and the spark arrestor* as per the drawing using hardware provided.

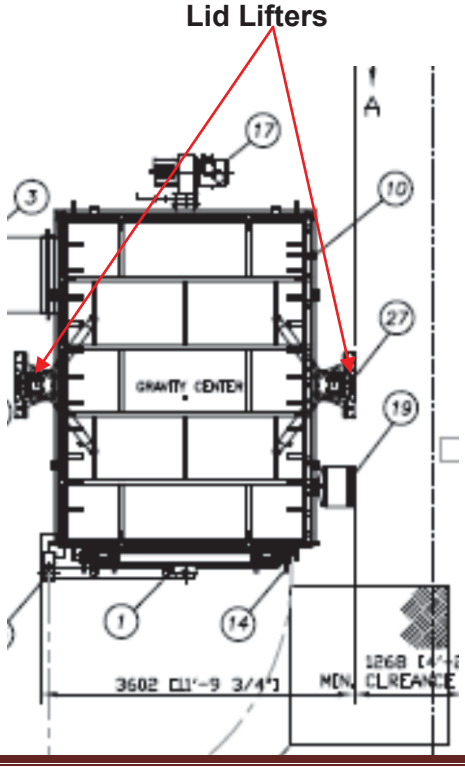
T-Stack and Stack Sections

This is a Sample Photo only of Erection of the Stack Sections

Installing the Lid Lifters

1. Place the lid lifters (item 27) on either end of the Primary Chamber. The slave column, the one without the hydraulic power pack, is to be located in between the chambers.

Lid Lifters



2. Once lifters are in place, shim and level, do not exceed 2.54 cm under the column. Anchor the columns to the floor.

3. Install the pre-assembled hydraulic pump on the master column reinforcement and connect the hydraulic hose and piping.

4. Install the limit switches, proximity switches and solenoid valves with the hardware provided.

5. Install the control stations for the lid lifters (attached to junction box at the master column). Location determined by customer.

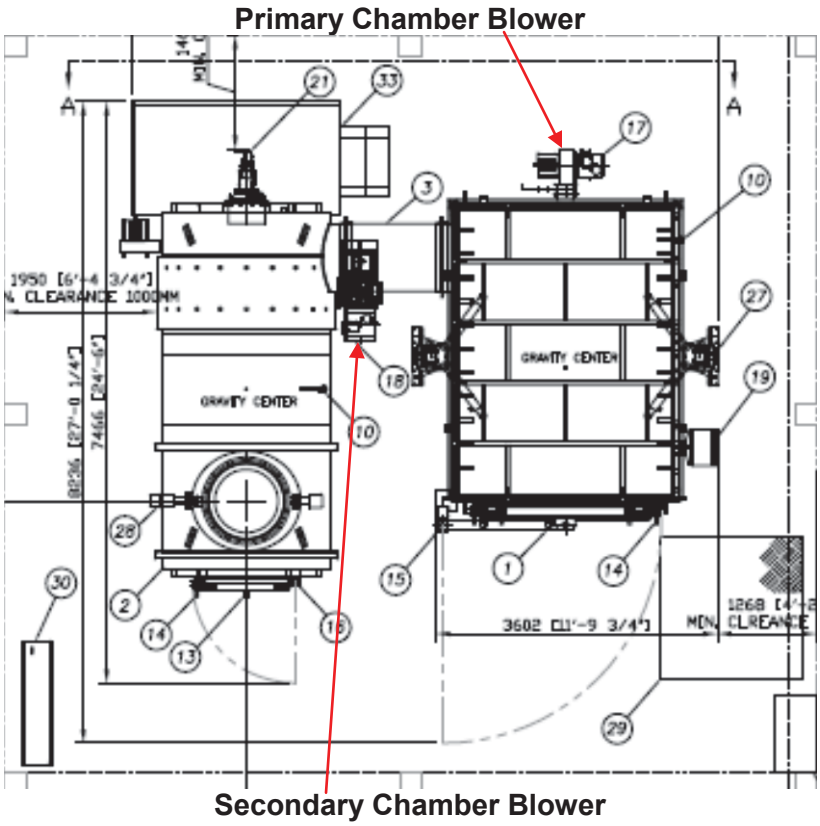
For further detail consult the OEM manual of this lifter in 6515-S-265-008-280-EDS-0015_Sub002.pages175to190

Assembling and Installing the Primary Chamber Blower

1. Place the **Primary Blower** mounting frame where the **Primary Blower** is to be installed.

2. Install **Primary Blower**, shim and level as required with steel shim plates until the flanges are align. Support pads should be shimmed as required to prevent rocking.

3. Bolt together using bolts provided after alignment of all bolt holes



Assembling and Installing the Secondary Chamber Blower

1. Place the **Secondary Blower** mounting frame where the **Secondary Blower** is to be installed.

2. Install **Secondary Blower**, shim and level as required with steel shim plates until the connecting flanges are level.

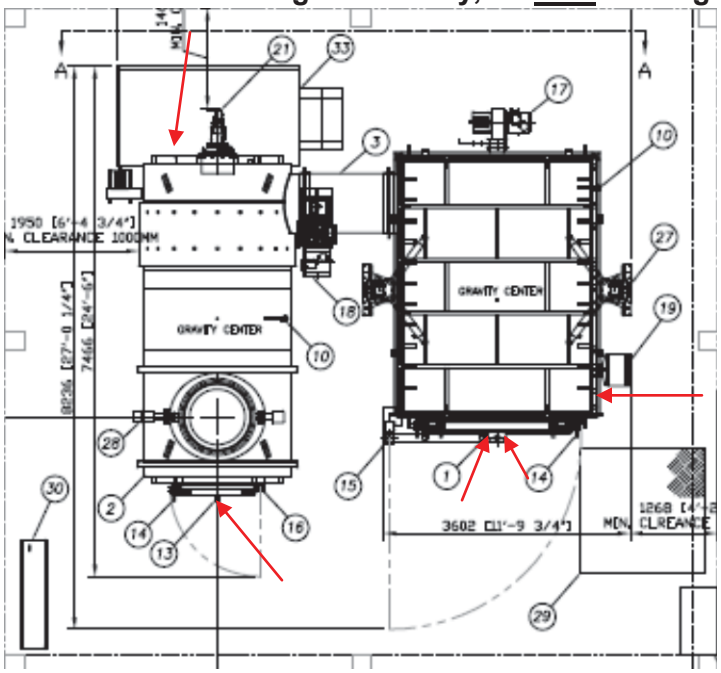
3. Bolt together using bolts provided after alignment of all bolt holes.

Secondary Chamber Blower

Installing the View Ports

1. Install four (5) 2” threaded **Viewports** at positions indicated in red below on **Primary Chamber** door, the left hand side of the **Primary Chamber Burner,** the **Secondary Chamber** door and the right hand side of the **Secondary Chamber Burner.**

NOTE **The viewports should be hand tightened only, do NOT over tighten.**

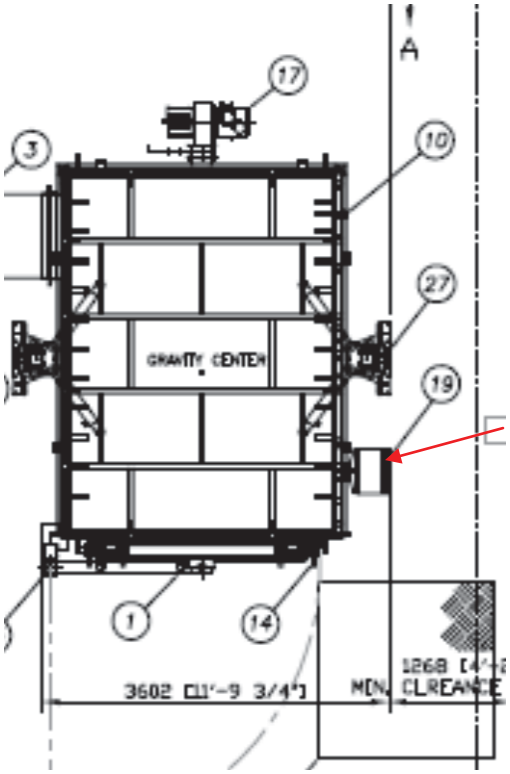


Installing the Primary Chamber Burner

1. Install the **Primary Burner** and burner gasket in the burner port located on the right side of the **Primary Chamber**.

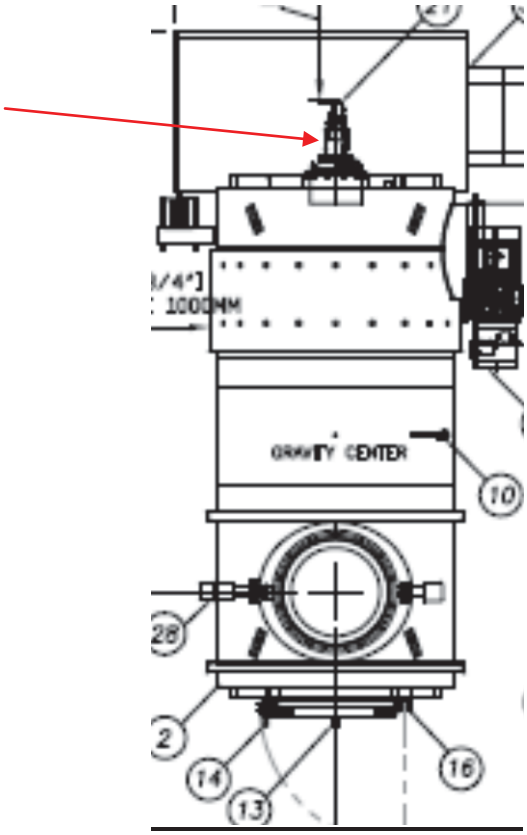
2. Bolt together using provided hardware after alignment of all bolt holes.

Primary Burner shown without red cover installed.



Installing the Secondary Chamber Dual Burner

1. Install the **Secondary Chamber Burner** and gasket in secondary burner ports using the hardware provided. The fuel train is pre-assembled and the final installation to follow the P&ID drawing



It is the customer's responsibility to conform to any local codes when installing the Waste Oil System.

Positioning and Installing the Diesel Tank

The Fuel Tanks are to be installed at ground level as per the site layout. Locations are to be determined by the customer to satisfy all local codes. Interconnecting piping and filters for each burner have been shipped with the equipment

Fuel Connections

Reference: General Arrangement ECO1.75TN1PVC100L-00A rev.1 and P&ID ECO1.75TN1PVC100L-00B rev.1 drawings

NOTE All fuel connections to be done by a certified technician and should satisfy all local codes (all lines to be pressure tested), including the distance between the incinerator system and the fuel tanks. If not properly installed and maintained, the waste oil tank (see image) can become a serious threat to the environment. Ensure the installation follows all local regulations and environmental protection measures.

Even though the tank is double walled, it is highly recommended that the installation site of the storage tank be equipped with a secondary containment system consisting of the following: dikes, berms, or retaining walls and a floor. The floor should cover the entire area within the dike, berm or retaining wall.

WASTE OIL PIPING TRAIN
The Waste Oil piping train consists of:
1. Pump skid.
2. Interconnecting piping.
3. Fuel train to dual burner.

When installing the waste oil piping train check to ensure that:
- Piping is clean.
- That the pipe has been reamed and free of burrs
- The work is done to trade standards

To perform the installation a (½" and 1") pipe threader is needed.

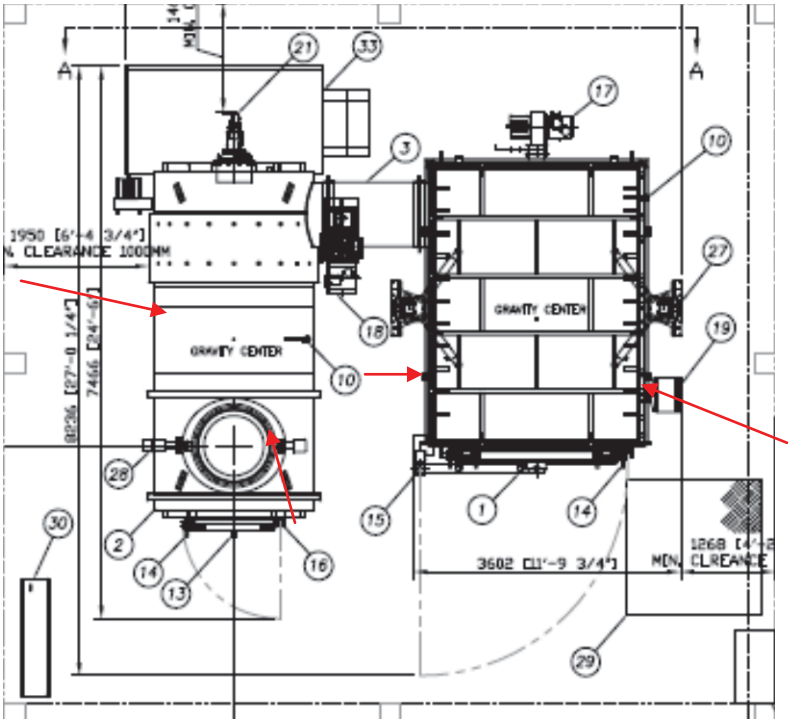
Note: When the pipe installation is complete flush out the line to remove any sediment and dirt that may have contaminated the pipes.

This incinerator system includes two (2) waste oil totes and their correspondent containment, as well as spill kits according to the volume, these items are to be deployed by the customer according with their waste management plan.

Also, two (2) ash bins are included for the storage of the ash removed from the incinerator.

Installing the Thermocouples

1. Install the four (4) ¾" threaded **Thermocouples** at the positions indicated in red below: two (2) in the **Primary Chamber,** one (1) on **Secondary Chamber** and one (1) on **T-Stack**



Installing the Weigh Scale

The weigh scale is to be installed closer to the loading point (to be determined by customer) and anchor it (note: the loading of this incinerator is intended to be through the roof when the lid is in the open position.

Electrical Connections

Reference: Electrical Drawings ECO1.75TN1PVC100L-10A / B/ C/ D rev.0 (17drawings)

NOTE All electrical connections, terminations and conduit installation to be done by a certified electrician and should satisfy all local codes.

1. The **Main Control Panel** should be installed at a minimum of 8' from the Incinerator system.

2. Wiring is necessary (customer's scope) from the power source to the **Main Control Panel** and between the **Main Control Panel** and the **Junction Boxes** on the incinerator and all Teck Cable from the junction boxes to the components.

3. The **Thermocouples** must be wired directly to the thermocouple input card on the **PLC** with the thermocouple wire provided, without splicing the wire. Interconnecting cable has been shipped with the equipment

4. Connect terminal wires. Connect main electrical feed through conduit connection in the bottom of the panel enclosure to the line terminals on the disconnect switch.

5. Run cables to scale and tank

Start Up and Commissioning EWS Field Services

Do not attempt to place the equipment into operation until an EWS Service Technician has inspected all equipment and interlocks.

1. Upon completion of mechanical erection, interconnection of equipment and provisions of utilities as described above, arrangements should be made with the EWS field service department for scheduling of a service technician for initial start-up.

2. An EWS representative must perform start-up of all incinerator systems unless specifically arranged otherwise in writing by EWS.

3. Attempts to start-up incinerator systems by the buyer without prior written approval may result in revocation of all expressed or implied warranties.

SECTION 5

OPERATING INSTRUCTIONS

Important Information

Proper operating and maintenance procedures must be followed in order for the ECO Model Incinerator system to perform at maximum efficiency.

Do not attempt to start or operate this equipment until this Operator Manual is read thoroughly and is understood.

The equipment has been designed with many safety features, however, like all thermal processes; this equipment is not free from the inherent hazards of high temperature processes.

Safety procedures and precautions must be followed at ALL times during operation.

There are safety procedures outlined in this Manual, however, no amount of written instruction can replace good judgment and safe operating practices.

Responsibility for the safe operation and maintenance of the equipment supplied rests solely on those operating it.

There are many engineered features incorporated into the ECO Model Incinerator system to free the operator of repetitive chores. They do not, however, relieve the operator of maintenance responsibilities. In order to maximize the operating life of the equipment, it is strongly recommended that the maintenance procedures, outlined in Section 6, be followed diligently. It is advisable to keep an equipment log for recording maintenance activities along with unusual operation.

NOTE

In the event that the equipment is not operating in the normal manner, contact Eco Waste Solutions immediately at (905) 634-7022 and ask for Customer Service Manager. It is important to report problems as soon as they are noticed to minimize damage that faulty operation could cause.

Design Specification Criteria

The **ECO 1.75 TN 1PVC100L incinerator systems** was designed specifically for the **Meliadine Mine.** Based on information provided, the EWS team designed an incinerator with the following criteria in mind.

Waste Description and Assumptions

Solid waste:

- Food waste (food, food packaging and containers, plastic and paper waste from food preparation) - 50%
- Domestic waste (paper, plastics, bottles, newsprint, cans, cardboard) - 40% Packaging (cardboard boxes, paper, plastic containers, plastic film, Styrofoam, poly-weave bags) - 10%
- Absorbents (Rags, wipes, spill cleanup materials) - negligible
- Medical waste (bandages, dressings, gloves, swabs, syringes, sharps) - Negligible

Waste Oil:

- Used Oils (hydraulic, transmission, motor, crankcase, gear box, synthetic and brake fluids)

The waste is expected to be bagged or stored in skips/bins around the mine operation and then brought to the incinerator building by truck. The waste oils will be brought to the incinerator by totes (handling by forklift or pallet jack).

Waste Quantity

The incinerator is designed to process and treat the waste generated on site, up to 1,750 kg per day. Therefore the ECO 1.75TN 1PVC100L incinerator system was selected, as it will process up to 1,750 kg of camp waste per day in a single batch.

Incinerator Design Parameters

Incinerator Design Parameters	Unit	Details
Secondary Chamber Operating Temperature	°C	1000
Secondary Chamber Retention Time	s	2 (minimum)
Incineration capacity	Kg/day	~~1700~~ 1750
Charge per cycle	Kg	1700
Burn Cycle Duration for entire load	h	less than 10
Cool Down Cycle Duration	h	8 to 12

NOTE

This incinerator was only designed for the type of waste and amount of waste mentioned above. It is important that the waste quantities and characteristics described above are processed in the incinerator. Otherwise, the incinerator system will not operate properly.

It is also important to note that some waste-streams are unacceptable and SHOULD NOT be processed in the incinerator.

Unacceptable Waste-streams

The following is a list of some of the waste streams that should not be processed in this system.

Waste Materials Not Suitable for Processing in Eco Waste Solutions Technology

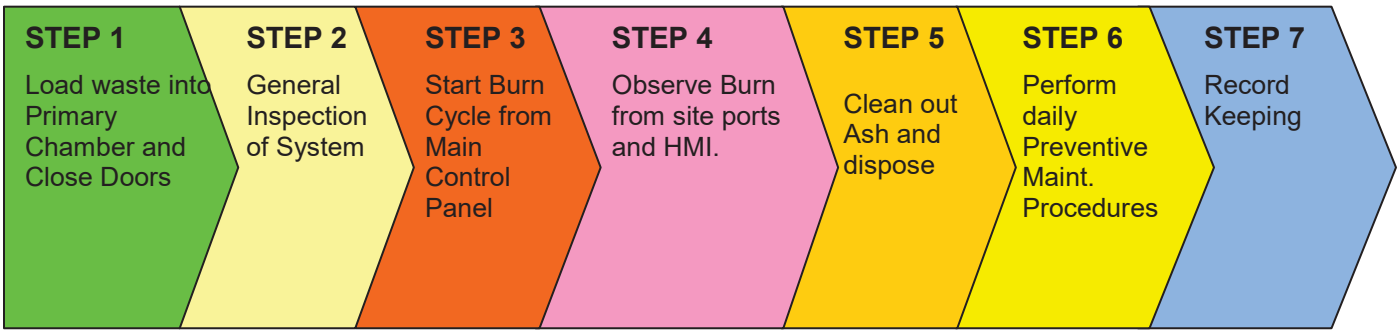
Solid Waste	Description	Origin
Bulky Materials	Automotive or heavy equipment parts such as engine blocks and transmissions	From vehicles and equipment maintenance shop
Non-Combustible Materials	Drywall, asbestos, bricks, concrete, soils	Construction activity
Radioactive Materials	Smoke detectors, laboratory wastes	From Buildings, laboratories
Potentially Explosive Materials	Large propane tanks, other pressurized vessels. Actual explosives	From warehouse, plant and production facilities
Heavy Metals	Items containing lead, mercury, cadmium, for example: batteries, electronic devices, fittings, old pipe work, fluorescent light bulbs, electrical switches, thermometers, PVC plastics, aluminum solder, photovoltaic cells	From maintenance activities, operations and construction activities
Liquid Waste	**Description**	**Origin**
High Alkaline or High Acid Materials	By-products of industrial processes, unrefined fuels	From warehouse, plant and production facilities
Solvents	Solvents such as acetone, xylene, methanol	From vehicles and equipment maintenance shop

Important Notes:

1. These lists are guides and should not be assumed to be an exhaustive list of materials
2. A waste and procurement audit is highly recommended and encouraged to ensure that all sources of heavy metals (especially mercury) are identified and diverted from the incinerator

General Operating Overview

The operation of the **ECO 1.75TN 1PVC100L Incinerator** package follows 7 general steps that take place over a 24-hour period.



Although all 7 steps are critical in the general operation of the incinerator system, this section of the manual focuses on **Step 1, Step 3** and **Step 4** and how to start the system and monitor it during operation.

It is assumed, at this point, that the waste material is properly loaded with the weight, density and type the incinerator is designed for, as outlined on page 5 of this section.

It is also assumed that the waste is loaded after the ash has been removed from the previous burn cycle and any daily maintenance routines have been completed.

This section will also cover **Step 7** on how to use the historical charts, store incinerator data, and access incinerator historical information for record keeping purposes.

Monitoring and Data Acquisition System

Overview

The **Human Machine Interface (HMI)** system automatically monitors the entire process and all system inputs are recorded and logged for record-keeping purposes and also allows for historical trending of key operating conditions.

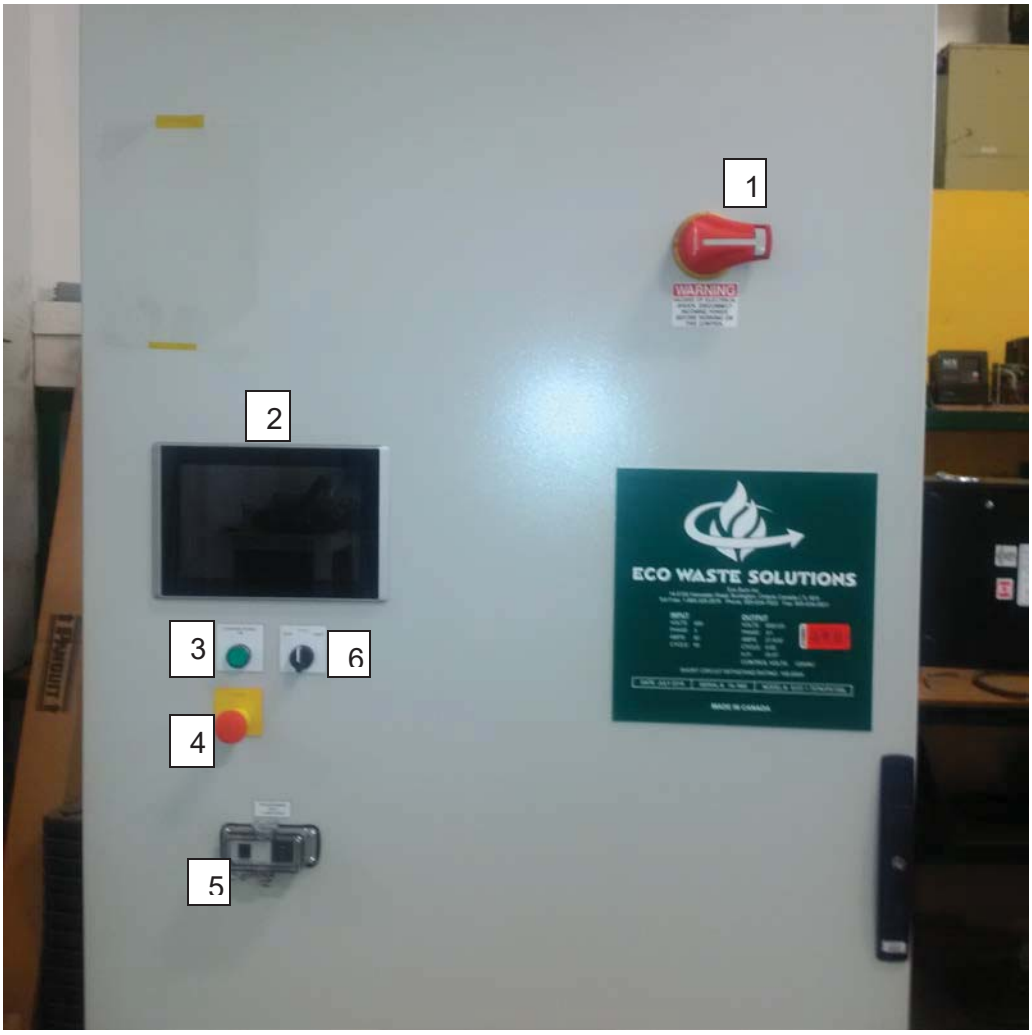
The integrated **Human Machine Interface (HMI)** in the Main Control Panel monitors and records the following:

1. Temperature sensors
2. Differential pressure sensor with transmitter (draft)
3. Monitoring of burner functions
4. Auxiliary burner operation and fan amperage monitoring via current transducer
5. Door position interlock monitoring
6. High temperature limit and interlock
7. Low Fuel level limit and interlock
8. Air proving switch interlocks
9. Waste loading records

All data can be transferred to storage by using USB port (to transfer to PC to print)

HMI Operator Interface

Main Control Panel Components



Number	Name	Purpose
1	**Main Disconnect Switch**	Isolates the incinerator from its source of electric power.
2	**Human Machine (Operator) Interface**	Displays various screens reflecting system performance.
3	**Control Power ON**	1. Green light indicates the control power in the panel is on. 2. Pushing it if the **Emergency-Stop** is out will turn on the control power.
4	**Emergency Stop Pushbutton**	When pushed, shuts down the system and disables any possibility of starting it.
5	**Communications Port**	Allows for communication to/from the PLC
6	**Start Switch**	Activates the system

The Human Machine Interface (HMI)

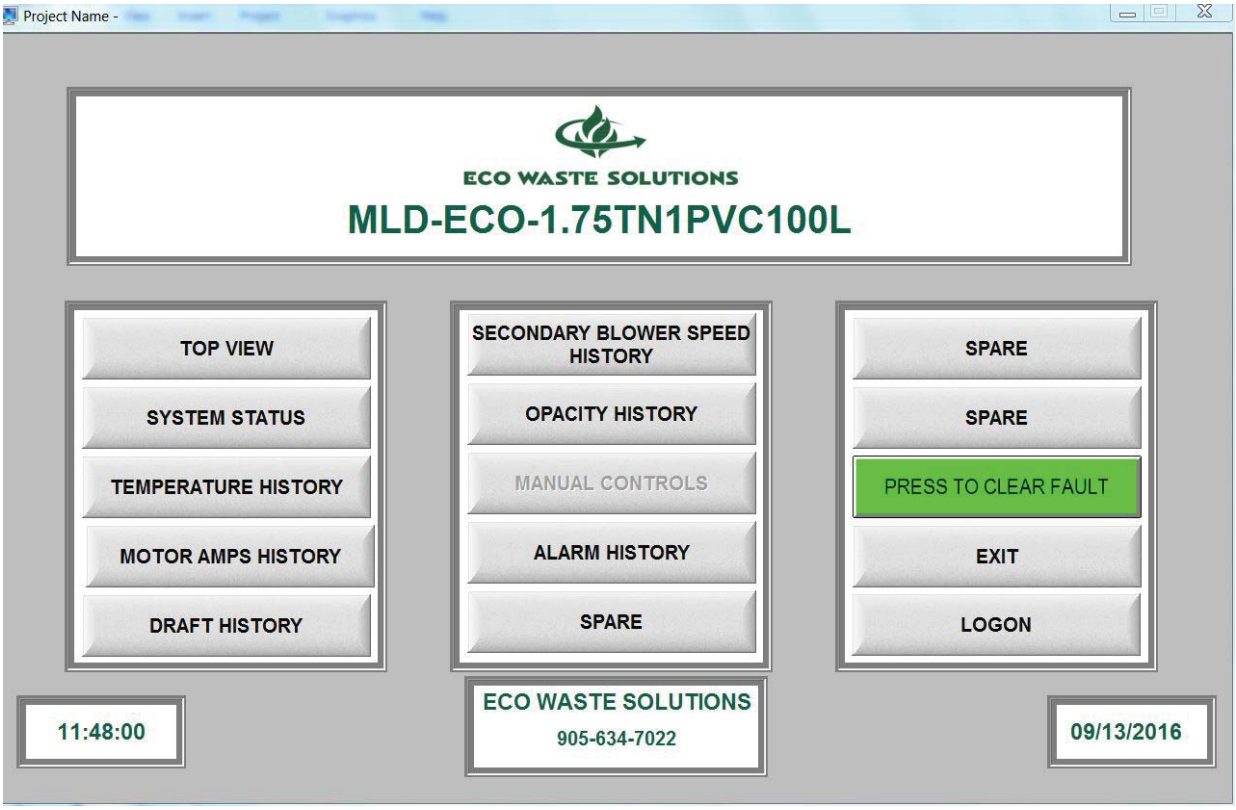
The **Human Machine Interface (HMI)** controls the operation of the incinerator directly from the **Main Control Panel.**

The **Main Menu** screen displays all the available options for viewing the system in operation.

The **Human Machine Interface (HMI)** has a touch-screen and items can be selected by touching them on the screen.

Main Menu

The first screen the operator will view is the **Main Menu** (see below).



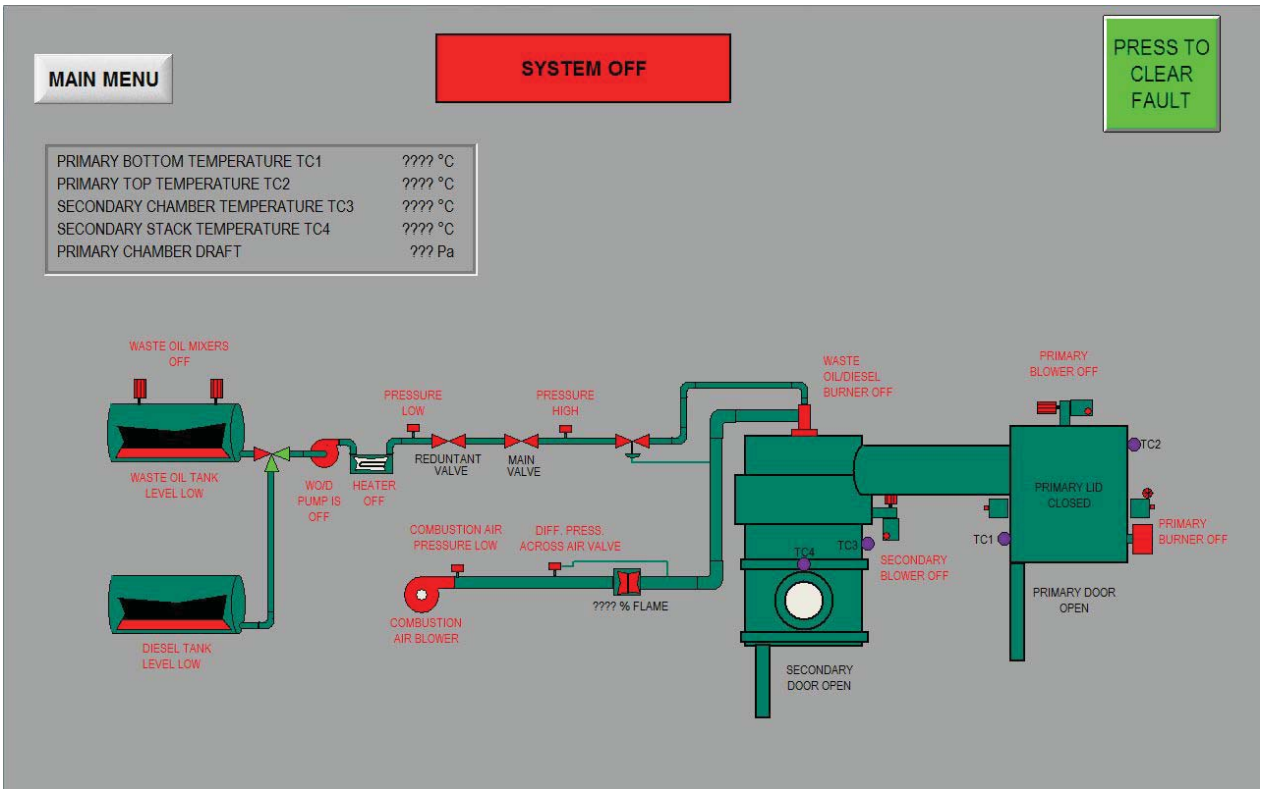
Top View

When the ***Top View*** button is selected, an overview of the incinerator and related components is displayed. This shows key temperatures, flows, and other indicators of what is happening in the process in a real-time basis.

NOTE

The system will not start if there are alarms or faults present. Clear and/or acknowledge faults.

At any time, touch **Main Menu** to go back to the main screen.

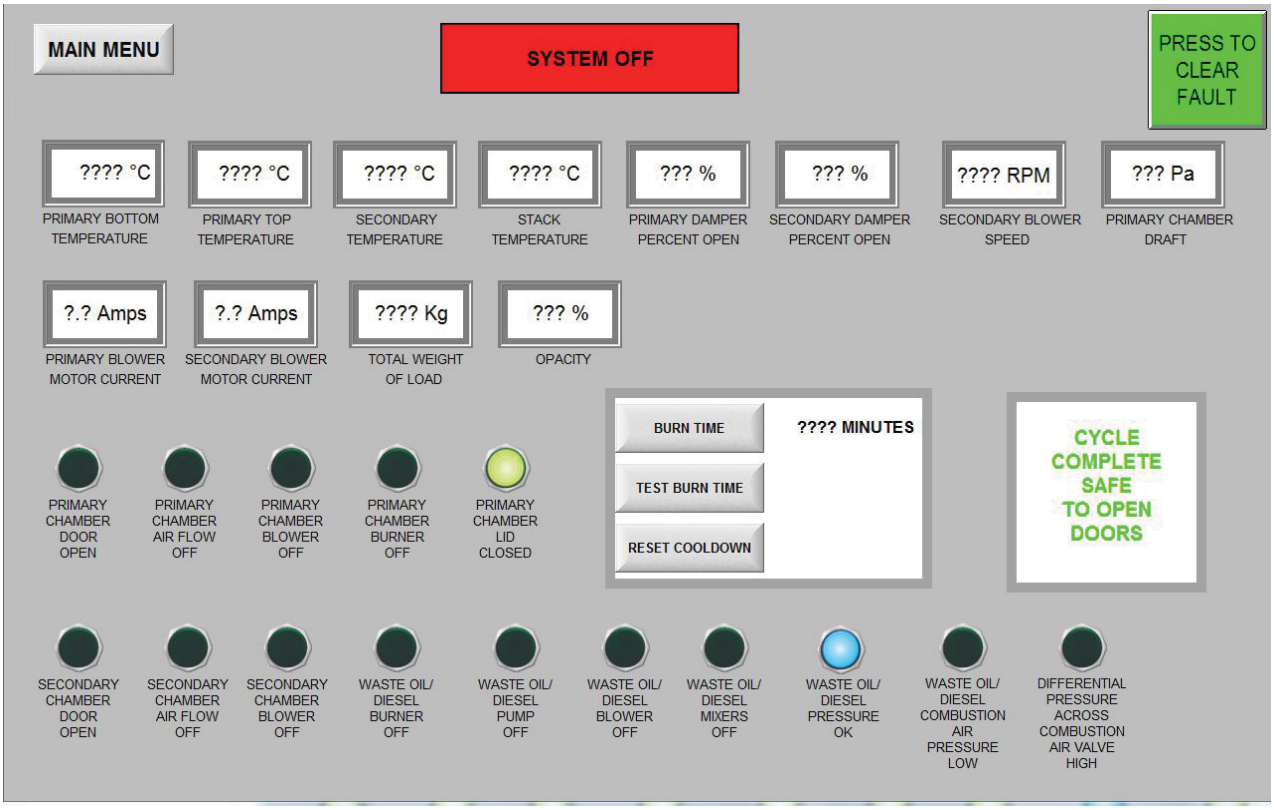


System Status

When the ***System Status*** button is selected from the **Main Menu,** a screen will display the status of all the operating parameters of the incinerator, such as the temperatures and the time remaining in the cycle, as well as displaying other informational items such as status of the door, lid lifter, blowers, etc.

The operator can change the burn time of the cycle by selecting “BURN TIME” and entering a time (in minutes). The operator may do this over time to either prolong the burn time, or decrease the burn time depending on the waste mixture; for example a very wet batch of garbage will take more time to burn than a dryer batch of waste.

At any time, touch **Main Menu** to go back to the main screen.



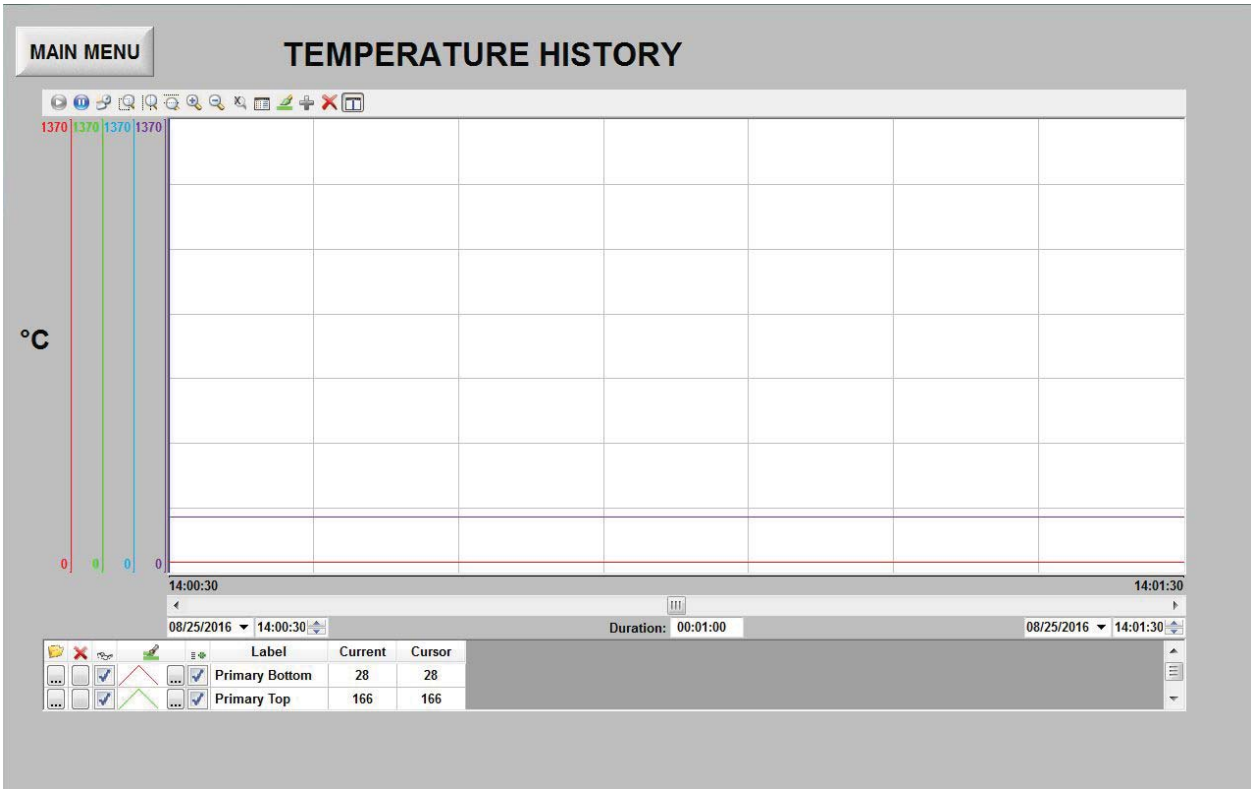
Overview of Historical Charts

The **Human Machine Interface (HMI)** monitors and records (every minute) critical operating parameters of the incinerator system like the temperature, motors, draft, load weights and alarms. Each operating parameter has its own graphic display for the operator to view, at any given time. Each display can easily be selected from the **Main Menu** of the **Human Machine Interface (HMI)**. The display will show the specific data collected from previous burn cycles.

This **Incinerator Data** is important for regulatory purposes and for general operating purposes. Also, the incinerator data is to be downloaded on a weekly basis to USB key for record-keeping purposes.

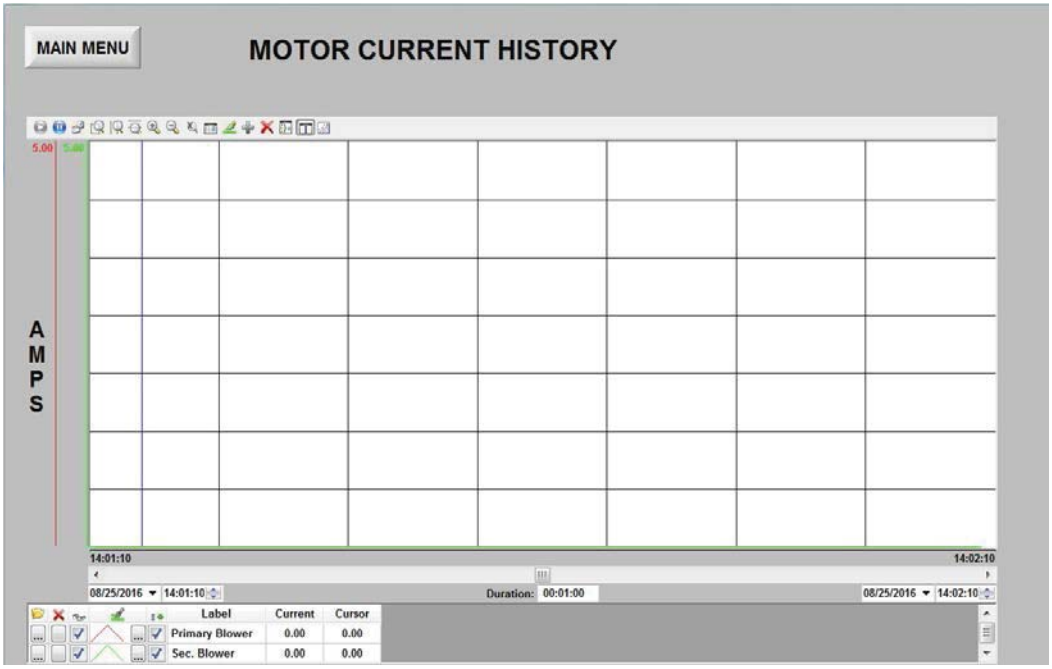
Temperature History

For example, when the ***Temperature History*** button is selected, the screen will display the trend in temperature during the operation of the system, include date & time of occurrence of that specific temperature.



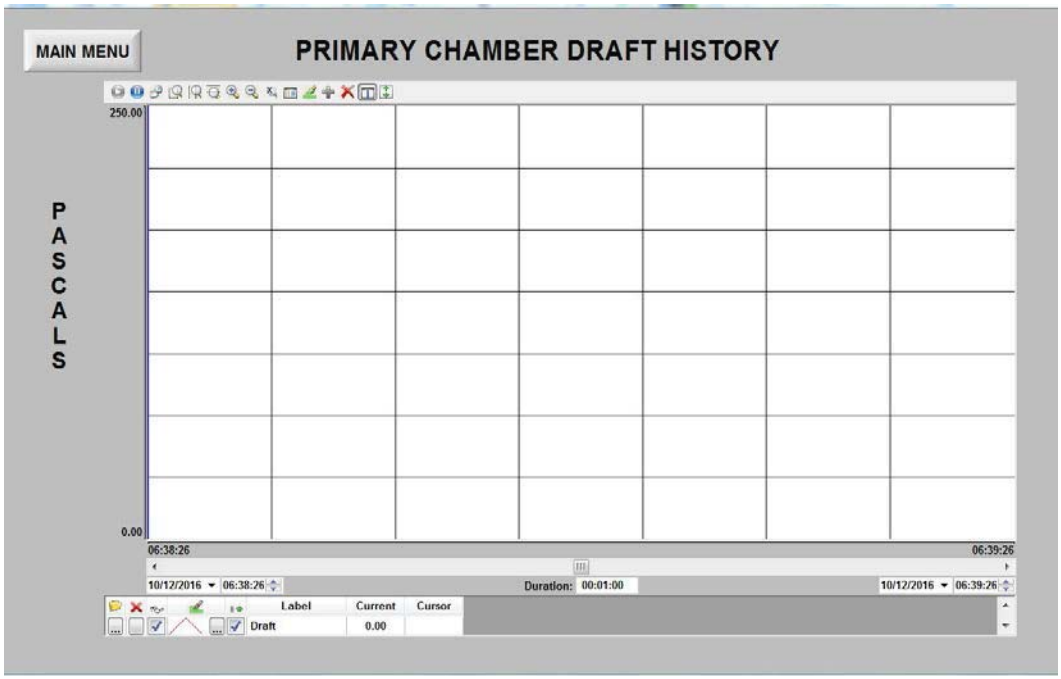
Motor Currents History

When the ***Motor Currents History*** is selected a screen will display the motor currents from the Primary Burner and the Secondary Burner, in AMPS, during the operation of the system, including date & time of occurrence of that specific motor current.



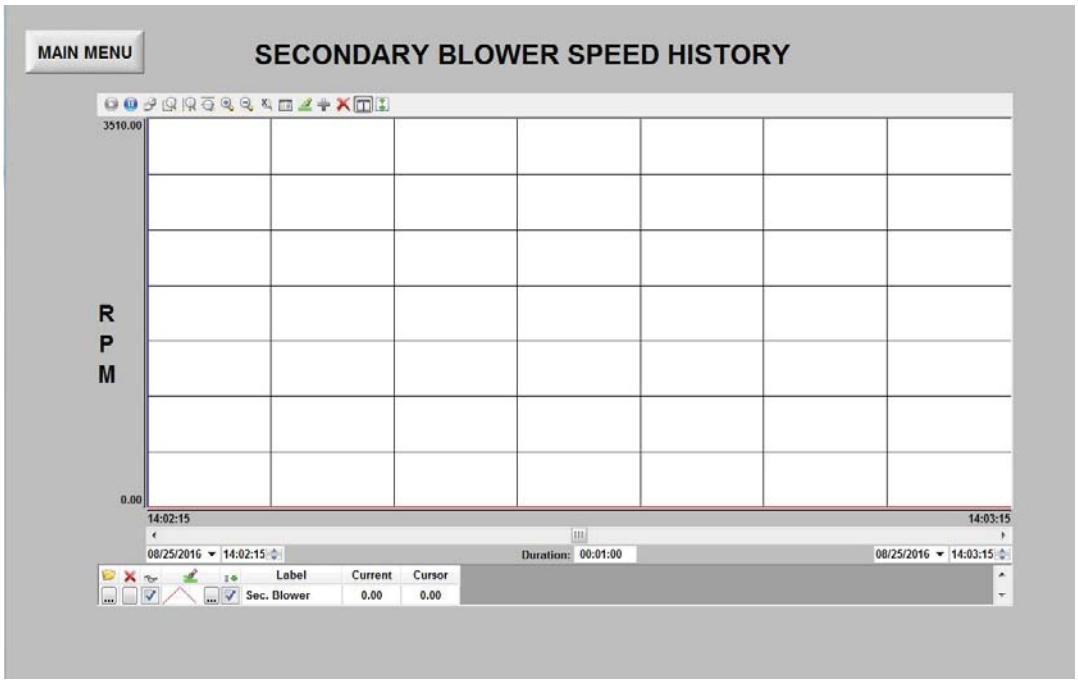
Draft History

When the ***Draft History*** button is selected a screen will display the draft during the operation of the system, include date & time of occurrence of that specific draft trend.



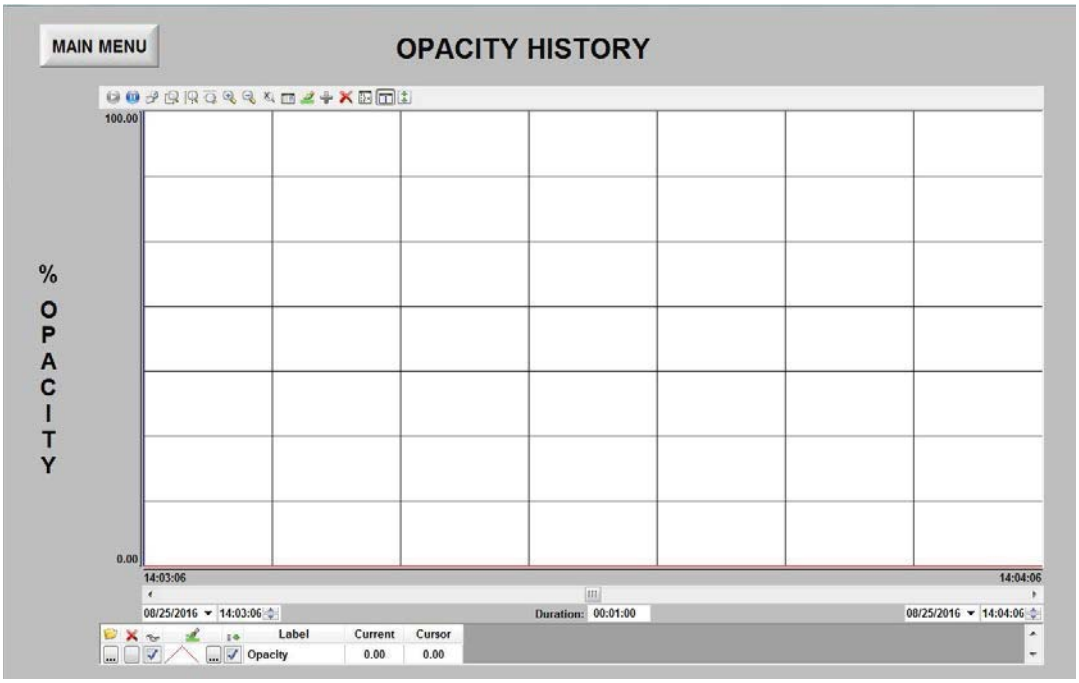
Secondary Blower Speed History

When the ***Secondary Blower Speed History*** button is selected a screen will display the RPM during the operation of the system, include date & time of occurrence of that specific speed.



Opacity History

When the ***Opacity History*** button is selected a screen will display the Opacity during the operation of the system, include date & time of occurrence of that specific reading.

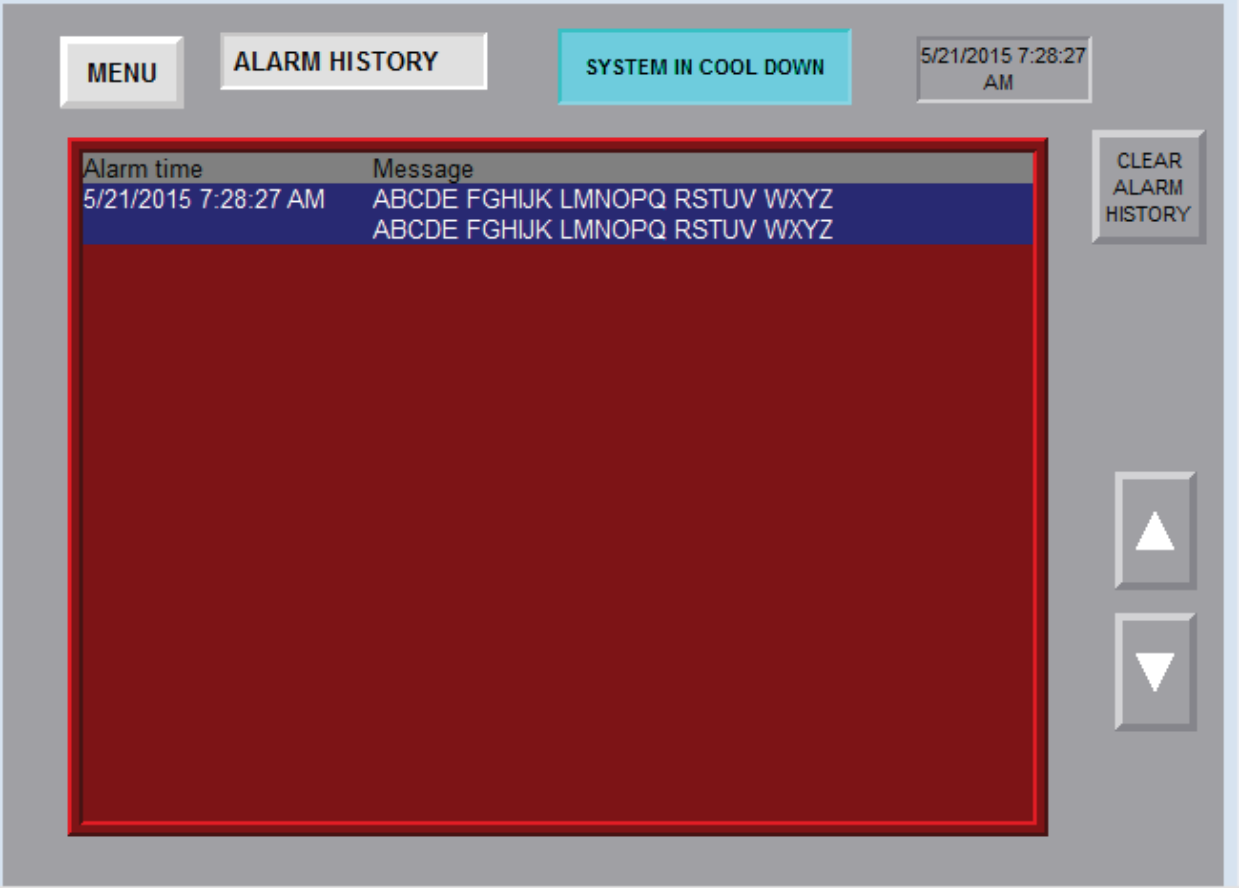


Alarm History

When the ***Alarm History*** button is selected a screen will display the last 128 faults with the date & time of occurrence.

The operator can press the *CLEAR ALARM HISTORY* to clear all of the faults, if they wish to. This does not affect the record-keeping feature of the system.

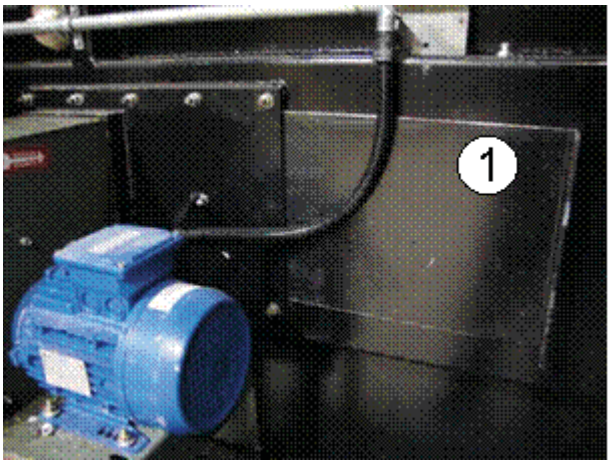
At any time, touch **Main Menu** to go back to the main screen.



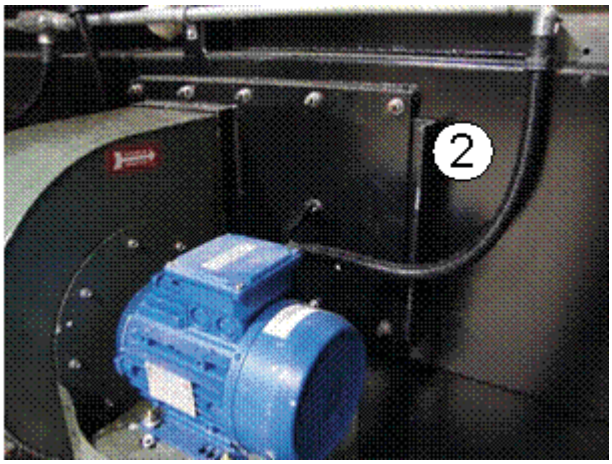
Standard Daily Operating Procedures

Incinerator Daily Start up

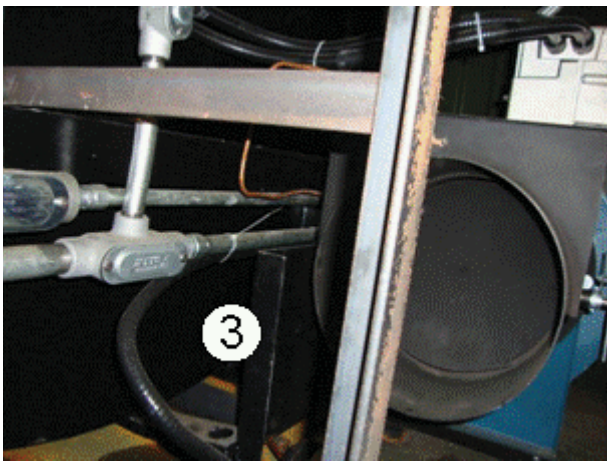
1. Ensure that manual slide gates for each blower are in the open position for free airflow into the **Primary and Secondary Chambers**.



1. **Primary Chamber Blower** Manual Slide Gate Open



2. **Primary Chamber Blower** Manual Slide Gate Closed



3. **Secondary Chamber Blower** Manual Slide Gate Open

2. Visually inspect the burner hoses to ensure that there are no fuel leaks. Check to see if lines are brittle or cracked, check for any oil spills near the burner, which would indicate a leak.

3. Ensure the draft gauge hose connection is tight and sealed. This is a clear flexible tubing located in the **Primary Chamber** (see photo below).

Sample picture

4. Unlatch all clamps on the **Primary Chamber** door, open and secure in the open position

5. Ensure the Primary Chamber floor is cool (less than 90°C). Remove all the ash from the previous burn and store ash is ash bins.
6. Lock the **Primary Chamber** Front Loading Door and ensure all latches are properly engaged.

If the floor is too hot the waste may spontaneously catch on fire during loading.

High Output dual Burner Secondary Chamber Start-up

SYSTEM CHECK

Filter & Pump.(sample image)

Do a walk around the Waste Oil System, ensuring that there are no leaks, all ball valves are in the proper and fully open position for either Diesel or Waste Oil according to the fuel to be used for this specific cycle

Ensure that the correspondent storage tank has enough fuel for the entire cycle.

Using Waste Oil: 800 L minimum of Waste Oil and 300 L minimum of Diesel (the Primary Chamber operated with Diesel only)

Using Diesel Only: 1100 L of Diesel minimum

Both the Waste Oil and Diesel Tanks require at least 150L stored at all time to keep the level sensor closed.

Clean the filter if necessary.

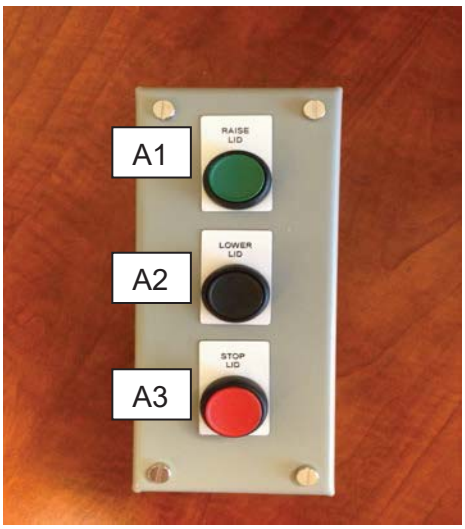
Check that all of the ball valves on the burner fuel oil train are fully open

Check that the Incinerator is not in cool down and the Primary temperature is 90°C or less.

Loading Procedure

Operator Stations for Lid Lifter

The Primary Chamber of the ECO 1.75TN 1PVC100L Waste Incinerator has a lid lifter to allow the roof of the chamber to be opened for quick loading of the waste.



Number	Name	Purpose
A1	**Raise Lid**	Raises the Lid on the Primary Chamber
A2	**Lower Lid**	Lowers the Lid on the Primary Chamber
A3	**Stop Lid**	Stops the lid during raising or lowering.

Once the roof is opened, the chamber can be loaded by the operator with the waste going to the incinerator.

Operating the Integrated Weigh Scale

1. The Operator has two options for managing the waste quantity prior to loading the selected Primary Chamber:

    i. Option 1: The operator will use the hoppers (previously tarred) to load waste onto the weigh scale.

    ii. Option 2: The operator may load waste/garbage (in bags/boxes) on the weigh scale directly.

2. Regardless of the option selected above, once the waste is on the weigh scale the Operator has to push the RECORD WEIGHT (black button) on the Weigh Scale Push-Button Station. By pressing this button, the weight value of that particular load of waste is sent to the PLC and the weight is recorded. At this time, the MAXIMUM WEIGHT (green button) will flash green once to show that the weight has been logged.

3. Then, the operator must take the waste and load it into the Primary Chamber. The hopper is to be raised just past the top edge of the Primary Chamber (using proper lifting equipment by others).

4. Once the hopper clears the edge of the Primary Chamber, the hopper's content can be dumped inside the chamber.

5. The empty hopper can now be pulled from the edge of the chamber and then lowered.

6. The operator returns to the weigh scale with some more waste and repeats Steps 2 to 6. This entire procedure is repeated until the maximum load weight for the Primary Chamber is reached. The PLC will indicate this to the operator when the MAXIMUM WEIGHT (green light) comes on and remains on. This indicates that the maximum weight permitted, in this case, the incinerator is designed for a maximum of 1,750Kg of waste material.

NOTE

No more waste should be loaded into the Primary Chamber after the load has reached the maximum weight.

7. The Primary Chamber is loaded, and the incinerator is ready to start.

Tips for loading: To decrease burn time and allow for more uniform burn.

a. Load the less dense waste first

b. Load dry waste first. Placing wet waste near the top of the Primary Chamber allows moisture to evaporate early in the cycle.

NOTE

Do not load waste greater than 90 Kg using the top loading system. This waste is to be loaded from the front of the unit. Loading waste over 90 Kg from the top will cause refractory floor to fracture.

NOTE

Do not throw the waste towards the sides of the Primary Chamber. Doing so will damage the ceramic blanket refractory.

NOTE

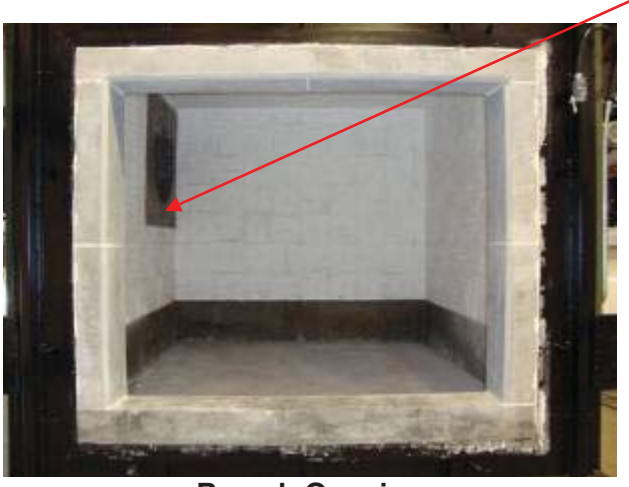
Load only the waste stream that the system has been designed for. DO NOT load a lot of high BTU rated waste for one burn (e.g. do not load more than three (3) gallons of bacon grease, kitchen grease or cooking oil). Doing so will result in excessive temperatures in the system reducing the life of the refractory.

NOTE

Do not load the Primary Chamber above its rated capacity by weight.

NOTE

Do not load the Primary Chamber such that the Breech and Burner section is blocked in any way.



Breech Opening

Burner port

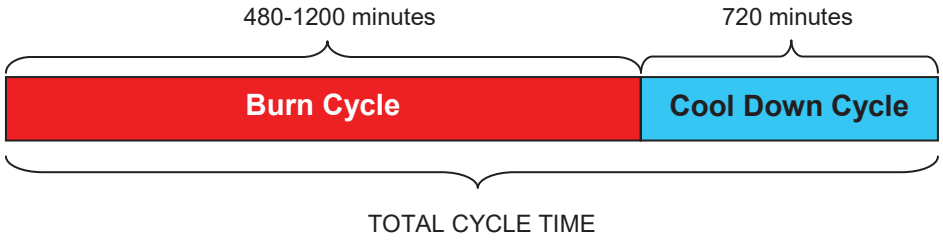
8. Inspect the lid ledge of the Primary Chamber and remove any debris that will prevent a tight seal with the lid.
9. Close the **Primary Chamber** lid by pressing the close button on the Lid Lifter Station. The lid will initially raise, after 0.5 seconds the safety pawls will pull out. Two seconds after sensing that the safety pawls are out the lid will lower.
10. The lid will keep lowering until either the down limit switch is activated or the stop button is pressed.
11. If the stop button was pushed just press the close button to resume lowering. The lid will raise then lower again. When the lid is stopped by either the lower limit switch or the stop button the safety pawls will be released back in.
12. Proceed to the **Main Control Panel.**

NOTE

The burn time will be set to the previous burn, if you wish to change the set time, proceed to the Primary Status screen and click on the BURN TIME button. The minimum number of minutes you can enter is 480 (8 hours). When you have finished, the time will be displayed in minutes beside the BURN TIME button

NOTE

The burn time value (in minutes) determines the length of the burn cycle before cool down cycle starts.



13. Check that the PRIMARY DOOR AND LID are closed on the **Human Machine Interface (HMI)** screens.
14. Check that no alarms are displayed on the **Human Machine Interface (HMI)**
15. Check that the EMERGENCY STOP BUTTON is out.
16. Check the GREEN CONTROL POWER BUTTON is lit up. Press this button to power on the control panel
17. On the **Main Control Panel turn the SELECTOR SWITCH** to the right to start the cycle. The following steps will automatically take place, controlled by the **Main Control Panel**:
    I. The **Primary Blower and Secondary Blower** will purge the system for 2 minutes.
    II. The **Secondary Burner** will purge for safety, and upon completion will ignite.
    III. Once the **Secondary Chamber** temperature reaches 1000°C, the **Primary Burner** on both Primary Chambers will purge for safety and upon completion will ignite.

IV. The burn time will start counting down when the temperature in the **Primary Chamber** reaches 427°C.

NOTE

The Main Control Panel System will maintain proper operating conditions and will provide continuous monitoring capability

After the burn cycle is completed the system will enter the cool-down cycle when the following things will occur:

- Primary Chamber & Secondary Chamber burners OFF
- Secondary Chamber Blower OFF
- Primary Modutrol 100% open
- Primary Blower ON

Once fully cooled and the temperature is below 90°C, proceed to the **Primary Chamber Clean Out Procedures**.

Primary Chamber Clean Out Procedures

Operators responsible for loading and cleaning out incinerators should wear appropriate protective equipment, including eye protection, dust masks, heavy gloves and safety shoes with puncture-proof toes and soles to avoid injury.

Although the ash from the system is considered sterile and will not contain microorganisms, it may contain a quantity of sharp objects, such as broken glass and other sharps which may not be fully destroyed in the burning process, and may thus still pose a hazard to persons who clean out the ash and residues. Also removing the ash does create dust particles in the air. Dust should not be inhaled. The operator must wear dust protection safety gear.

Please follow these steps when the cycle is complete:

1. When the internal temperature of the **Primary Chamber** has cooled to less than 40°C, lock out the power to the system on the **Main Control Panel** by moving the main disconnect to the “OFF” position.
2. Unlock all door latches on the access door to the **Primary Chamber.**
3. While standing in front of the **Primary Chamber** door, slowly open the door to allow clear entry. Secure **Primary Chamber** Door in the OPEN position.
4. With the **Primary Chamber** Door secured in the open position, raise the lid to fully opened
5. Clean the **Primary Chamber** by using ash handling tool(s) and proper safety equipment (not provided).
6. Inspect the interior of the **Primary Chamber** for wear and inspect around the door seals to ensure the door will maintain a tight seal upon closure.
7. Check the air inlet holes and remove any obstructions if necessary.

8. Inspect the door seals to ensure there are no gaps between the door gasket and the door jamb.
9. Close the **Primary Chamber** access door by clamping each latch until it is tight.
10. Clean the inspection **View Port** (glass) with a mild soap and water. To clean the view port, unscrew it by hand and re-tighten by hand.

In Case of Emergency

1. Go to manual Slide Gates on the **Primary Chamber**, located just after the blower and close them all the way. This will help to put the fire in the **Primary Chamber** out.
2. Check alarms to see what the problem is.
3. Do not open the door of the **Primary Chamber** unless the temperature inside the chamber is below 90°C.
4. Call a certified technician to fix the problem and/or consult with **Eco Waste Solutions Customer Service Department at 905.634.7022, toll free 1-866-326-2876.**

Start Up After Power Failure

1. Once the power is restored turn breaker (main disconnect) back on.
2. The **Human Machine Interface (HMI)** and PLC will begin a boot up procedure.
3. Wait until the **Human Machine Interface (HMI)** on the **Main Control Panel** has booted up before turning the control power to the panel back on by pressing the Control Power ON button.
4. When the power is restored to the **Main Control Panel**, the button should illuminate.
5. If the system was interrupted during a burn cycle, restart the system by turning the selector switch on the main panel to the right to start the cycle . If the system was interrupted during cool-down cycle, it will resume the cycle where it left off.

Dealing with Warning and Faults

Troubleshooting

The burn cycle will not start if one of the following conditions exists:

1. The system is in the “cool-down” part of the cycle. Wait until the “cool down” cycle is complete.

2. There is a fault in the system as indicated on the **HMI**

3. Loss of power due to any one or more of the following:

    - The main disconnect (see image) is off or there is no electrical power. Turn on the disconnect switch or check why there is no power.

Power is OFF in this position

Power is ON in this position

- An open breaker. Check the breakers and replace any that are defective.

- The EMERGENCY STOP is pushed in. Twist the EMERGENCY STOP button to unlock, and then push the CONTROL POWER ON button. The CONTROL POWER BUTTON should now be illuminated.

4. If on the Main Control Panel HMI the **Primary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

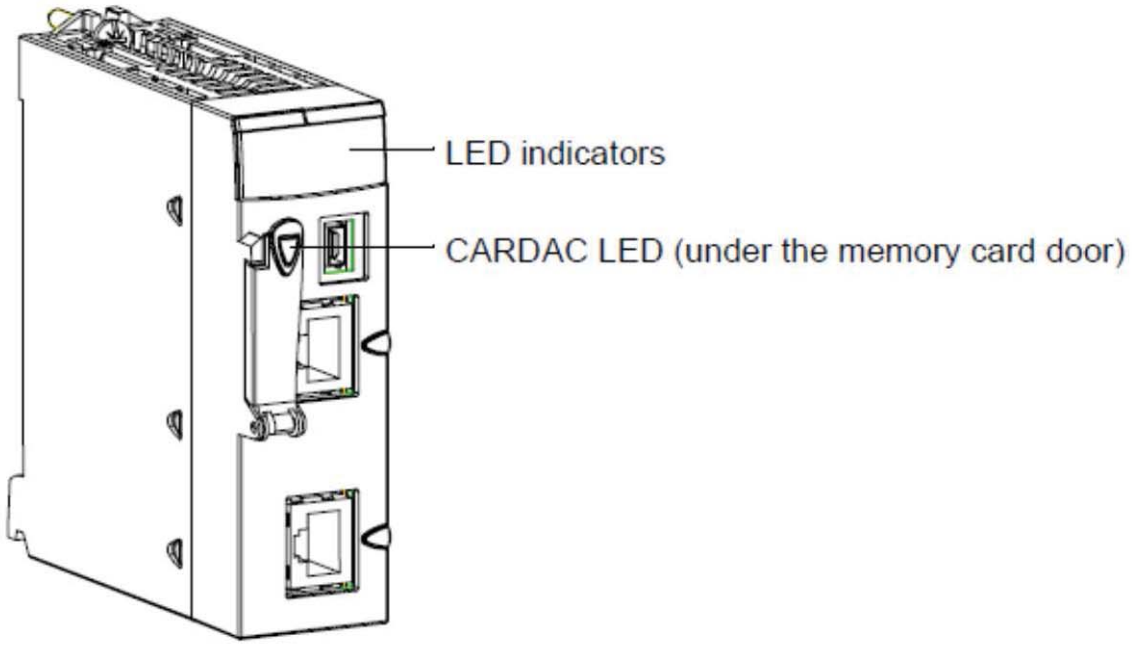
5. If on the Main Control Panel HMI the **Primary Chamber** roof lid is not closed, the lid has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

6. If on the Main Control Panel HMI the **Secondary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm, if necessary. Check the limit switch and that the wiring is in working order.

7. If fuel tank is low, system will not start. Tank on the **HMI** will be red, indicating the level is low and needs to be filled.

PLC Processor Problem

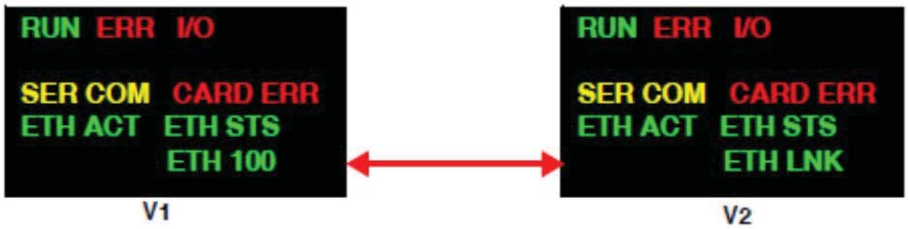
There are several LEDs available on the front panel of each Modicon M340 module or processor, enabling rapid diagnosis of the PLC status:



These LEDs provide information on:
- PLC functioning
- the memory card
- communication with the modules
- serial communication
- communication on the CANopen network
- communication on the Ethernet network

The following diagram shows the diagnostic LEDs on the BMX P34 2020 processor. Note that two displays exist, depending on whether you are using firmware V1 or V2

(or greater) of the processor.



The colors and blink patterns of the LEDs indicate the status and operating conditions of Ethernet communications on the module:

Label	Pattern	Indication
RUN (green): operational state	on	• PLC hardware and PLC program operations are normal. • Module is in RUN state.
	flashing	• PLC is in STOP mode or a blocking error in the application has been detected. • Processor is configured but not in RUN state.
	off	PLC is not configured (application is absent, invalid, or incompatible).
ERR (red): detected error	on	Processor, system, or configuration detected error
	flashing	• PLC is not configured (application is absent, invalid, or incompatible). • PLC is in STOP mode or a blocking error in the application has been detected.
	off	Normal (no detected errors)
ETH STS (green): Ethernet communication status	on	Communication OK
	2 flashes	Invalid MAC address
	3 flashes	Link not connected
	4 flashes	Duplicate IP address
	5 flashes	Waiting for a server IP address
	6 flashes	Secure and safe mode (with default IP address)
	7 flashes	Configuration conflict between rotary switches and internal configuration
CARDERR (red): memory card detected error	on	• Memory card is missing. • Memory card not usable (bad format, unrecognized type). • Memory card content is inconsistent with internal RAM application.
	off	• Memory card is valid and recognized. • Application on card is consistent with the internal RAM application.
I/O (red): input/output status	on	• Error detected on a configured module or CPU channel • Configuration mismatch with the application (module missing...)
	off	Normal (no detected errors)

SER COM (yellow): serial data status	flashing	Data exchange (send/receive) on the serial connection in progress
	off	No data exchange on the serial connection
CAN RUN (green): CANopen operations	on	CANopen network operational
	rapid flashing (note 1)	Automatic detection of data flow or LSS services in progress (alternates with CAN ERR).
	slow flashing (note 2)	CANopen network is pre-operational.
	1 flash	CANopen network is stopped.
	3 flashes	Downloading CANopen firmware.
CAN ERR (red): CANopen detected error	on	CANopen bus is stopped.
	rapid flashing (note 1)	Automatic detection of data flow or LSS services in progress (alternates with CAN RUN).
	slow flashing (note 2)	CANopen configuration is not valid.
	1 flash	At least one error counter has reached or exceeded alert level.
	2 flashes	A guard event (NMT slave or NMT master) or a heartbeat event has occurred.
	3 flashes	The SYNC message was not received before the end of the communication cycle period.
	off	No error detected on CANopen.
CARDAC (green): memory card access **Note:** This LED is located under the memory card door (see *The Module, p. 20*).	on	Access to the card is enabled.
	flashing	Activity on the card: during each access, the card LED is set to OFF, then back to ON.
	off	Access to the card is disabled. You can remove the card after you disable card access by setting system bit %S65 to 0.
Note 1: Rapid flashing is defined as ON for 50 ms and OFF for 50 ms.		

Note 2: Slow flashing is defined as ON for 200 ms and OFF for 200 ms.

The following table describes the meaning of the ETH ACT and ETH 100 LEDs on the front panel for firmware V1 NOE and CPU modules.

Label	Pattern	Indication
ETH ACT (green): Ethernet communication (transmission/ reception activity)	on	Ethernet link detected: no communications activity.
	off	No Ethernet link detected.
	flashing	Ethernet link detected: receiving or sending packets.
ETH 100 (green): Ethernet transmission speed	on	Ethernet transmission at 100 Mbit/s (Fast Ethernet).
	off	Ethernet transmission at 10 Mbit/s (Ethernet) or no link detected.

The following table describes the meaning of the ETH ACT and ETH LNK LEDs on the front panel for firmware V2 NOE and CPU modules.

Label	Pattern	Indication
ETH ACT (green): Ethernet communication (transmission/ reception) activity	on	Communications activity detected.
	off	No communications activity detected.
ETH LNK (green): Ethernet link status	on	Ethernet link detected.
	off	No Ethernet link detected.

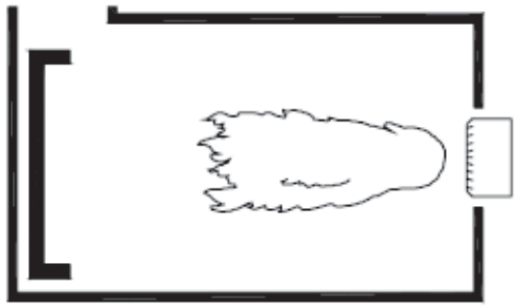
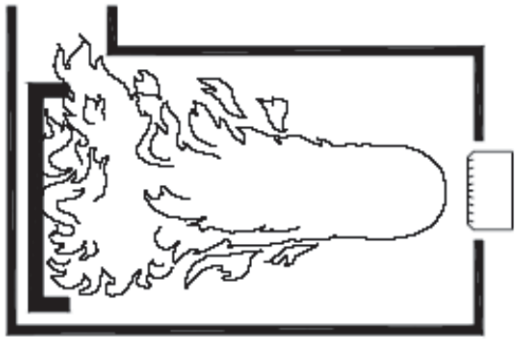
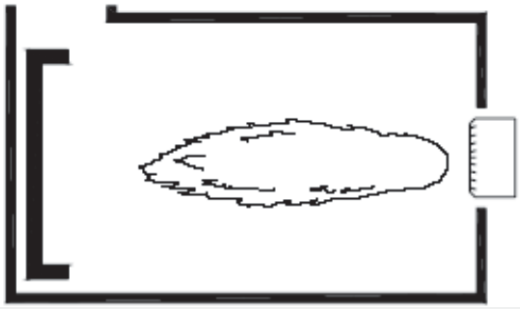
Note:

- Rapid flashing is defined as ON for 50 ms and OFF for 50 ms.
- Slow flashing is defined as ON for 200 ms and OFF for 200 ms.

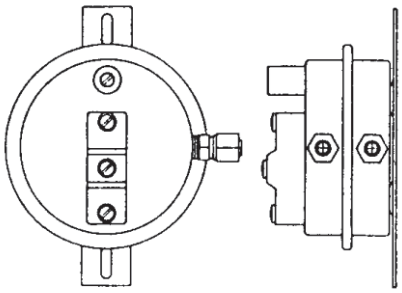
Possible Problems, Causes and Solutions

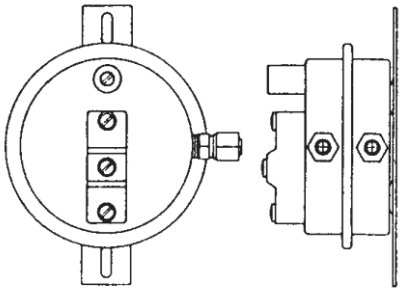
Problem	Causes	Solutions
Blower Fails to start	Over load tripped, blown fuse	Turn power off. Open Panel and reset overload. Check fuse and replace.
	Motor starters or contactor coil is burnt out	Locate contactor for Blower and visually observe if the contactor is pulled in. Use a volt meter to check for voltage across the coil If there is voltage across the coil and the contactor is not pulled in, replace the contactor.
Secondary Burner won't ignite	Bad Electrodes	Refer to Section 6 of this manual.
	Low Oil Pressure	Adjust pressure setting on burner pump. Refer to Riello Manual in Section 10.
	Fuel Line Leak	Visually inspect the lines for the leak. Tighten any fittings that are near the leak.
	Door Switch not making contact Burner alarm has been tripped	Make sure main door is closed and latched shut. Make sure limit switch is hitting striker plate.
	Bad Thermocouple	Replace thermocouple .
Primary Burner won't ignite	Bad Electrode	Refer to Section 6 of this manual.
	Low Oil Pressure	Adjust pressure setting on burner pump. Refer to Riello Manual in Section 8.
	Fuel Line Leak	Visually inspect the lines for the leak. Tighten any fittings that are near the leak.
	Door Switch not making contact or broken	Make sure main door is closed and latched shut. Make sure limit switch is hitting striker plate.
	Secondary temperature not at 1000°C	Wait until Secondary temperature is at 1000°C and try again.
	Burner main switch is turned off	Turn switch on.
	Burner alarm has been tripped	Acknowledge burn alarm and then hit the reset button on control panel.

Problem	Causes	Solutions
Persistent Black Smoke	Insufficient air supply to Secondary Chamber to completely consume emissions	Check to ensure combustion air blower/damper assembly is operating properly.
	Secondary Chamber is not hot enough.	Check that the Secondary temperature is operating at required temperature set point.
	Secondary Chamber is not hot enough.	Too much draft, open barometric damper.
	Overloading or loading highly volatile material	Decrease load size on next batch (confirm by weighing), ensure the waste mix is correct.
	Burner failure	Check burner operation – if no flame or a poor flame is visible through the flame view port adjust air/fuel ratio.
	Operating at a too high Primary Chamber temperature	Check/decrease primary chamber combustion air.
Smoke coming out of Primary	Too much air	Check dampers on primary blower.
	Too much volatile material loaded	Decrease load size on next batch to ensure the waste mix is correct.
	Primary Chamber temperature too high	Waste loaded may not be a good mix of heat value.
	Low draft	Close barometric damper on stack's T-section
Too much fuel usage	Too much secondary combustion air	Check/reduce secondary combustion air.
	Too much air infiltration	Reduce air flow by adjusting the damper.
	Fuel leakage	Check fuel trains and burners for fuel leakage.
	Wet waste	Spread wet waste with other waste through several loads – do not charge all of the wet waste at one time.
	Excessive draft	Check/reduce draft – check door seals and other seals for leakage adjust damper.
	Burner setting too high	Check air/fuel mix.

Problem	Causes	Solutions
		Correct Maximum Flame Adjustment (Proper Oil and Air Pressure with correct supply of combustion air)
		Incorrect Flame Adjustment (Not enough Combustion Air)
		Incorrect Flame Adjustment (Air Pressure too high; too much air)
Incomplete burnout/poor ash quality	Build-up around air holes – clogged with ash from previous burn	Check around air holes and clean.
	Poor draft	Draft should be -0.2-0.06 KPa (or 0.8-0.25“ W.C).
	Too much wet waste – overloading system	Spread wet waste with other waste through several loads – do not charge all of the wet waste at one time.
	Insufficient burn time	Allow longer burn time period.

Possible Alarms (Faults)

#	ALARM (System Fault)	SOLUTION
1	The Primary Chamber top/bottom thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
2	The Secondary Chamber thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
3	The Secondary Stack Thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
4	The primary burner is faulted	The primary burner has failed to light when it received a signal to start. To reset the burner, press the reset button located on the Burner. If this does not start the burner, refer to Supplier Catalogue (Riello Burner) in Section 8
5	The secondary burner is faulted	The secondary burner has failed to light when it received a signal to start. To reset the burner,
6	The system has shut down due to primary blower low air flow. 	Visually examine the primary blower for any obstructions that may be causing low air flow. Check slide gate located between Primary chamber and blower, ensure it is open. Check damper assembly, ensuring modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air proving switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.
7	The primary blower motor overload is tripped.	Turn power off on Control panel by turning the Main Disconnect to the OFF position. Reset overload.

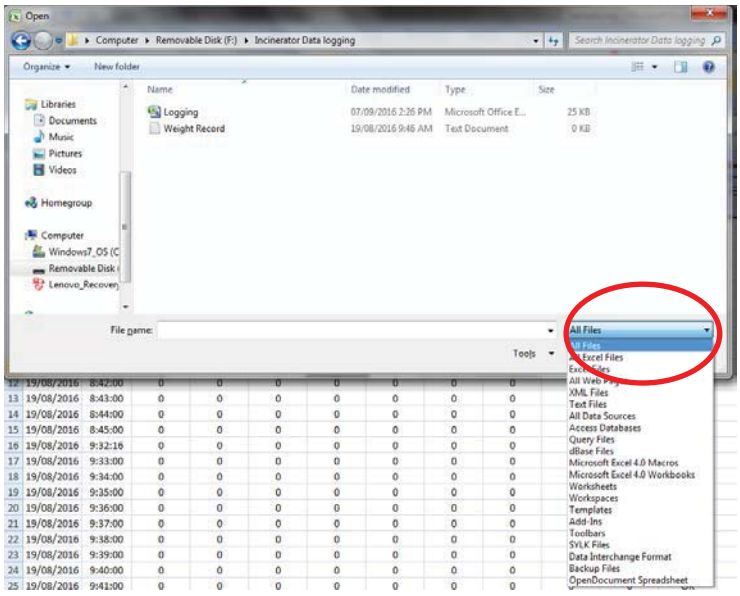
#	ALARM (System Fault)	SOLUTION
8	The system has shut down due to secondary blower low air flow 	Visually examine the Secondary Blower for any obstructions that may be causing low air flow. . Check slide gate located between Secondary chamber and blower, ensure it is open. Check damper assembly, ensuring Modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air flow switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.
9	The Secondary blower variable frequency drive is faulted	Push fault reset button on the HMI If fault persist check the error code on the variable frequency drive and check manual for troubleshooting alarm.
10	The burner fuel level is low.	Add fuel to the fuel tank and the alarm should reset itself. If alarm persists, replace the low level switch.
11	Primary Chamber – lid lifter hydraulic pump overload.	Turn power off on Control panel by turning the Main Disconnect to the OFF position. Reset overload.
12	Primary Chamber – lid lifter stuck while rising.	Check to see if anything is blocking the lifts or roof from raising Check the power pack fluid level to ensure enough hydraulic oil is available Check the limit switch is working

#	ALARM (System Fault)	SOLUTION
13	Primary Chamber - lid lifter stuck while lowering.	Check to see if anything is blocking the lifts or roof from lowering Check the power pack fluid level to ensure enough hydraulic oil is available Check the limit switch is working This can be caused by a burnt out solenoid valve. Check that the control valve is open.
14	Primary Chamber - lid lifter left or right safety pawl failed to retract.	Check the proximity switch that senses that the safety catch is out Check the solenoid valves (located on each column)

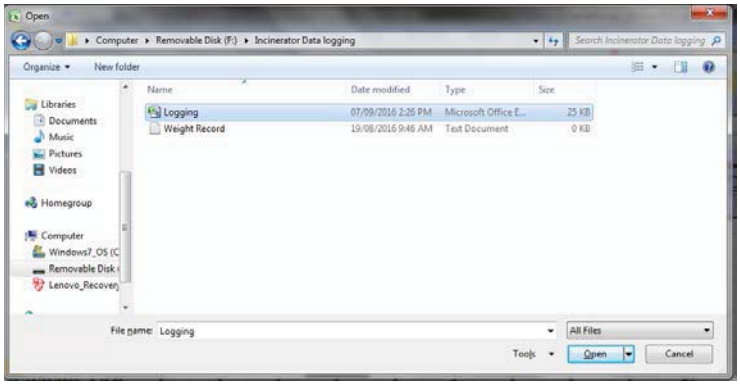
Record Keeping

Accessing Historical Information

1. It is recommended that a dedicated folder be set on the destination computer that is used for storing data from the Incinerator Package (e.g. “Incinerator Data”)
2. Turn power off to the Main Control panel by turning the Main Disconnect to the OFF position.
3. Open the Main Control Panel door and remove the USB from the back of the HMI panel and insert the USB into the destination computer.
4. Open an Excel File, once opened go to File/Open locate the USB on your computer, in the bottom right corner choose “All Files”.

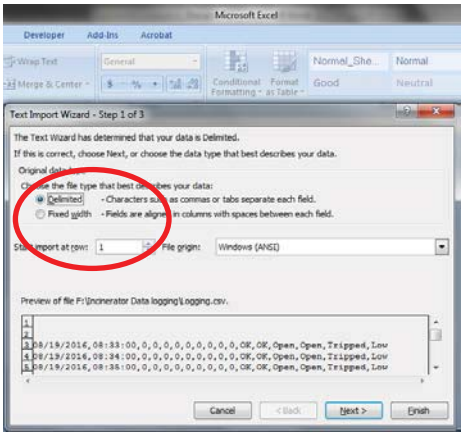


5. Click on the “logging” file and press open.

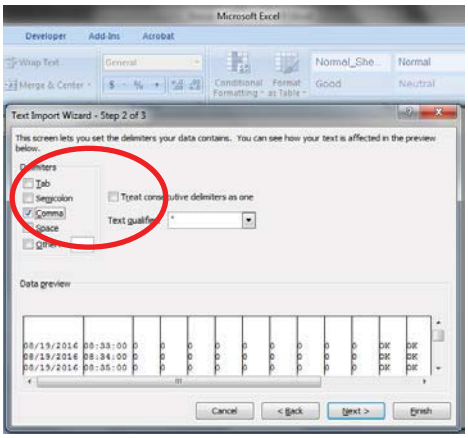


6. Excel will prompt you with a text import wizard, follow the next 3 steps to ensure the log files is displayed properly:

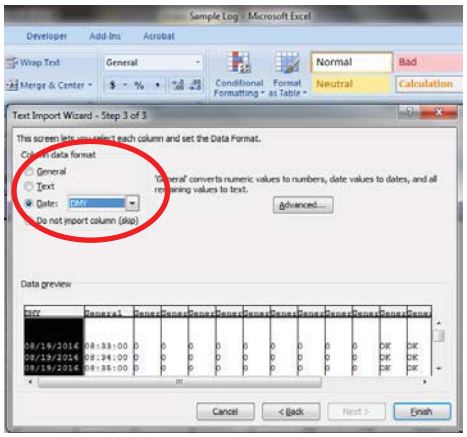
7. Steps 1 of 3 choose delimited – character such as commas or tabs separate each field, and choose Next:



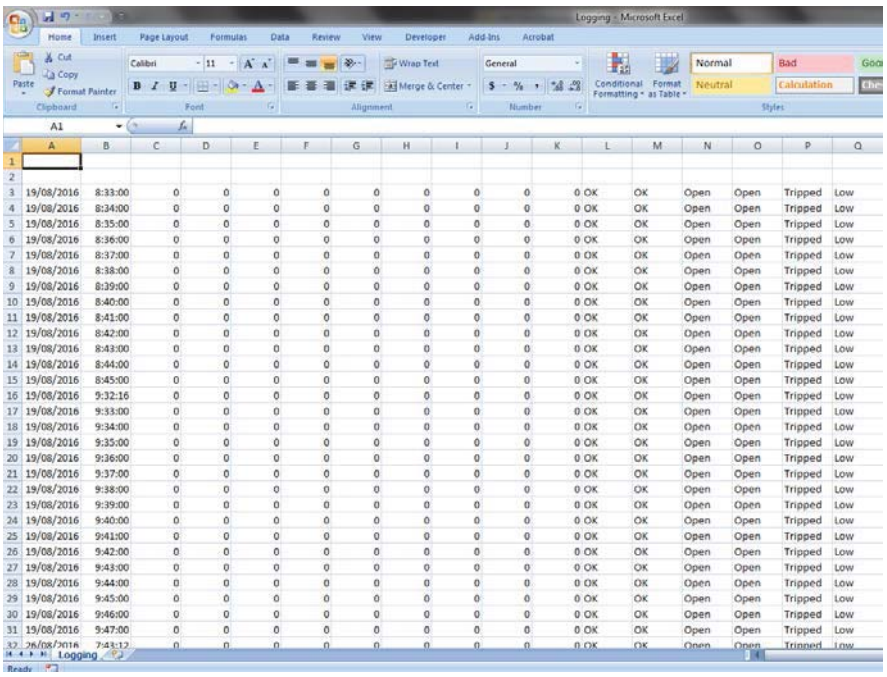
8. Steps 2 of 3 choose Comma as the delimiting item, and choose Next:



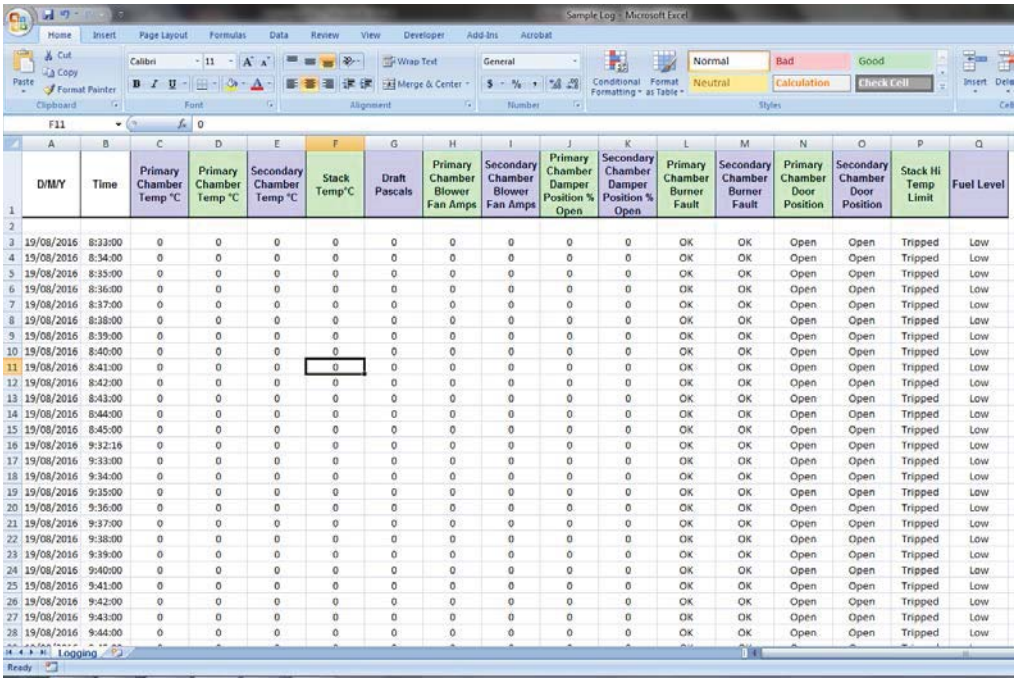
9. Steps 3 of 3 Column data format should be Date with DMY – character such as commas or tabs separate each field, choose Finish.



10. Once the data is open, it will look similar to the following:



11. From the electronic template file located on the USB for the manual copy the first row and paste into your log file:



	D/M/Y	Time	Primary Chamber Temp °C	Primary Chamber Temp °C	Secondary Chamber Temp °C	Stack Temp°C	Draft Pascals	Primary Chamber Blower Fan Amps	Secondary Chamber Blower Fan Amps	Primary Chamber Damper Position % Open	Secondary Chamber Damper Position % Open	Primary Chamber Burner Fault	Secondary Chamber Burner Fault	Primary Chamber Door Position	Secondary Chamber Door Position	Stack Hi Temp Limit	Fuel Level
1																	
2																	
3	19/08/2016	8:33:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
4	19/08/2016	8:34:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
5	19/08/2016	8:35:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
6	19/08/2016	8:36:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
7	19/08/2016	8:37:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
8	19/08/2016	8:38:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
9	19/08/2016	8:39:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
10	19/08/2016	8:40:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
11	19/08/2016	8:41:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
12	19/08/2016	8:42:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
13	19/08/2016	8:43:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
14	19/08/2016	8:44:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
15	19/08/2016	8:45:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
16	19/08/2016	9:32:16	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
17	19/08/2016	9:33:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
18	19/08/2016	9:34:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
19	19/08/2016	9:35:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
20	19/08/2016	9:36:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
21	19/08/2016	9:37:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
22	19/08/2016	9:38:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
23	19/08/2016	9:39:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
24	19/08/2016	9:40:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
25	19/08/2016	9:41:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
26	19/08/2016	9:42:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
27	19/08/2016	9:43:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
28	19/08/2016	9:44:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low

12. Save your excel file with the date in the designated folder.

13. Reinstall the USB to the back of the HMI, close the Main Control Panel door and turn power back on to the system.

SECTION 6

MAINTENANCE INSTRUCTIONS

Zero Mechanical State & Lock Out Procedures

Proper maintenance of the equipment is essential to ensure long term, reliable operation of the EWS Incinerator.

NOTE The warranty will become void if proper maintenance is not performed as instructed.

Safety

During maintenance of the EWS mobile incinerator, it is very important to be aware of special hazards. Two safety programs are described in the following sections:

1. Zero Mechanical State
2. Power Lock Out Procedures

Failure to comply with these instructions during maintenance could result in injury or death. The responsibility for implementation of a comprehensive safety program rests with the operating staff and supervision. The safety procedures in this *Manual* should be considered only as a starting point for the safety program at site.

ACCIDENTS CAN BE PREVENTED A CAREFUL WORKER IS THE BEST SAFETY DEVICE

Zero Mechanical State

Zero Mechanical State (ZMS) exists when the possibility of an unexpected mechanical movement has been eliminated. During maintenance, it is absolutely mandatory to totally deactivate the incinerator so that there is no possibility of an unexpected machine movement. Power lock-out, described in the next section, is commonly used for this purpose. Most machines are powered by electrical, hydraulic or pneumatic drives. Energy may be stored in a shutdown machine in various ways: Air pressure in a cylinder, hydraulic pressure fluid stored in pressurized hoses, or machine members whose weight can generate fluid pressure. Therefore, just cutting off the electrical power may not be enough to neutralize all power sources. Certain maintenance procedures at site should require ZMS condition as a matter of course.

Zero Mechanical State (ZMS) Checklist:

1. Every electrical power source to the incinerator must be cut off and locked out (to prevent others who may not be aware of maintenance work from turning the power back on inadvertently).

2. Ensure that the mechanical potential energy of the incinerator is at its lowest practical value so that opening of pipe, tubing, hose or actuation of any valve will not produce an unexpected movement that could cause injury.

3. Check that there is no pressurized fluid (air, oil, gas or other) trapped in the incinerator lines, cylinders or other components. This will ensure that there will be no incinerator motion when a valve is actuated.

4. Secure loose or freely moving parts so that there is no possibility of accidental movement.

Power Lock Out Procedures

Unexpected operation of electrical equipment started by automatic or manual remote control may cause injuries to persons who happen to be nearby. For this reason, when repair work is to be done on motors or other electrical equipment the circuit should be opened at the switch box and the switch pad locked in the OFF position. Tag the switch with a lock out tag indicating who must be contacted before the power is turned back on again.

BECAUSE OF THE SEVERE CONSEQUENCES, INCLUDING DEATH, OF NOT PROPERLY LOCKING OUT ELECTRICITY SUPPLIES DURING MAINTENANCE, THE SUPERVISOR SHOULD ENSURE THAT THERE IS ONLY 1 KEY FOR THE LOCK USED TO LOCK OUT THE POWER SUPPLY.

For identification, locks may be color coded to indicate different crews or shifts.

The Supervisor should maintain the master key and list of key numbers, and should keep an extra key to each lock for his department. The master key should not be loaned out under any circumstances.

No matter what method is used to lock out power to electricity, strict discipline and constant supervision should be employed during any equipment maintenance work.

Power Lock Out Checklist

1. Alert the operator of the equipment.

2. Before starting the work on an engine or motor, line shaft or other power transmission equipment or power-driven machine, make sure it can not be set in motion without your knowledge.

3. Place your own padlock on the control switch, lever, or valve, even if someone has locked the control panel before you. You will not be protected unless you put your own padlock on it. (Another maintenance person could remove their lock and then someone else could start the equipment if they were not aware of maintenance work being done.)

When finished working at the end of your shift remove your own padlock. Never permit someone else to remove it for you. Be sure you are not exposing someone else to danger by removing your padlock

Instruction Classification

Each component is associated with an identification number, see table below:

System Component	Identification number
Primary Blower	01-001
Secondary Blower	02-001
Primary Burner	01-002
Secondary Burner	02-002
Refractory	05-001
Air Compressor	03-001
Thermocouple	05-002
Main Control Panel	03-010
Paint	05-003
Electrical	05-004
Limit Switch	05-005
Lid Lifters	06-001

To differentiate if the instruction is weekly, monthly, quarterly or yearly, the above identification number will be followed by a letter:

Daily: D
Weekly: W
Monthly: M
Quarterly: Q
Yearly: Y

For example**, 01-001.Q.01** Primary blower assembly quarterly instruction number 1.

i. Daily Instructions

Primary Chamber Burner: (01-002.D)

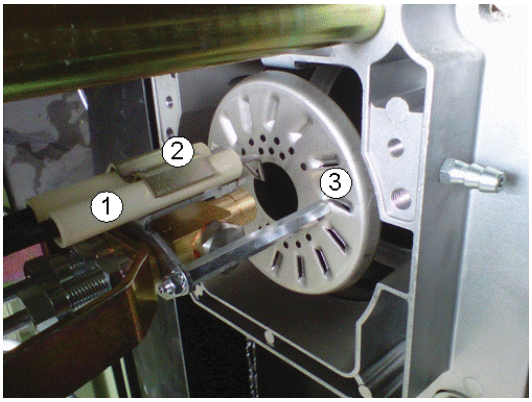
Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

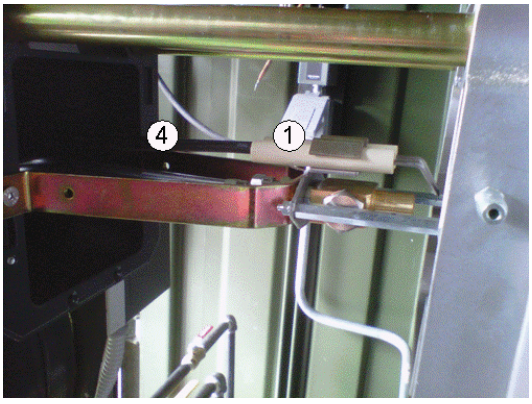
Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 01-002.D.01: INSPECTING AND CLEANING ELECTRODES

1. Remove the cover from the Burners as described in 01-002.W.01
2. Inspect the electrodes (PN: 3003796) for any soot build-up.



1. Electrode
2. U-bolt
3. Diffuser Disc

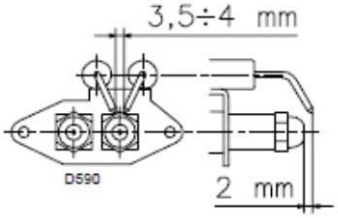


4. HT Leads

3. Clean/wipe down the ignition electrode with a cloth should there be a build-up of soot.

NOTE Do not use sand paper as this will increase the deposit of future soot.

4. If electrodes are damaged remove the screws and u-bolt (see above photo) and install new electrodes. When reinstalling the electrodes make sure that they are positioned as shown below.



Primary Burner

Check the High Temperature (HT) Leads (PN: 3012995) for any heat damage. If HT Leads are severely damaged (ie, you can see the wire beneath the sheathing) then replace. (See *CMI 6.3.3/01-002A)*

INSTRUCTION 01/02-002.D.02: INSPECTING THE FUEL LINES

1. Visually inspect all fuel lines to the Primary and Secondary Burner for any leaks.
2. The Primary Burner have two oil lines, one feed and one return. the Secondary Burner has only a feed line
3. If any leaks are observed tighten or replace the fitting where the leak is occurring

INSTRUCTION 01-002.D.03: INSPECT AND CLEAN BURNER NOZZLES

Primary Burner:

1. Remove the burner cover as outlined in 01/02-002.W.01 REMOVAL OF BURNER COVERS
2. Remove the centre retaining bolt.
3. Slide burner out.
4. Check nozzle. If there is carbon, remove the nozzle and clean.
5. Reinstall or replace if necessary (PN: C5222433)

Refractory: (05-001.D)

When working with the refractory make sure you use the proper tools; wear goggles, approved dust mask and gloves

INSTRUCTION 05-001.D.01: INSPECTING THE REFRACTORY

Ensure power is locked out.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

1. Open Primary Chamber door by unlatching all four clamps.

2. Tie-off door to open position to ensure that it will not close unintentionally.

3. Enter Primary Chamber and check the refractory for shrinkage, any gap between the modules greater than 2.5 cm should be patched with the blanket refractory

4. Check for any exposed metal between the modules, if metal is exposed make sure to patch area with blanket material (PN: 1" x 24" 8# 2600) or new module (PN: 6" Mod ZR) (*CMI 6.3.2/05-001A & 6.3.2/05-001B)*

ii. Weekly Instructions

Primary & Secondary Chamber Blowers: (01-001.W & 02-001.W)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

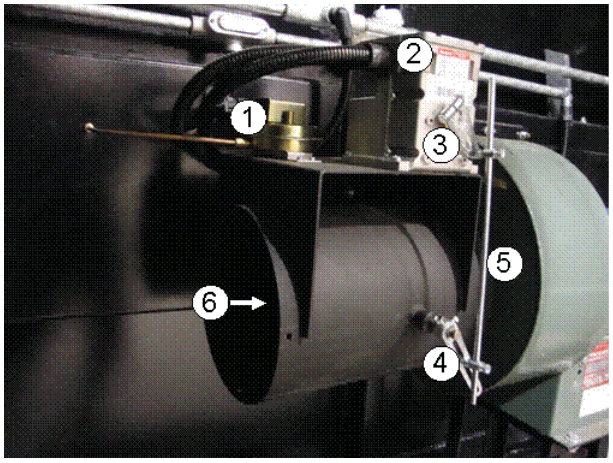
A fan can windmill despite removal of all electrical power therefore, take extra care when working with fans in the system.

The rotating assembly should be blocked securely before attempting maintenance of any kind.

INSTRUCTION 01/02-001.W.01: DAMPER CRANK ARM

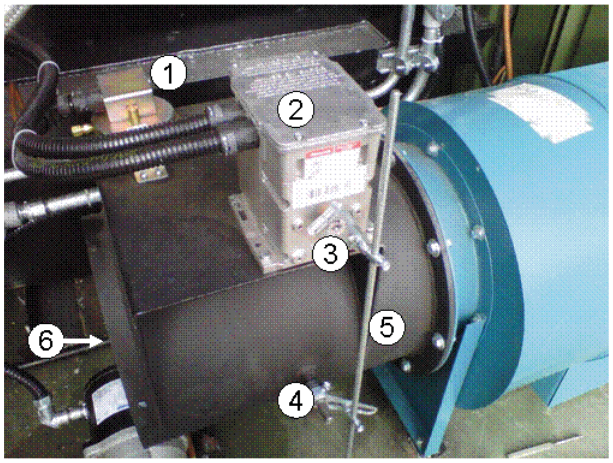
Check to see that the damper crank arm is connected to the damper and the rod.

Ensure mechanical linkage on damper is tight, if loose tighten with wrench.



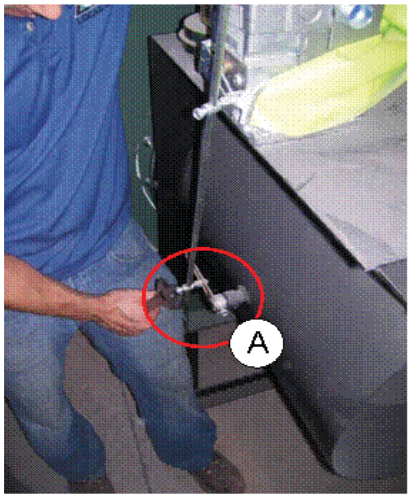
PRIMARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



SECONDARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



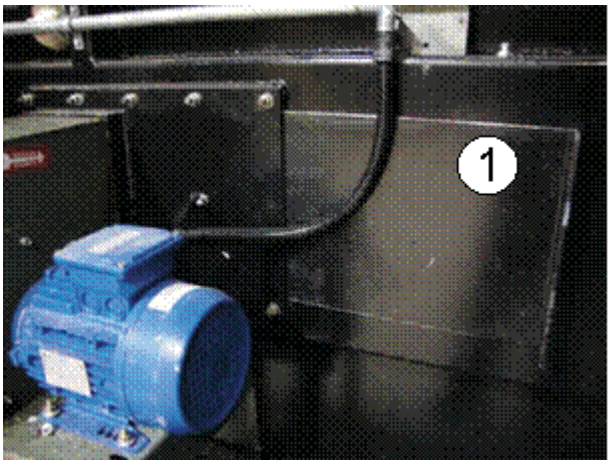
A. Damper Crank arm and connection to Damper and Rod

INSTRUCTION 01/02-001.W.02: SLIDE GATES

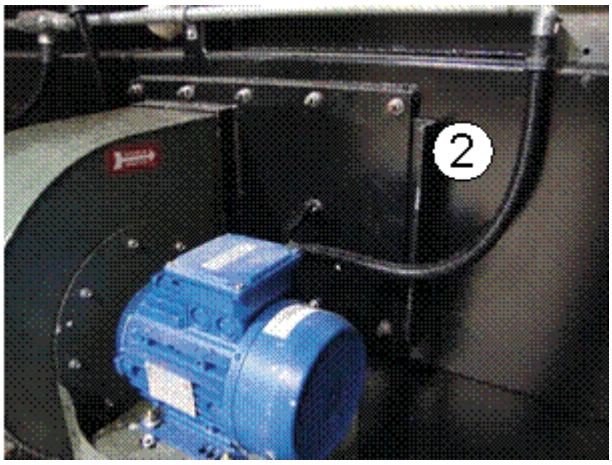
Check to see if slide gates move freely.

1. Move slide gate in and out to ensure free movement. If sticking, use lubricant to loosen. Lubricant should be rated for a high temperature (>150°F) application.

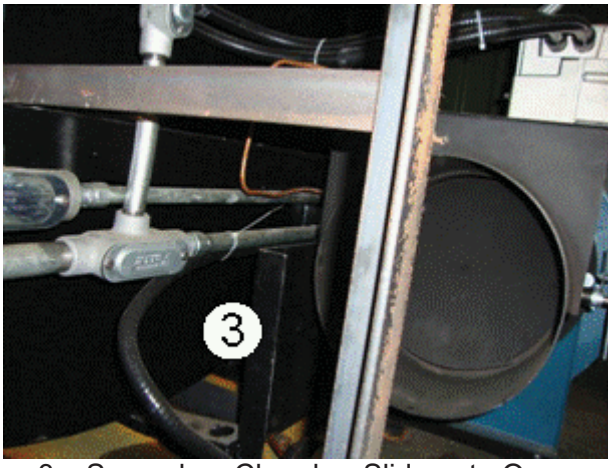
2. Gates must be opened to allow under fire air to enter the chamber. They should only be closed to reduce air in abnormal operating conditions.



1. Primary Chamber Slide Gate Open



2. Primary Chamber Slide Gate Closed



3. Secondary Chamber Slide gate Open

Primary Chamber Burner: (01-002.W)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 01/-002.W.01: REMOVAL OF BURNER COVER

Switch off the electrical power. Please follow all instructions in *Section 6.1 Zero Mechanical State & Lock Out Instructions.* Cover must be removed to perform maintenance on the burner.

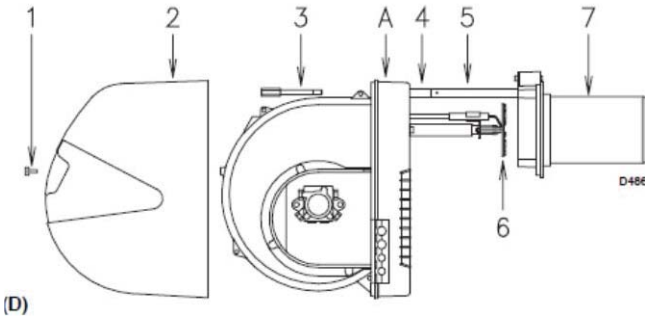
To remove the cover and to pull out the Primary or Secondary Burner, follow instructions below:

1. Loosen screw (Item #1, in the following diagrams) and withdraw the cover (Item #2, in the following diagrams)

2. Primary Burner has one screw to remove the cover. The Secondary Burner has four screws to remove the cover.

3. Remove bolt (Item #3) for the Primary Burner, or screws (Item #3) for the Secondary Burner.

4. Pull (Part A) backwards keeping it slightly raised to avoid damaging the diffuser disk (Item #6).



Primary Burner has 1 screw

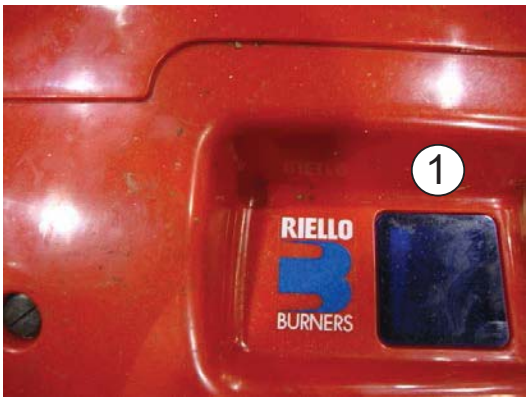
INSTRUCTION 01/02-002.W.02: CLEANING THE PHOTO ELECTRIC CELL

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.
2. Clean Photo Electric (P.E) cell with a wet cloth (Primary Burner PN: 3006216)
3. P.E. cell (Item #1) can be removed by pulling it outward forcefully. Ensure you take note of the position of the eye while removing, this will help when reinstalling.
4. Once cleaned insert P.E. cell back into position ensuring the eye is not facing directly into the chamber (where the flame will be) but on the same angle as before it was removed.
5. Replace burner cover.

Primary Burner PE Cell

INSTRUCTION 01-002.W.03: CLEANING THE INSPECTION WINDOWS

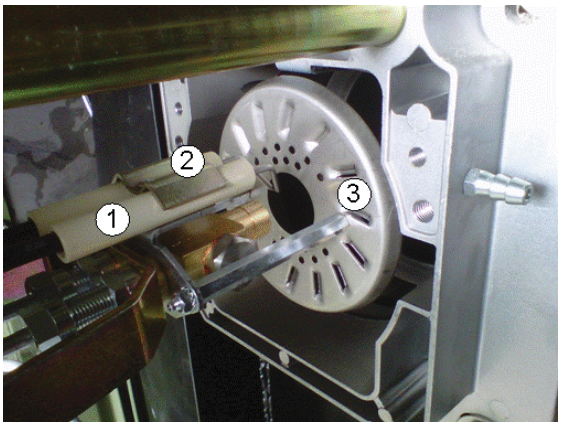
Clean the inspection windows with a wet cloth.



1. Primary Burner Inspection Window

INSTRUCTION 01-002.W.04: INSPECTING THE DIFFUSER DISC ASSEMBLY

1. Remove the cover from the Burners as described in 01-002.W.01.
2. Check the diffuser disc assembly (Primary Burner PN: 3003791) for any heat damage
3. If any heat damage, deformation or excess rust is noted, replace. (*CMI 6.3.8/03-009K)*



1. Electrode
2. U-bolt
3. Diffuser Disc

Secondary Chamber High Output Dual Burner: (02-002.W)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 02-002.W.01: SECONDARY BURNER WEEEKLY ROUTINE

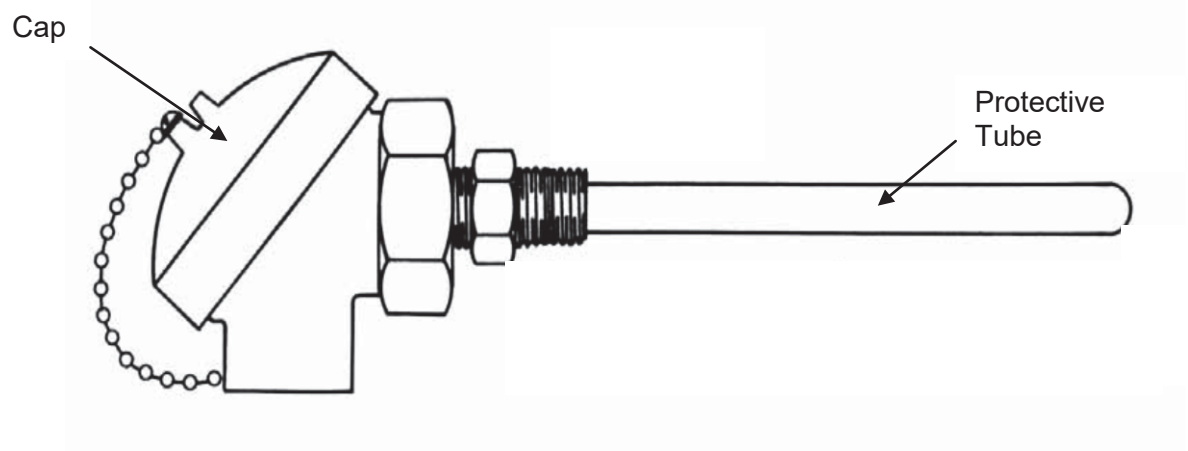
1. Clean flame sensors.
2. Clean the glass on the flame inspection window.
3. Clean spark ignitors.
4. Clean pilot assemblies.
5. Check spark ignitor lead connections.
6. Check turbulator ring.
7. Clean all filters and filter screens.
8. Lubricate all moving parts (i.e. bearings on doors, door latches & hinges, air and fuel valves, proportioning fuel valves, particularly the shafts on both air modulation valves

9. Check all motors for bearing noise, loose fans, etc.

10. Inspect fuel lines for leaks

Thermocouple: (05-002.W)

When working with electrical components ensure lock out instructions are being followed.

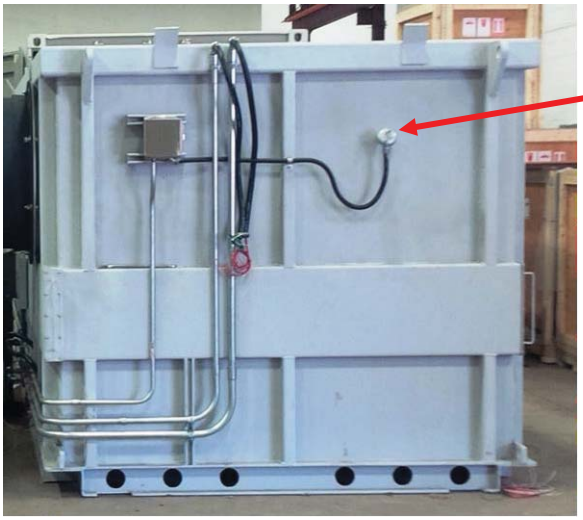


Thermocouple Assembly

Thermocouple Element

INSTRUCTION 05-002.W.01: INSPECT THERMOCOUPLE FOR DAMAGE

Turn main power to the system off - Remove thermocouple and visually inspect for damage. If damaged, see *CMI 6.3.1/05-002A*



1. Primary Chamber #1 Thermocouple

2. Two Secondary Thermocouples on Secondary Chamber body and beside the burner

3. Stack Thermocouple on Stack

i. Monthly Instructions

Primary & Secondary Chamber Blowers: (01-001.M & 02-001.M)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 01/02-001.M.01: CHECK FAN WHEEL

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures, if left in operation.
2. The wheel can be accessed one of two ways.
   a. Remove the blower assembly from the unit and look down the outlet of the blower.
   b. Remove the damper assembly from the inlet of the blower and inspect by looking through the inlet of the blower.
3. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards.
4. Clean the wheel as required.
5. If replacement is necessary follow these steps:

   a. Remove damper assembly from the unit
   b. Remove the blower assembly
   c. Remove the blower housing around the wheel
   d. Loosen all set screws that are located on the wheel.
   e. A puller may be required if the wheel hasn't been removed for some time.
   f. Ensure the shaft "key" is installed on the shaft before installing the new wheel.
   g. When installing a new wheel, the wheel should be positioned in the housing with the correct spacing between the edge of the inlet cone and the wheel. The wheel to cone clearance on the Primary Blower is 0.3175 cm.
   h. Ensure that the wheel is installed securely before reassembling the blower assembly.
   i. Install the blower assembly
   j. Install the damper assembly

Primary Chamber Burner: (01-002.M)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01-002.M.01: CHECK FLEXIBLE OIL LINE

1. Check flexible oil lines to make sure that they are still in good condition. This includes frayed, leaking, or worn swivel joints.

2. If any type of damage is observed replace the flexible oil lines see *CMI 6.3.3/01-002F & 6.3.3/02-0002F*

Primary Chamber Burner Flexible lines

INSTRUCTION 01-002.M.02: INSPECT BURNER PUMP DELIVERY PRESSURE

1. Remove the cover from the Burner as described in Instruction 01/02-002.W.01.

2. The pump delivery pressure must be between 180-210 psi, and can be viewed on the gauge shown below.

3. If the pressure is found to be unstable or if the pump is running noisily try the following:
    a. Detach the flexible hose from the line filter (Shown below as #1).
    b. At the tank pour fuel into the supply line.
    c. If there is fuel coming in through the filter it means the filter is not clogged. If no fuel is coming through the filter remove and replace.

Primary Chamber Burner Flexible lines

4. If the pump is found to be responsible:
    a. Loosen the bleed screw.
    b. Turn on the burner
    c. Once all the air has been bled out. Close the bleed screw.

    If the pump is still not working after these steps replace the pump.

5. If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping from a loose fitting or damaged line.

INSTRUCTION 01-002.M.03: CLEAN BURNER OF DUST

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.

2. Check that no dust has accumulated inside the burner fan or on fan blades.

3. If any dust is visible take a clean soft cloth to the fan or the blades and wipe clean.

INSTRUCTION 01-002.M.04: CHECK BURNER COMBUSTION HEAD

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.

2. Check that all parts of the combustion head are in good condition, free of all impurities, and that no deformation has been caused by operation at high temperatures.

(Below is an example of burner in good condition)

If damage is found, please refer to *CMI 6.3.3/01-002D* & *6.3.3/02-002D*

Secondary Chamber High Output Dual Burner: (02-002.M)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 02-002.M.01: SECONDARY BURNER IN-LINE HEATER

1. Check all electrical connections.
2. Remove heater element from casing and inspect for build-up. Clean any deposits. When reinstalling always ensure the bundle will be restarted immersed. **NEVER** use the inline oil heater dry.

INSTRUCTION 02-002.M.02: SECONDARY BURNER SOLENOID VALVES

1. Examine solenoid valves for any deposits. Remove if necessary
2. Check electrical connections.

Refractory: (05-001.M)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 05-001.M.01: INSPECT REFRACTORY

1. Ensure power is locked out.
2. Open Secondary Chamber door.
3. Fasten door open, ensuring it will not close by its own weight.
4. Enter Secondary Chamber and check the refractory for shrinkage, any gaps between the modules greater than 2.5 cm should be patched.
5. Fix gaps with supplied blanket by stuffing material into opening. (See *CMI 6.3.2/05-001A)*
6. Check for any exposed metal, if metal is exposed make sure to patch area with blanket material or new module. (See *CMI 6.3.2/05-001A* & *6.3.2/05-001B)*
7. Pay special attention to areas where the junction boxes are located, as any excessive heat may melt the wires within the box.
8. From Secondary Chamber interior look up the stack while the cap is in closed position.
9. View the surface of the bottom of the stack cap flap with a flash light
10. Some cracking is normal, however if pieces are missing or have fallen out, (See *CMI 6.3.2/05-001E)*

Lid Lifters: (06-001.M)

Controls are normally closed. Do not modify to by-pass or leave the controls open.

Always remain vigilant and avoid injury.

INSTRUCTION 06-001.M.01: CHECK HYDRAULIC FLUID

Check the level of the hydraulic fluid. Fill if necessary.

1. Always use High temperature hydraulic oil Grade 32 to fill the tank.

ii. Quarterly Instructions

Primary & Secondary Chamber Blowers: (01-001.Q & 02-001.Q)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 01/02-001.Q.01: LUBRICATE BEARINGS

1. Lubricate the bearings, but do not over lubricate.

2. Bearings are completely filled with grease at the factory; they may run at an elevated temperature during initial operation. Surface temperatures may reach 180°F and grease may bleed from the bearing seals. This is normal and no attempt should be made to replace lost grease. Bearing surface temperatures will decrease when the internal grease quantity reaches a normal operating level.

3. Bearings should be lubricated with premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

   Mobil - Mobilgrease XHP
   Texaco - Premium RB
   Chevron - Amolith #2
   Shell - Alvania #2

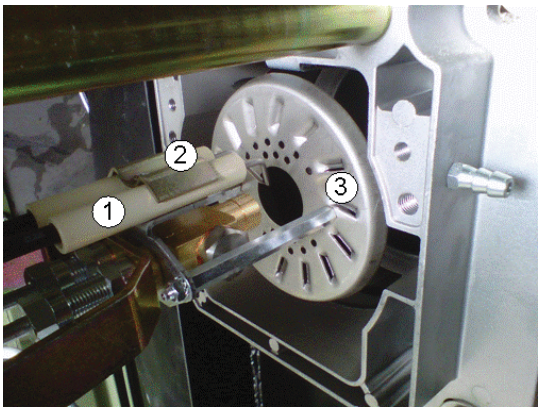
4. Add grease to the bearing via the grease nipple while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Do not over lubricate.

Primary Chamber Burner: (01-002.Q)

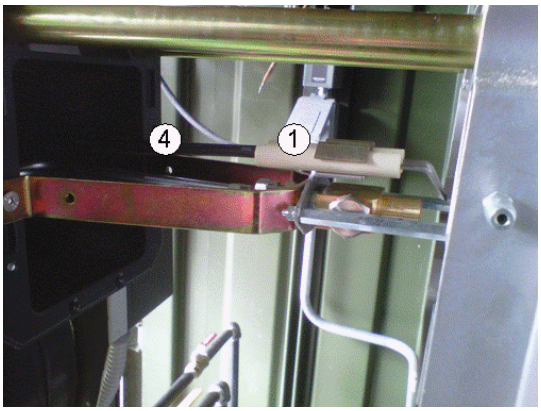
⚠Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01-002.Q.01: INSPECT COMPONENTS FOR HEAT DAMAGE

1. Check all components for heat damage.
2. Look for excessive rust, deformation of all the parts including but not limited to the end cone and the diffuser disc.
3. Check to see that the High Temperature Leads (HT leads) are still intact and have not melted from any excessive heat coming back into the burner. If they are damaged replace with new HT Leads (PN: 3012995 Primary). *See CMI 6.3.3/01.002A.*
    a. The HT leads are attached to the control box and the electrode via a squeeze fitting. Remove the leads from the electrode and control box by simply pulling them out.



1. Electrode
2. U-Bolt
3. Diffuser Disc



4. HT Leads

End cone

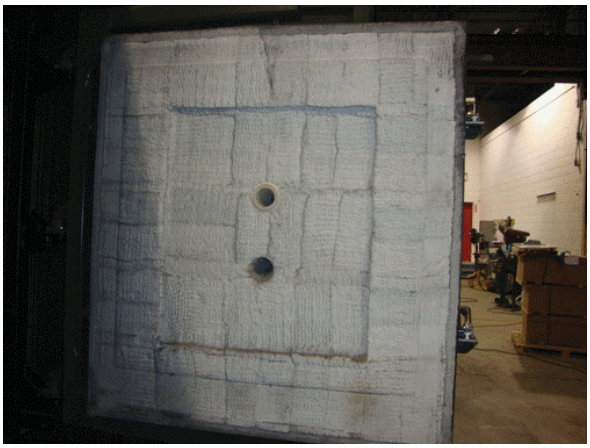
Refractory: (05-001.Q)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

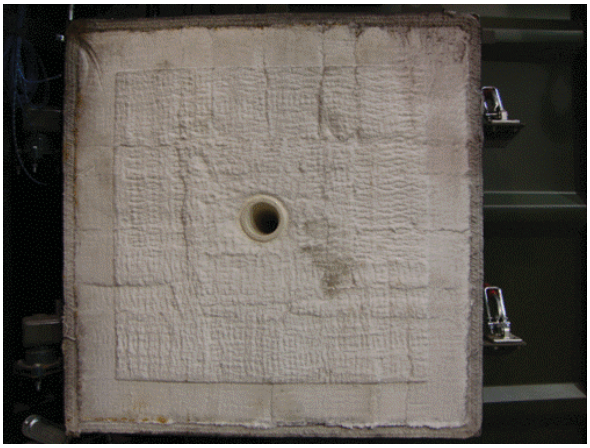
INSTRUCTION 05-001.Q.01: INSPECT DOOR GASKETS

1. Open Primary and Secondary Chamber doors.
2. Fasten doors open, ensuring the door will not close on its own.
3. Inspect door gasket for damage.
4. Replace any damaged segments of door gasket (PN: GSB 1.5") if necessary. Cut out the damaged section and replace with new door gasket. See *CMI 6.3.2/05-001C*.
5. Doors must close tightly and securely, ensuring a good seal.

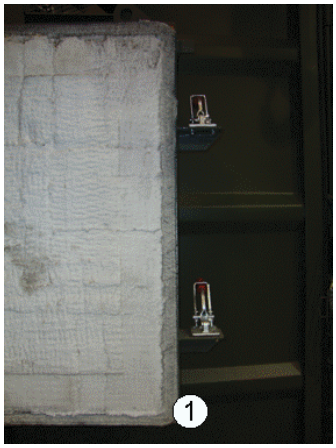


Primary Door (refractory lined)

1. Primary Door Gasket



Secondary Door (refractory lined)



1. Secondary Door Gasket

INSTRUCTION 05-001.Q.02: INSPECT REFRACTORY FOR SHRINKAGE

1. Ensure power is locked out.
2. Open Primary and Secondary Chamber doors.
3. Fasten doors open, ensuring they will not close on their own.
4. Enter Primary and Secondary Chamber and check the refractory for shrinkage, anything greater than 2.54 cm should be patched.
5. Check to make sure the anchoring of the modules is still strong and intact, if any modules seem loose replace complete module with new module.

A. **REMOVAL:** Remove existing Module (physically pull away existing refractory from underlying Module Anchor).

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell).

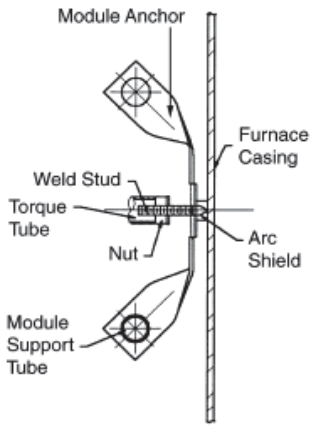


Figure 1: Side view of the Weld Loc Module

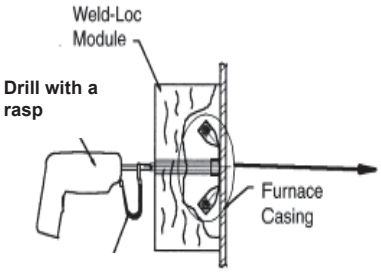


Figure 2: Stud Gun with rasp and Torque Tube.

A. **INSTALLATION**: Once the new module (PN: 433026) is in place take the stud gun (PN: ECO-STUD) with rasp to the Torque Tube and drill into place.

B. Once it has tightened the Torque Tube should come off with the drill.

Paint: (05-003.Q)

Ensure proper ventilation and proper equipment is being used when using any paint product.

INSTRUCTION 05-003.Q.01: INSPECT AND MAINTAIN EXTERIOR PAINT

1. Maintain paint exterior to protect metal from heat and corrosion damage. This includes all components in the system including containers and incinerator components.

2. If discoloration is noted and painting needs to be performed, on areas where paint will be applied, you must do a light sanding before application.

3. Follow paint manufacturer's application instructions which will include surface preparation, priming and painting.

4. If components within the container need to be painted, for example the Primary Chamber or the Secondary Chamber, proceed as above. Use a type of paint that meets the following specifications:

Paint Specifications:

Incinerator Paint: This is the paint coated directly on the incinerator shell. This includes the following components:

1. Primary Chamber
2. Secondary Chamber
3. Breech Section
4. Hot Stack Section (Black)

Finish needs to be able to withstand temperatures in the 650-750°F (340-400°C) range.

Parts: There are no paint specifications for each individual component. This is left up to the discretion of the customer.

iii. Yearly Instructions

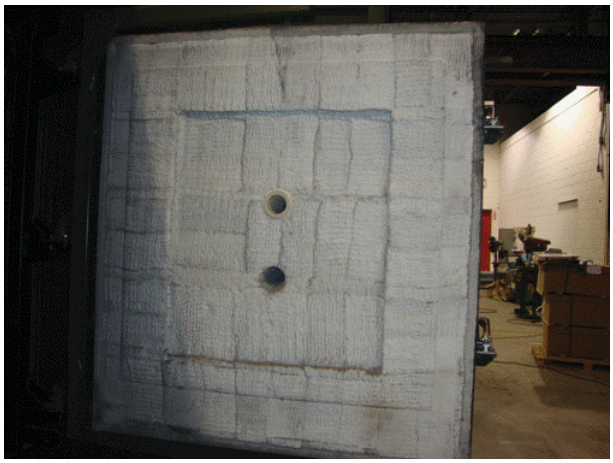
Refractory: (05-001.Y)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

INSTRUCTION 05-001.Y.01:
CHECK DOOR GASKET ALONG PRIMARY & SECONDARY CHAMBER DOORS

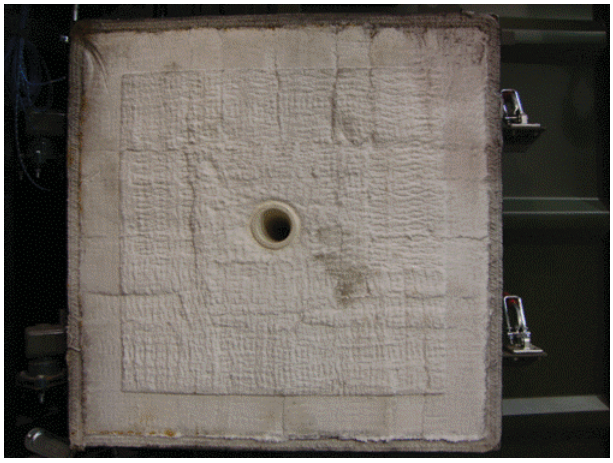
1. If required replace the door gasket. The gasket can last over 2 years but will depend on the careful use by the operator when loading and unloading.

2. Remove the damaged section of door gasket from door and reinstall new gasket (PN: GSB 1.5")



Primary Door (refractory lined)

Primary Door Gasket



Secondary Door (refractory lined)

Secondary Door Gasket

Electrical: (05-004.Y)

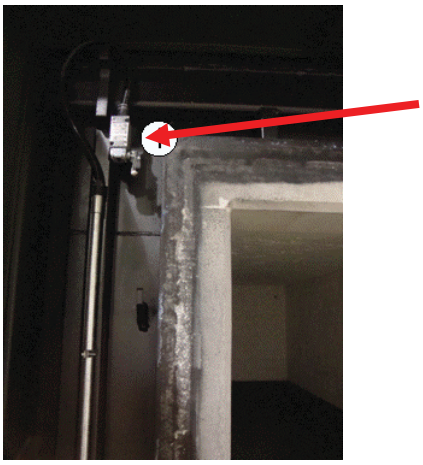
When working with electrical components ensure lock out instructions are being followed

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

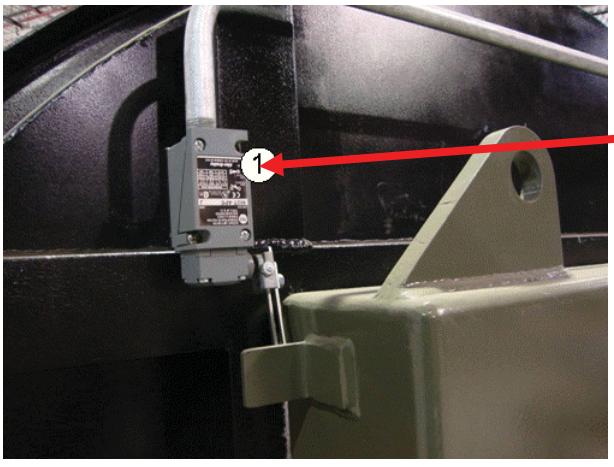
INSTRUCTION 05-004.Y.01: CHECK LIMIT SWITCHES

NOTA **System must not be running or in cool down to perform this inspection**.

1. Open Primary and Secondary Chamber doors and check top view screen on the HMI to ensure that it indicates door is open.
2. Close Primary and Secondary Chamber doors and check top view screen on the HMI to ensure that it indicates door is open.
3. All limit switches located on the unit are checked this way.
4. Replace limit switches (PN: 802T-APE) if necessary.



Primary Chamber Limit Switch



Secondary Chamber Limit Switch

1. See *CMI 6.3.1/05-005A)*.

2. Check all other limit switches in the system.

    a. Limit Switch located at upper limit of lid lifter Primary Chamber
    b. Limit Switch located at lower limit of lid lifter Primary Chamber

CORRECTIVE MAINTENANCE INSTRUCTIONS (CMI)

The following instructions relate to the replacement or correction (fixing) of components of the EWS Incinerator Package.

These Corrective Instructions are grouped in this section by the following:

6.3.1 General Corrective Maintenance Instructions
6.3.2 Refractory Corrective Maintenance Instructions
6.3.3 Primary & Secondary Burner Corrective Maintenance Instructions
6.3.4 Primary & Secondary Blower Corrective Maintenance Instructions
6.3.5 Waste Oil Burner Corrective Maintenance Instructions
6.3.6 Main Control Panel Corrective Maintenance Instructions

the following table is utilized to identify the components of the system that require corrective maintenance.

System Component		**Identification number**	
Primary Blower		**01-001**	
	Air Proving Switch Replacement		6.3.4/01-001A
	Damper Calibration		6.3.4/01-001B
	Modutrol Resistor Replacement		6.3.4/01-001C
	Damper Crank Arm Replacement		6.3.4/01-001D
	Motor Replacement		6.3.4/01-001E
	Modutrol Motor & Transformer Replacement		6.3.4/01-001F
Secondary Blower		**02-001**	
	Air Proving Switch Replacement		6.3.4/02-001A
	Damper Calibration		6.3.4/02-001B
	Modutrol Resistor Replacement		6.3.4/02-001C
	Damper Crank Arm Replacement		6.3.4/02-001D
	Motor Replacement		6.3.4/02-001E
	Modutrol Motor & Transformer Replacement		6.3.4/02-001F
Primary Burner		**01-002**	
	Replacing Fuel Filter		6.3.1/01-002A
	HT Lead & Electrode Replacement		6.3.3/01-002A
	Diffuser Disc Replacement		6.3.3/01-002B
	Nozzle Replacement		6.3.3/01-002C
	End Cone Replacement		6.3.3/01-002D
	Nozzle Assembly Repair or Replacement		6.3.3/01-002E
	Burner Flexible Oil Line Replacement		6.3.3/01-002F
	Low Level Switch Replacement		6.3.3/01-002G
	Inspection Window Replacement		6.3.3/01-002H
	Fuel Pump Replacement		6.3.3/01-002I
	Control Box Replacement		6.3.3/01-002J
	Oil Tube Replacement		6.3.3/01-002K
	Burner PE Cell & UV Detector Replacement		6.3.3/01-002L
	Burner Fan Motor Replacement		6.3.3/01-002M

Refractory		**05-001**	
	Wall Refractory: Gaps between the Modules		6.3.2/05-001A
	Wall Refractory: Replacement of the Modules		6.3.2/05-001B
	Door Gasket		6.3.2/05-001C
	Castable Refractory		6.3.2/05-001D
	Temporary Repair of Castable		6.3.2/05-001E
Main Control Panel		**03-010**	
	Main Control Panel		6.3.6/03-010A
	Reboot PLC		6.3.6/03-010B
Limit Switch		**05-005**	
	Limit Switch Replacement		6.3.1/05-005A

iv. General Corrective Maintenance Instructions

LIMIT SWITCH REPLACEMENT (6.3.1/05-005A)

1. Loosen the 2 screws holding the limit switch in place.
2. Remove limit switch, replace with a new one (PN: 802T-APE).
3. Take arm off of old body and mount to new.
4. Tighten the 2 screws holding the limit switch body.

REPLACING THERMOCOUPLE (6.3.1/05-002A)

The thermocouple will require routine replacement. The environment inside the incinerator will erode the protection tube to the point of failure. If the element is exposed to this environment it will be destroyed and will need to be replaced.

1. Unscrew thermocouple lid and remove wires.
2. Remove protection tube. To aid with this a vise and a pipe wrench will be needed.
3. Remove element and replace with new element (PN: TK-K08B-0100-S) and protection tube (PN: TA-A427A-K08B-010).

4. Reinstall on incinerator.

5. After installation turn power back on. Observe the temperature reading of the thermocouple you were just working on. If the wires were installed incorrectly the temperature will read the opposite temperature. (ie 20°C would read as -20°C). If this is the case open the thermocouple housing and switch the wires.

REPLACING FUEL FILTER (6.3.1/01-002A AND 02-002A)

The fuel filter will require routine replacement to ensure clean fuel delivery to the Primary and Secondary Chamber burners.

1. Close the ball valve on the supply line.

2. Unscrew the used filter. Use a bucket to catch the surplus fuel when you unscrew the filter.

3. Before installing the filter lubricate the seal on the new filter.

4. Install the new filter, and open the supply line ball valve.

v. Refractory Corrective Maintenance Instructions

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

WALL REFRACTORY: GAPS BETWEEN THE MODULES (6.3.2/05-001A)

The ceramic block refractory will shrink over time exposing the exterior metal shell. These gaps need to be filled in with ceramic refractory blanket.

1. Identify gaps in the chamber that are larger than 1” in width between the modules or if you can see exterior shell.

2. With a Utility knife cut a length of ceramic blanket (PN: 1" x 24" 8# 2600) that will fit in the gap between the modules.

3. Stuff the blanket into the space with a straight edge or ruler.

WALL REFRACTORY: REPLACEMENT OF MODULES (6.3.2/05-001B)

Excessive damage to a section of refractory may necessitate the replacement of modules in the incinerator. Such damage is largely due to mechanical wear. The following diagram walks through the removal and installation of new modules.

A. REMOVAL: Remove existing Module (physically pull away existing refractory from underlying Module Anchor)

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell)

Figure 1: Side view of the Weld Loc Module

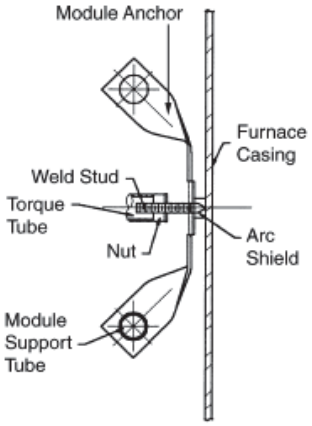
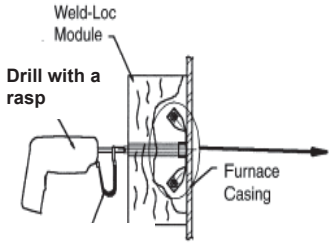


Figure 2: Stud Gun with rasp and Torque Tube (part of module assembly).



C. INSTALLATION: Once the new module is in place take the stud gun (PN: Eco-Stud) with rasp to the Torque Tube and drill into place.

D. Once it has tightened the Torque Tube should come off with the drill.

DOOR GASKET REFRACTORY (6.3.2/05-001C)

The door gasket will degrade over time and will need to be replaced over time. The bottom of the door will see more degradation due to the waste burning in that vicinity.

1. Identify the damaged section of gasket that will need to be removed
2. With a utility knife cut out the section that needs to be replaced.
3. A new piece of gasket (PN: GSB 1.5”) will need to be cut the same length as the removed piece.
4. With contact cement coat the gasket on one side and the door section and install.

CASTABLE REFRACTORY (6.3.2/05-001D)

Operators will notice that the castable refractory will show signs of minor cracking. The minor cracking is normal. Large sections of castable should not separate from the rest of the monolithic cast. Such occurrences are largely due to a sudden impact from machinery or dropping of the units themselves. Mortar (PN: SM3000) is supplied to help with a temporary repair while a permanent repair is resolved. Such permanent repairs are a third level repair and have to be considered on a case by case basis.

TEMPORARY REPAIR OF CASTABLE (6.3.2/05-001E)

1. Find the pieces of castable refractory that have separated.

2. Clean both the pieces of refractory and the area where the separation occurred.

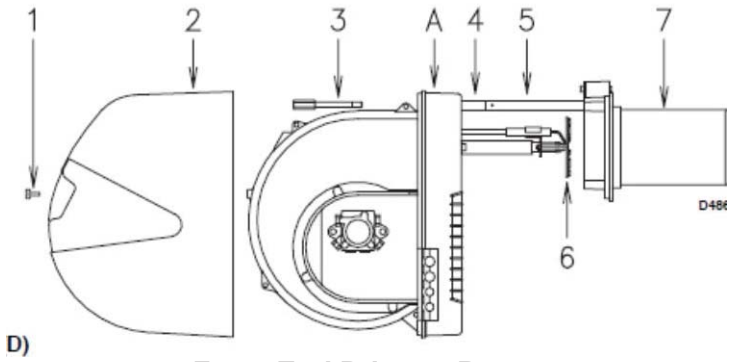
3. Spread an even amount of high temperature mortar on the pieces and the area of separation.

4. Put the pieces back where they originated and support as necessary for a minimum of an hour while the mortar cures.

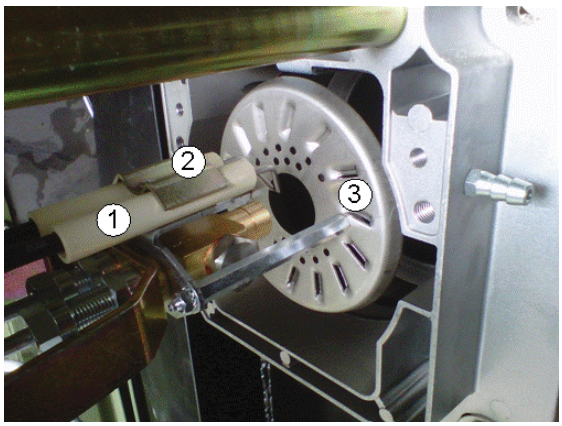
vi. Burner Corrective Maintenance Instructions

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

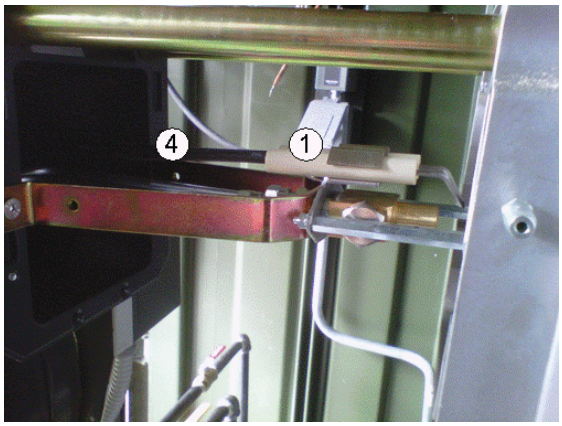
The Burners are pieces of equipment that will require routine corrective and preventive maintenance. Parts within this assembly will need to be repaired or replaced. The most common parts to be repaired or replaced are located at the front end of the burner where the parts are exposed to high temperatures.



Front End Primary Burner



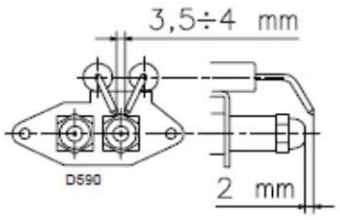
1. Electrode
2. U-bolt
3. Diffuser Disc



4. HT Leads

HT LEAD & ELECTRODE REPLACEMENT (6.3.3/01-002A)

1. In order to change out the HT leads (PN: 3012995) Primary Burner or Electrode (PN: 3003796) the U-Bolt will have to be removed
2. Remove the electrode by pulling the lead out of the white ceramic tube, replace and re-install.
3. To change the Leads the wire will need to be removed from the burner.
4. Pull the wire out of the burner housing through the rubber grommet.
5. The other end is connected to the back of the control box. Pull the wire straight out and the spring fitting will disengage.
6. Replace the lead with a new one reversing the above directions.
7. When reinstalling the electrodes make sure that they are positioned as shown below:



Primary Burner

DIFFUSER DISC REPLACEMENT (6.3.3/01-002B)

1. Identify the diffuser disc in the above pictures.
2. The disc assembly is secured to the nozzle housing by 2 hex nuts.
3. Remove these nuts and remove the assembly from the burner.
4. The disc is attached to the assembly with 2 screws.
5. Remove the screws and replace the disc.
    - Primary Chamber Burner diffuser disc PN: 3003791
6. Reassemble.

NOZZLE REPLACEMENT (6.3.3/01-002C)

1. Identify the nozzle at the very front end of the burner just behind the diffuser disc.

2. Remove the nozzle with a wrench.

3. Install the new nozzle.
    - Primary Chamber Burner nozzle PN: C5222433

END CONE REPLACEMENT (6.3.3/01-002D)

The end cone will need replacement when the flame becomes unstable from too much heat damage.

1. Loosen and remove the 4 hex bolts that hold the burner on the flange.

2. Remove the burner completely from the incinerator. This will require more than one operator because the burner is heavy.

3. There are two screws that hold the end cone on. Remove and save the screws for the new end cone.

4. Install the new End Cone with the old screws.
    - Primary Chamber burner end cone PN: 3003807

5. Reinstall the burner.

NOZZLE ASSEMBLY REPAIR OR REPLACEMENT (6.3.3/01-002E)

The nozzle assembly is subjected to high heat cycling. The heat cycling will eventually cause the seals and assembly to leak. The assembly will have to be replaced when this occurs. First identify the location of the nozzle assembly.

The parts (seals, nozzle assembly) needed for these replacements are all included under one part number.

- Primary Chamber Burner nozzle assembly: PN: 3003814

Remove all connections to the nozzle assembly and replace with the above parts.

BURNER FLEXIBLE OIL LINE REPLACEMENT (6.3.3/01-002F)

1. Turn the inline ball valve to the closed position to isolate the fuel supply from the burner. This valve is located down line from the burner.

2. Remove flexible lines.

3. Replace with new lines.

    - Primary Chamber Burner flexible oil line: PN: C5281160

4. Open ball valve.

Primary Chamber Burner Flexible lines
(Item # 1 Above)

LEVEL SWITCH REPLACEMENT (6.3.3/01-002G & 02-002G)

The level switch is located in the Fuel Tank.

NOTA
Tanks do not have to be emptied to replace.

1. Unplug the level switch.
2. Disconnect the cord and remove the level switch.
3. Replace level switch (PN: FS301-01) and reconnect the cord.
4. Plug in the level switch.

INSPECTION WINDOW REPLACEMENT (6.3.3/01-002H & 02-002H)

To replace the inspection window simply remove the old inspection window and replace with a new one:

- Primary Burner inspection window PN: 3003763

FUEL PUMP REPLACEMENT (6.3.3/01-002I)

Identify the pump on the burner you wish to replace.

Remove all fuel connections to the pump with the appropriate wrench. Unbolt the pump from the main body of the burner and pull the pump away from the burner to remove.

Reinstall the new pump, and reattach all fuel connections.

- Primary Burner: PN: 3013027

CONTROL BOX REPLACEMENT (6.3.3/01-002J & 02-002J)

Identify the control box on the burner you wish to replace:

Ensuring the power is off unscrew the old control box and install the new one.

- Primary Burner: PN: 3012933

OIL TUBE REPLACEMENT (6.3.3/01-002K)

Oil tubes leak due to heat cycling which causes the fittings to fail or a loose fitting.

1. Identify the oil tubes on the Primary Burner and on the Secondary burner.
2. First try tightening the fittings to see if the leak stops. If the leak does not stop:
3. Remove the old oil tubes with a wrench and install the new ones:

- Primary Burner Tubes: PN: 3003821
  PN: 3003822

BURNER PE CELL REPLACEMENT (6.3.3/01-002L)

Primary Burner: If the PE cell has been damaged, then it will need to be replaced. The PE cell while removed needs to be unplugged from the control box. This is accomplished by pulling the connection towards you. With the new PE cell install the control box end first by pushing the connection hard. Reinstall the PE cell in the burner.

BURNER FAN MOTOR REPLACEMET (6.3.3/01-002M)

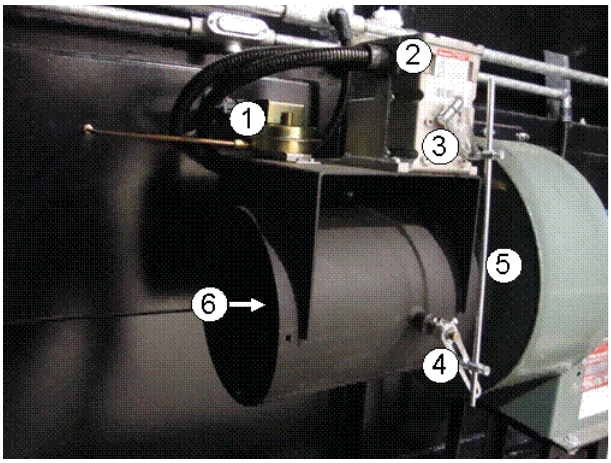
Identify the malfunctioning motor in the affected burner:

Unbolt and remove the malfunctioning motor from the housing. Disconnect all electrical connections. Reinstall the new motor exactly how the old motor was installed.

vii. Primary & Secondary Blower Corrective Maintenance Instructions

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

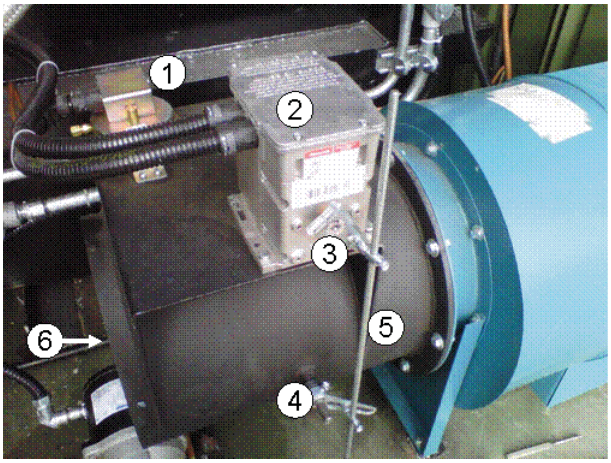
Primary Blower assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



Primary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

Secondary Blower assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



*Sample picture of a Secondary Blower and its assembly

Secondary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

AIR PROVING SWITCH REPLACEMENT (6.3.4/01-001A & 02-001A)

1. Ensure all power is locked out.
2. Remove wiring from switch.
3. Remove tubing from switch.
4. Unscrew screws at the two locations and remove switch.
5. Reinstall new switch (PN: SML8221210034) complete with tubing and wiring and then retighten.
6. Turn power back on.

DAMPER CALIBRATION (6.3.4/01-001B & 02-001B)

Sometimes the damper linkage will slip when the connections become loose (Items 3,4,5 in the Secondary Blower photo) In order to ensure that the linkage is correctly calibrated the operator will need to look at the display screen on the control panel while the unit is in operation

1. Read the % Open value on the control panel operator interface (PanelView) for the Primary Blower.
2. During operation the damper is factory preset to be 0% open, or fully closed.
3. Look inside the damper (Item 6) and ensure that the linkage is completely closed.
4. If it is then this maintenance is complete.
5. Should the damper be open even a small percentage the linkages are to be loosened and the damper adjusted to be completely closed, and then retighten.

MODUTROL RESISTOR REPLACEMENT (6.3.4/01-001C & 02-001C)

The Modutrol resistors are located inside the top lid of the Modutrol motor. Remove the lid to the Modutrol motor by unscrewing the top four (4) screws. The connection between the control panel and the Modutrol is made with a small white connector with 3 terminals. Jumpered between these terminals is the resistors.

Remove and replace the resistors one at a time to ensure the correct resistors are replaced. You identify the correct resistor by examining the color band on the center node of the resistor. Replace like resistors.

DAMPER CRANK ARM REPLACEMENT (6.3.4/01-001D & 02-001D)

The crank arm will only need to be replaced if the arm is damaged due to misuse. Identify the damper crank arm (Item #4 in the picture on the previous page).

Identify the location of the linkage on the rod and the damper arm with a marker, so the new crank arm will be in the same spot when reinstalled. Remove the connections to the crank arm and replace with the new one (PN: 26026G) and ensure it is in the same spot as the old one.

MODUTROL MOTOR & TRANSFORMER REPLACEMENT (6.3.4/01-001F & 02-001F)

To replace the Modutrol motor all power needs to be off to the system as you will need to expose electrical connections. Firstly get the new motor and orientate the motor in the same direction as the old motor. Identify where the conduit is connected on the old motor and punch the connector holes for the new motor.

Removal

1. Remove all electrical terminations and remove the transformer.
2. Install the transformer in the new Modutrol motor.
3. Remove all conduit connections on the motor.
4. Remove the damper arm and linkage from the motor.
5. Unbolt the motor from the damper, and ensure all nuts and bolts are kept for the new motor install

Install

1. Bolt the new motor in the same orientation as the old motor.
2. Install the damper arm and linkage to the motor
3. Install all conduit connections

Terminate all electrical connections the same as the old motor.

REPLACE THE BLOWER CONTACTOR 6.3.4/01-001G

1. Turn the Main Disconnect Switch off.
2. Open Panel.
3. Remove the wires from M1.
4. Pull the retaining clip up.
5. Tilt contactor forward and remove.
6. To reinstall tilt new contactor (PN: 100-C09D10) until it clicks back in.
7. Pull the retaining clip back down to lock.
8. Reinstall wires to M1.
9. Close panel.
10. Turn power back on.

viii. Main Control Panel Corrective Maintenance Instructions

MAIN CONTROL PANEL (6.3.6/03-010A)

All control panel diagnostics are to be completed by certified or trained technicians. Electrical drawings / diagrams are provided to aid electricians with any diagnostics.

REBOOT PLC (6.3.6/03-010B)

Turn Main Disconnect to the off position on the front of the Control Panel. Turn the main disconnect back on.

SECTION 7

PARTS LIST

ECO WASTE SOLUTIONS

ECO 1.75TN 1PV100L Parts List

General Incinerator Components	Quantity		Part #	Supplier
Primary Door Bearings			F4B-E-200R DGE	Canadian Bearings Ltd.
Secondary Door Bearings	5		F4B-E-104R DGE	Canadian Bearings Ltd.
Stack Bearings	2		P2B-SC-100	Canadian Bearings Ltd.
Toggle Clamps US$	6		51335A66	McMaster-Carr
View Ports	5		P1030/8	Pegasus
Thermocouple	4		TA-A427A-K08B-010.0	Thermo-Kinetics Company Ltd.
Metal ash bins 2.5 yds with lid	2		JT-2.5-60-188	JT Fabrication Ltd..
Blower Assemblies	Quantity		Part #	Supplier
Primary Chamber Blower	1		BI10	Canarm
Secondary Chamber Blower w/flanges	1		BI13	Canarm
Modutrol	2		M9184D4009	Yorkland Controls Limited
Air Proving Switch	3		SML 8221210034	Yorkland Controls Limited
Primary Chamber Burner	Quantity		Part #	Supplier
Primary Burner RL 28/2	1		C9511200	Riello
Fuel Tank 4500l	1		6011000	Hassco Industries Inc.
Ktech 37.5" low level switch stainless steel	1		FS301SF-1 28"NC	Ktech Industrial Products Inc.
Diesel filter	1		VF1210	National Energy Equipment Inc.
5 micron pleated paper filter	2	KPP21005B		National Energy Equipment Inc.
High Output Used Oil Burner	Quantity		Part #	Supplier
Special 6514-8-A fireall dual fuel burner complete with refractory tile, standard capacity iron nose	1		6514-8-A/LX/1.0A-X13546	Fives North American Combustion
3/4" Pilot Set	1		4015-0-T	Fives North American Combustion
1/2" std regulator	1		7218-01	Fives North American Combustion
3/8" sensitrol oil valve	1		1813-02-D	Fives North American Combustion
1/2"dia. x 18" AOL; 1/2" mnpt connectors e/e; braided CGA approved and tagged	1		C8777-01/18-CGA	Fives North American Combustion
2" butterfly valve	1		1122-4	Fives North American Combustion
Gauge, 0 - 60" wc and 0 - 35 osi	2		8735-HI	Fives North American Combustion
8" wafer valve	1		1156-9	Fives North American Combustion
Control motor, 310 IN/LBS, 37 second timing,4-20 ma, no feedback signal, 1000 ohm potentiometer, 135 degree travel, 110-120VAC	1		1615-F	Fives North American Combustion
Bracket and Linkage for 1615-A through N, for 1136, 1146, and 1156-9 through -22	1		2-9004-205	Fives North American Combustion
Pressure switch, 12 - 60" wc	1		8757-GAO-A4/4/6	Fives North American Combustion
DIF. PRES. SW 1-20"W.C.AUTO.RST	1		C8757-DG50T-DIF	Fives North American Combustion
1/2" ball valve	4		C1821-01	Fives North American Combustion
1/4" ball valve	5		C1821-03	Fives North American Combustion
Pressure gauge, 2-1/2"; 0-60 psi/400 kPa, dual scale; liquid filled 1/4" bottom; SS case;	2		C8735-M-LF	Fives North American Combustion
1/2" pressure regulator	1		7142-01-25	Fives North American Combustion
1/2" relief valve	1		7177-01-75	Fives North American Combustion

Pressure switch #B424B range=0-100 psi	2	C8757-B424B-100	Fives North American Combustion
1/2" oil solenoid valve, NEMA 3R	1	1483-01	Fives North American Combustion
1/2" automatic reset oil shutoff valve 120/1/60	1	1517-01	Fives North American Combustion
1/4" Oil flow meter nickel-plated brass housing Buna o-ring 0.2-0.9 GPM SS orifice and spring vertical flow up	1	8598B-03-0.9-VU	Fives North American Combustion
1/2" ratiotrol with gauges	1	7052-01-WG	Fives North American Combustion
1/2" expansion chamber	1	C7000-0-HSR	Fives North American Combustion
3/4" regulator	2	C1485-01	Fives North American Combustion
Combution Blower -Chicago Blower	1	D53 E4	Canada Blower
Burner control	1	RM7895C1012	Yorkland Controls Limited
1" three way valve	1	4093T25	McMaster-Carr
1/2" three way valve	1	4093T23	McMaster-Carr
Used Oil Pump	1	03HB1131 code10/13	Albany Pump Company Ltd.
Basket suction strainer with 60 mesh	1	SBS-100	Albany Pump Company Ltd.
Ball Valve, 1” NPT, cUL Listed	1	BAVA-100	Albany Pump Company Ltd.
Relief Valve c/w WS spring (30-100 PSI)	1	FVJ-3R-SS	Albany Pump Company Ltd.
Pressure gauge, 4” Dial; liquid filled, 100 PSI	1	PG100LF-100	Albany Pump Company Ltd.
Compound Gauge;4" Dial; liquid filled; 30-0-30 PSI	1	CG100LF-30/30	Albany Pump Company Ltd.
Watson McDaniel size 3/4” Series ‘B’ pressure reducing valve	1	with Viton disc and diaphragm. 1-50 psig	Albany Pump Company Ltd.
Waste Oil ciculation heater with controller 600v. 3ph, 4687watts	1	CBLS747E13S	Hassco Industries Inc.
Transfer Pump	1	FR450B	National Energy Equipment Inc.
Oil Filter	1	VF1210	National Energy Equipment Inc.
5 micron pleated paper filter	2	KPP21005B	National Energy Equipment Inc.
Waste oil Tank 5000L	1	CUSTOMTANK	Hassco Industries Inc.
Level Switch	1	FS301SF-1 45”NC for 60 dia. tank	Ktech Industrial Products Inc.
Mixer	2	NP HGL-3.3	Metex Corporations
Waste oil totes IBC containment	2	H4435	ULINE CANADA CORPORATION
Waste oil totes IBC	2	H-3886	ULINE CANADA CORPORATION
Salt and/or sand box spillage kit	2	S18304	ULINE CANADA CORPORATION
Top Loading Package	Quantity	Part #	Supplier
Lid lifter HT 3500 Stoke 72"	1	9-LL-3500-72-BE-575	Canada Hydraulique Equipment Inc.
Lid Lifting Link Assembly	4	ECO5TN2PV-06-XX	P.D.S. WELDING LTD
Jaw Only 3/4" - 10 Right Hand Thread 12" max adj	4	3001T23	McMaster-Carr
18-8 Stainless Steel Clevis Pin, 3/4" Dia 2" L	4	92390A521	McMaster-Carr
Opacity Monitor	Quantity	Part #	Supplier
Compliance Opacity Monitoring System (EPA PS-1)	1	PN 80-0290	Akrulogic
Includes:			
Transceiver / Reflector			
Stack Mounting Flanges			
Local Control Panel			
1hp Air Purge Assembly			

ECO 1.75TN 1PV100L Parts List

-60C Air Purge Hose (2 pcs @ 20')	1	PN 80-3411 (Upgrade)	Akrulogic
Opacity Optic Head Extension Control Cable	1	PN 80-0297	Akrulogic
Scale	Quantity	Part #	Supplier
4 x 4 Scale w/ digital indicator, analog output and weather gland	1		Matrix Scale Service Inc.
Electrical	Quantity	Part #	Supplier
IEC 60 amp 600 volt rotary disconnect	1	GS2GU3N	Graybar
Disconnect operating handle	1	GS2AH420	Graybar
Operating shaft	1	GS2AE81	Graybar
175 amp power distribution block	1	PDB220-3	Graybar
175 amp power distribution block cover	1	CPB162-1	Graybar
Ground lug	1	LAMA2/0-14-QY	Graybar
600 volt 30 amp 3 pole class J fuse block	11	JT60030	Graybar
250 volt 30 amp 1 pole class RK1 fuse block	11	H25030-1CR	Graybar
600 volt 60 amp class J fuse	3	LPJ-60SP	Graybar
600 volt 17 amp class J fuse	3	LPJ-17SP	Graybar
600 volt 10 amp class J fuse	3	LPJ-10SP	Graybar
600 volt 7 amp class J fuse	8	LPJ-7SP	Graybar
600 volt 4 amp class J fuse	9	LPJ-4SP	Graybar
250 volt 30 amp class RK1 fuse	1	LPNRK-30SP	Graybar
250 volt 10 amp class RK1 fuse	1	LPNRK-10SP	Graybar
250 volt 6 amp class RK1 fuse	1	LPNRK-6SP	Graybar
250 volt 5 amp class RK1 fuse	2	LPNRK-5SP	Graybar
250 volt 2 amp class RK1 fuse	2	LPNRK-2SP	Graybar
250 volt 1 amp class RK1 fuse	4	LPNRK-1SP	Graybar
12 amp IEC contactor 120 VAC coil	1	LC1D12G7	Graybar
9 amp IEC contactor 120 VAC coil	6	LC1D9F7	Graybar
4 N.O. top mount auxilary contact	1	LADN40	Graybar
IEC solid state overload relay range 6.4- 32 a	1	LR9D32	Graybar
IEC solid state overload relay range 1.6-8 a	2	LR9D08	Graybar
IEC solid state overload relay range 0.2- 2 a	2	LR9D02	Graybar
16 amp SPDT slim line relay 120 VAC coil	10	RXG15F7	Graybar
Base slim line relay	10	RGZE1S35M	Graybar
8 PIN tube based relay 120VAC coil	10	RUMC23F7	Graybar
DPDT 8 PIN tube based relay base	10	RUZC2M	Graybar
600 to 120 VAC 3000 VA transformer	1	CE3000JA	Graybar
24 VDC 1.3 amp switching power supply	1	PS5R-SC24	SnS
5 port unmanaged ethernet switch US$99	1	SE-SW5U	Automation Direct
Current transducer US$75.5	1	ACT050-42L-F	Automation Direct
10.4" TFT touch panel with Intouch run time	1	TCND1U-10AC-CM2	Wonderware Canada East
600 volt 3 H.P. V.F.D.	1	ACS25-03U-04A1-6	Gerrie
480 volt 8 amp line reactor	1	3PR-004C5H	Graybar
0-1" H2O draft transmitter	1	616KD-00	Furneco
Ethernet PLC programing port	1	P-R2-F3R0	Gerrie

ECO WASTE SOLUTIONS

ECO 1.75TN 1PV100L Parts List

22mm Green illuminated push button operator	2	ZB5AW333	Graybar
22mm Emergency stop push button operator	1	ZB5AS844	Graybar
22mm 3 position return to center selector switch	1	ZB5AD5	Graybar
22mm Green flush push button operator	2	ZB5AA34	Graybar
22mm Black flush push button operator	2	ZB5AA24	Graybar
22mm Red extended push button operator	2	ZB5AL4	Graybar
Green integrated led module	2	ZBVG3	Graybar
N.O. contact block	5	ZBE101	Graybar
N.C. contact block	3	ZBE102	Graybar
Limit switch	4	802T-AP	Gerrie
Limit switch lever	4	802T-W2B	Gerrie
18 mm AC inductive proximity switch US$31	2	VK1-AO-1B	Automation Direct
Pt100 RTD for cold junction compensation	1	TFD	Omega
Unity CPU cw 1 Enet port and 1 serial port	1	BMXP342020	Graybar Canada Inc.
8 Slot Backplane	1	BMXXBP0800	Graybar Canada Inc.
110Vac Power supply	1	BMXCPS2000	Graybar Canada Inc.
16 point 120 vac input module	2	BMXDAI1604	Graybar Canada Inc.
8 channel analog input module	1	BMXAMI0810	Graybar Canada Inc.
4 channel thermocouple input module	1	BMXART0414	Graybar Canada Inc.
16 point relay output module	1	BMXDRA1605	Graybar Canada Inc.
4 Channel analog output module	1	BMXAMO0410	Graybar Canada Inc.
Connectors for all modules except AMI0810 and ART0814	4	BMXFTB2000	Graybar Canada Inc.
Connector for AMI080	1	BMXFTB2800	Graybar Canada Inc.
Connector	1	BMXFCW301S	Graybar Canada Inc.
IEC solid state overload relay range 0.2- 2 a	1	LR9D02	Graybar
1hp VFD ABB	1	ACS250-03U-02A1-6	Gerrie
1hp line reactor	1	REX3PR0002C5H	Graybar Canada Inc.
Type K Thermocouple 20AWG	300	K-20S-TT	Thermo-Kinetics Company Ltd.

APPENDIX B • TECHNICAL SPECIFICATIONS OF WASTE OIL BURNER

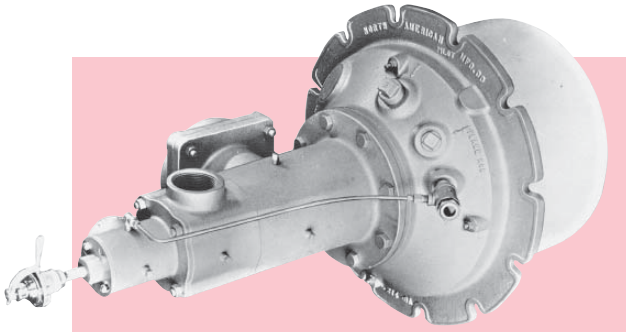
fives north american

FIRE•ALL™ DUAL-FUEL™ BURNERS

Bulletin 6514

February 2011

- **Dual Fuel Burner – gas or oil (light or heavy grade oil)**
- **Conventional forward flame pattern**
- **1.8 to 30 million Btu/hr**
- **Chambers up to 2400F (with alloy nose)**
- **Includes low pressure fuel oil atomizer**



6514 Burner Complete shown with optional (recommended) Sensitrol™ Oil Valve.

6514 FIRE•ALL Dual-Fuel Burners are nozzle mix, sealed-in burners for gas, light oil, or heavy oil. Capable of efficient operation throughout a wide temperature range, these burners are equally at home on low temperature ovens and high temperature forge and melting furnaces.

Ruggedly built for sustained, maintenance-free operation, 6514 Burners also provide for quick change of fuels without disturbing process operations.

Sealed mountings help maintain furnace pressure, controlled atmosphere, and closer air/fuel ratio control--all contributing to better product quality.

Fire•All Burners are a proven workhorse on all types of furnaces.

COMBUSTION CHARACTERISTICS

Oil. Oil viscosity at the burners must not exceed 100 SSU. Oil pressure at air/fuel Ratiotrol™ should be between 25 and 30 psi. Oil pressure at rated capacity is 10 to 15psi at Sensitrol™ and less than 1 psi at burner. Minimum atomizing air pressure at the burners is 14 osi for light oil, 22 osi for heavy oil.

Gas. Atomizing air (4 osi minimum) should be left on to protect the atomizer. Maximum required natural gas pressure at the burner for stoichiometric ratio is less than 4osi.

Air/Fuel Ratio. 6514 Dual-Fuel Burners are stable throughout a wide range from excess fuel to excess air. They can operate with excess fuel without forming carbon, but additional air for complete combustion must be available in the furnace near the burner.

For limits in a specific case, either rich or lean, consult Fives North American.

Turndown. Fire•All Burners can be turned down to atomizing air only (with fuel to match) except when burning residual oils in a cold, tight furnace.

Total air capacities (including main and atomizing air)

Burner designation	16 osi air pressure drop across the burner: Air① scfh	Light oil② gph	Heavy oil③ gph	Gas④ scfh	24 osi air pressure drop across the burner: Air scfh	Light oil gph	Heavy oil gph	Gas scfh	Approx. flame lengths with 16 osi main air (in open furnace)
6514-6	17 900	13	12	1 790	21 900	16	15	2 190	4' - 5'
6514-7	28 400	21	19	2 840	34 800	26	23	3 480	5' - 6'
6514-8-A	48 900	36	33	4 890	60 000	44	40	6 000	8' - 9'
6514-8-B	81 500	60	54	8 150	100 000	74	67	10 000	9' - 12'
6514-9	165 000	122	110	16 500	202 000	150	135	20 200	15' - 18'
6514-10	247 000	183	165	24 700	303 000	224	202	30 300	20'

① For Btu/hr, multiply by 100 ② Light oil at 135 000 Btu/gal. ③ Heavy oil at 150 000 Btu/gal. ④ Natural gas at 1000 Btu/cf.

Burner designation	Main air capacities in scfh: Air pressure drop across the burner in osi 1	5	6	8	12	16	Atomizing air capacities in scfh: Air pressure drop across the burner in osi 14	16	18	20	22	24
6514-6	3 710	8 300	9 100	10 500	12 900	14 900	2 800	3 000	3 180	3 360	3 510	3 660
6514-7	6 100	13 600	15 000	17 200	21 000	24 400	3 770	4 030	4 270	4 500	4 720	4 900
6514-8-A	10 600	23 700	26 000	30 000	36 700	42 400	6 050	6 500	7 000	7 300	7 600	7 850
6514-8-B	17 600	39 200	43 000	49 600	60 500	70 000	10 600	11 300	12 000	12 700	13 200	13 800
6514-9	36 600	82 000	89 500	104 000	127 000	146 000	17 200	18 400	19 600	20 700	21 600	22 500
6514-10	54 500	122 000	135 000	154 000	189 000	218 000	27 200	29 100	30 900	32 600	34 100	35 500

Flame Supervision. An ultraviolet cell‡ will monitor pilot or main flame on gas or oil. For maximum safety, Fives North American urges **interrupted** pilots when flame safeguards are used--pilots should be on only for a preset ignition period (usually 15 seconds), after which flame supervision detects main fire only. Adapters for mounting flame detection devices on 6514 Burners are tabulated on Bulletin 8832.

Tile/Installation. Burner tiles are cast refractory rated for 2800F furnace temperature. They should be supported securely in the furnace wall by castable refractory (not insulation) at least 9" thick all around the tile, extending back to the furnace shell and securely anchored to it. (See Supplement DF-M1.)

Tiles are replaceable in the field except for the 6514-10, whose mounting must be returned to the factory for tile replacement (or purchase a spare mounting plate with a tile cast onto it).

Complete burners include tile, mounting plate, and an observation port into which a small quantity of atomizing air is introduced to keep the glass clear. Order pilot tips and Sensitrol™ Oil Valve separately. See 6514 Dimension Sheet for recommended Sensitrol™ oil valve and premix pilot tip.

Jacketed Tile options are available for applications where the tile is not supported by furnace refractory. Jackets are available in three different metals and have maximum temperature ratings for each. They must be protected with sufficient insulation so as not to exceed rated temperature.The maximum temperature rating depends upon frequency of heat-up/cool-down cycles. As an example, batch annealing furnaces that are heated and cooled every day should use the "intermittent exposure" ratings. Continuous annealing furnaces that remain at the same temperature for months at a time, can use the higher "continuous" rating.

Designation	Jacket Metal	Continuous max.temp.	Intermittent exposure
6514- -LC	carbon steel	700 F	700 F
6514- -L4	304 stainless	1600 F	1500 F
6514- -L9	309 stainless	1900 F	1800 F

‡ Cleaning air must be introduced into the port downstream of the sensor to keep oil and poc's off the lens.

Burner Nose options are available for sizes shown below and can be specified in the product number. The burner nose establishes main combustion air flow and influences flame propagation. Nose material is either cast iron that is suitable for cold air applications up to 1800F, or cast stainless alloy for preheated air (maximum 700F) applications up to 2400F.

Mat'l	Cap'y	-6	-7	-8A	-8B	-9	-10
Cast iron	1.0	√	√	√	√	√	√
Cast Alloy	1.0	√	√	√	√	√	√
Cast iron	1.1		√	√	√	√	√
Cast Alloy	1.1		√	√	√	√	√
Cast iron	1.2			√	√	√	√
Cast Alloy	1.2			√	√	√	√
Cast iron	1.3			√	√	√	√
Cast Alloy	1.3			√	√	√	√

The product designation 1.0 represents standard main air capacity shown on page 1. Use of an extra capacity burner nose will result in either more air at 16 osi or standard air flow at lower pressure. Extending the capacity of the burner by increasing air pressure beyond 16 osi, or using the extra capacity nose, is acceptable for most gas and light oil applications. Specific applications involving either low Btu fuels or heavy oil and extra capacity should be reviewed with Fives North American.

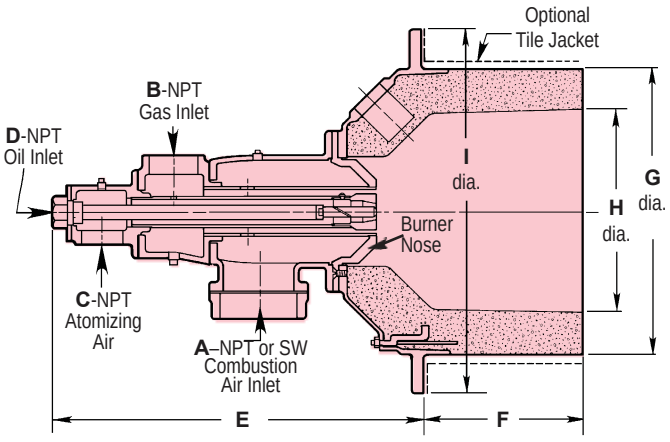
Also, when firing extra capacity, the combustion air flow velocity within the supply piping, and associated pressure loss, can be excessive for some burners. The -8B, -9 and -10 products when operated at 1.2 or 1.3 capacity will develop high pipe velocity based on the burner's air connection size. As an alternative to increasing blower pressure, an oversized air inlet can be purchased separately for these size burners. The connections are SW-type (slip-on sleeve or welded construction) and are one pipe size larger than the standard supply. Nose and oversize air connection part numbers can be found in supplement literature (see Parts List and Burner Options documents).

Options are available for the 6514 burner but require consultation with your Fives North American for application and ordering information. See Sheet 6514-3 for an overview of burner options.

CLEARANCE DIMENSIONS (for details, see Dimensions 6514)

Burner designation	dimensions in inches A†	B	C	D	E	F	G	H	I	Wt. lbs.
6514-6	3	2	1½	⅜	18¾	9	15	10⅜	19½	195
6514-7-	4	2½	2	⅜	20 13/16	8⅞	16	11⅜	20½	225
6514-8-A	6	2½	2½	⅜	27 1/16	10	17¾	12⅜	22¾	335
6514-8-B	6	3	3	⅜	31¼	12⅞	19	13½	24	450
6514-9	8	4	4	½	38⅝	13 7/16	23	16	28	795
6514-10	10	6	6	½	45⅛	13⅝	27½	20½	32½	1035

† SW connection standard for -9 and -10 only.



DIMENSIONS SHOWN ARE SUBJECT TO CHANGE. PLEASE OBTAIN CERTIFIED PRINTS FROM FIVES NORTH AMERICAN COMBUSTION, INC.
IF SPACE LIMITATIONS OR OTHER CONSIDERATIONS MAKE EXACT DIMENSION(S) CRITICAL.

Ordering Information

6514 - _ _ _ / _ _ / _ _ _ _

Product Size
Connection

6 ..... 3"
7 ..... 4"
8-A ..... 6"
8-B ..... 6"
9 ..... 8"
10 .....10"

Tile

BO .. burner only
LX ... refractory tile (no jacket)
LC ... steel tile jacket
L4 ... 304 stainless jacket
L9 ... 309 stainless jacket

Burner Nose

Capacity	Material
1.0 ... main air capacity	H ... cast iron
1.1 ... 1.1 x main air capacity	A ... alloy
1.2 ... 1.2 x main air capacity	
1.3 ... 1.3 x main air capacity	

Example 1 6514-8-A/LC/1.2A Fireall gas burner complete with carbon steel jacketed tile and 1.2 capacity alloy nose
Example 2 6514-6/BO/1.0H Fireall gas burner only with standard capacity iron nose
Example 3 6514-9/LX/1.2H Fireall gas burner complete with refractory tile and 1.2 capacity iron nose

Note: See Supplement 6514-6 for cross referencing old product numbers.

WARNING: Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Parts of this product may exceed 160F in operation and present a contact hazard. Fives North American Combustion, Inc. urges compliance with National Safety Standards and insurance Underwriters recommendations, and care in operation.

Fives North American Combustion, Inc. - 4455 East 71st Street - Cleveland, OH 44105 USA - Phone 216.271.6000
Fax 216.641.7852 - email: fna.sales@fivesgroup.com - www.fivesgroup.com/fivesna

APPENDIX C • REGISTRATION FORM FROM THE NUNAVUT DEPARTMENT OF ENVIRONMENT: USED OIL AND WASTE FUEL APPLIANCE

REGISTRATION FORM: USED OIL AND WASTE FUEL APPLIANCE

A copy of the Used Oil and Waste Fuel Appliance registration form and user's guide is available by contacting the Nunavut Department of Environment or by downloading the documents at http://env.gov.nu.ca/programareas/environmentprotection. Although registration is voluntary, it enables Nunavut's Department of Environment to better manage used oil and waste fuel by maintaining an up-to-date inventory of certified appliances operating in Nunavut.

Instructions

1. The following information must be provided in order to register a used oil or waste fuel appliance and obtain a registration number. Incomplete applications will be returned to the applicant.
2. Completed registration forms are to be forwarded to the Environmental Protection Division, Department of Environment, Government of Nunavut, Box 1000, Station 1360, Iqaluit, Nunavut, X0A 0H0. Electronic registration forms are preferred and may be forwarded to EnvironmentalProtection@gov.nu.ca.
3. Use additional pages to provide information as required.
4. Applicants should refer to the accompanying user's guide for further assistance on completing the generator registration form.
5. There is no fee for registering a used oil or waste fuel appliance with the Department of Environment.

Section 1 - Identification

Applicant (Legal Name) Agnico Eagles Mines Limted- Meliadine Project

Mailing Address Suite 879- Rankin Inlet, Nunavut, Canada

Postal Code X0C 0G0

Principle Contact Person Martin Theriault Title Compliance counselor

Phone 1-819-759-3555; EX: 4608171 Email martin.theriault@agnicoeagle.com

Section 2 – Description of Operation

General Type of Business Mining Industry

Site Location(s) Where the Waste is Generated Meliadine project, Rankin Inlet- Incinerator area

Make, Model and Size of the Appliance 5000L waste oil tank- Hassco- 5000L DW S601

Waste Oil tank level switch- Ketch industrail FS301-01: Mixer- NP HGL 3.3

Section 4 - Certification

I certify that the information provided on this form is correct, accurate and complete.

Signature of Contact Person _____ Date (dd/mm/yy) 2019-01- 16

Print Name of Contact Person Martin Theriault Title Compliance counselor

Phone 1-819-759-3555; EX: 4608171 Email martin.theriault@agnicoeagle.com

For Department Use Only

Appliance Registration Number NUA# _____ Approved by _____ Date _____

APPENDIX D • CONSULAIR AIR & ENIVIRONMENT GLOBAL MANAGEMENT AIR EMISSIONS REPORT

CONSULAIR
AIR & ENVIRONMENT GLOBAL MANAGEMENT

PROFESSIONNAL SERVICES
STACK TESTING PROGRAM
AIR EMISSIONS QUANTIFICATION
DOMESTIC WASTE INCINERATOR

AGNICO EAGLE

AGNICO EAGLE MINES LTD,
Rankin Inlet (Nunavut)
MELIADINE DIVISION
Kevin Buck
General Supervisor Environment

O/REF: **#18-5528**

consul-air.com

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AGNICO EAGLE

Revision history

Version name	Date	Detail	Reviewed by
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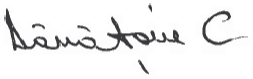
PREPARED BY:

Louis Lawson, project manager

VERIFIED BY:



Cristina Danatoiu, engineer.

Quebec, December 2018

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GLOSSARY

PM: Particulate matter

SVOC (PCDD/F): Dioxins and furans

ME: Metals

O_2: Oxygen

CO_2: Carbon dioxide

CO: Carbone monoxide

NO_X: Nitrogen oxide

ACFM: Actual cubic feet per minute

ECCC: Environment and Climate Change Canada

USEPA: United Stated Environmental Protection Agency

QA/QC: Quality Assurance / Quality Control

ΔP: Differential pressure read at the stack

ΔH: Differential pressure read at the control unit

DL: Detection Limit

SUMMARY

Consulair was mandated by Agnico Eagle Mines, Meliadine Division, to sample the atmospheric emissions at the outlet of an incinerator of its plant located near Rankin Inlet, Nunavut.

The objectives of the characterization of atmospheric emissions were to:

- Evaluate the physical characteristics of the gas flow in the stack;
- Evaluate the concentration and the emission rate of the particulate matter (P), Metals (ME) and Hydrogen chloride (HCl);
- Demonstrate the performance of the incinerator to meet the standards for mercury (Hg) and dioxins and furans (PCDD/F);
- Ensure that QA/QC of Consulair is respected throughout the stack sampling program.

For this project, the applicable standards are shown below with the tests results. The applicable standards for dioxins and furans (PCDD/F) were met for all tests, as well as the applicable standard for mercury (Hg). The standards come from the "Environmental Guideline for the Burning and Incineration of Solid Waste" emitted by the Department of Environment of the Government of Nunavut base on the Canadian Council of Ministers of the Environment (CCME) Canada - Wide Standards for Dioxins and Furans and Mercury Emissions.

The government of Nunavut presented a guideline document in October 2010, which was revised in January 2012, for the burning and incineration of solid waste. The document presented two criteria for air emissions which are applicable in the current project. A standard for Dioxins and Furans is stated at 80 pg I-TEQ/m^3 and another standard for mercury is stated at 20 µg/Rm^3. The reference conditions are stated at 101.3 kPa and 25°C and both standards are corrected to 11% O_2.

APPLICABLE STANDARDS		
CONTAMINANTS	**TEST RESULTS**	**STANDARDS**
MERCURY (Hg)	0.23 µg / Rm³ @ 11 % v/v O_2	20 µg / Rm³ @ 11 % v/v O_2
DIOXINS AND FURANS (PCDD/F)	0.042 ng / Rm³ @ 11 % v/v O_2	0.08 ng TEQ / Rm³ @ 11 % v/v O_2

R: Reference conditions 25 °C and 101.3 kPa on a dry basis.

SUMMARY

INORGANIC SAMPLING TRAIN	
STACK GAS PROPERTIES	
TEMPERATURE (°C)	744
MOISTURE (% v/v)	6.0
VELOCITY (m/s)	11.9
VOLUMETRIC FLOW RATE (m^3/h)	22,871
VOLUMETRIC FLOW RATE (Rm^3/h)	6,282
PARTICULATE MATTER	
PARTICULATE MATTER (mg/Rm^3)	26.8
PARTICULATE MATTER (mg/Rm^3) at 7 % O_2	58.3
PARTICULATE MATTER (mg/Rm^3) at 11 % O_2	41.5
PARTICULATE MATTER (kg/h)	0.16
PARTICULATE MATTER (g/s)	0.045
METALS (µg/Rm^3) @ 11% O_2	
CONCENTRATION	7,440
CLASS I (Cu, Pb, V & Zn)	352
CCME GUIDELINE	1,500
CLASS II (As, Cr & Ni)	22
CCME GUIDELINE	500
CLASS III (Cd, Hg & Tl)	2.3
CCME GUIDELINE	150
HCl	
HCl (mg/Rm^3)	25.7
HCl (mg/Rm^3) at 11 % O_2	37.3
HCl (ppm)	17.2
HCl (kg/h)	0.16
ORGANIC SAMPLING TRAIN	
STACK GAS PROPERTIES	
TEMPERATURE (°C)	743
MOISTURE (% v/v)	6.1
VELOCITY (m/s)	12.1
VOLUMETRIC FLOW RATE (m^3/h)	23,252
VOLUMETRIC FLOW RATE (Rm^3/h)	6,386
PCDD/F	
PCDD/F TEQ (ng/Rm^3) at 11 % O_2	0.042
STANDARD (ng/Rm^3) at 11% O_2	0.08
PCDD/F TEQ (µg/h)	0.18
R: Reference conditions 25 °C, 101.3 kPa on a dry basis.	

SUMMARY (Cont'd)

GAS	
OXYGEN (O_2)	
O_2 (% v/v d) - average	14.3
CARBON DIOXIDE (CO_2)	
CO_2 (% v/v d) - average	5.1
CARBON MONOXIDE (CO)	
CO (ppmvd) - average	2.8
CO (mg/Rm^3)	3.3
CO (kg/h)	0.021
NITROGEN OXIDES (NO_X) as NO_2	
NO_X (ppmvd) - average	53
NO_X as equivalent NO_2 (mg/Rm^3)	100
NO_X (kg/h)	0.65
SULPHUR DIOXIDE (SO_2)	
SO_2 (ppmvd) - average	0.2
SO_2 (mg/Rm^3)	0.6
SO_2 (kg/h)	0.004
R: Reference conditions 25 °C, 101.3 kPa on a dry basis.	

The sampling was performed in compliance with the rules of the requirements of the Report No. EPS 3/UP/2, including methods recommended by "Environment and Climate Change Canada" (ECCC) of the Government of Canada inside "Environment Canada, The National Incinerator Testing and Evaluation Program: Air Pollution Control Technology". Report No. EPS 3/UP/2, Ottawa, 1986.

1 INTRODUCTION

Consulair was mandated by Agnico Eagle Mines, Meliadine Division (Nu), to demonstrate the performance of the incinerator to meet the standards for mercury (Hg) and dioxins and furans (PCDD/F).

1.1 Sampling scope

The objectives of the characterization of atmospheric emissions were to:

- Evaluate the physical characteristics of the gas flow in the stack;
- Evaluate the concentration and the emission rate of particulate matter (P), Metals (ME) and Hydrogen chloride (HCl);
- Demonstrate the performance of the incinerator to meet the standards for mercury (Hg) and dioxins and furans (PCDD/F);
- Ensure that QA/QC of Consulair is respected throughout the stack sampling program.

The study included sources and pollutants referred in the following table.

Table 1-1 – OVERALL TEST MATRIX

SOURCE	POLLUTANTS	SAMPLING METHODS
Incinerator outlet	Particulate matter (PM)	EPS 1/RM/8 EC
	Hydrogen chloride (HCl)	EPS 1/RM/1 EC
	Metals	USEPA 29
	SVOC (PCDD/F)	EPS 1/RM/2 EC

2 SAMPLING TEAM AND PARTICIPANT

The interveners of this testing program are listed in Table 2-1 and 2-2. The analysis laboratory used is defined in Table 2-3.

Table 2-1 – CLIENT CONTACT

CLIENT	CONTACT	FUNCTION
Agnico Eagle Mines Limited Meliadine Division Rankin Inlet, Nunavut, Canada X0C 0G0	Kevin Buck General Supervisor Environment Tel: 819-759-3555 Kevin.buck@agnicoeagle.com	Test program coordination

Table 2-2 – SAMPLING TEAM

STAFF	TITLE	FUNCTION
Louis Lawson	Project Manager	On-site team leader On-site sampling Report writing
Jean-François Guay	Health and Safety Manager	On-site sampling
Cristina Danatoiu	Engineer	Report validation

Table 2-3 – ANALYSIS LABORATORY

LABORATORY	ANALYSIS	FIELD OF ACCREDITATION DR-12-LLA
Consulair	Particulate Matter	400
	Hydrogen chloride (HCl)	---
Maxxam	Metals	404 - 406
Agat	PCDD/F	510

3 SAMPLING

3.1 Process operation

A representative of the Agnico Eagle mines company had the responsibility to monitor the operating conditions to ensure the representativeness of the sampling. In order to perform the sampling program under representative conditions, a tight liaison was maintained with the operators during testing.

Process operating conditions of the incinerator were under Agnico-Eagle's responsibility. The operating conditions were maintained stable throughout each days of the test program.

3.2 Source description

The number of measuring points in the stack was determined in accordance with the requirements of Environment Canada's EPS 1/RM/8 sampling method entitled: "Reference methods for source testing: measurement of releases of particulate from stationary sources".

Stacks characteristics are described in the following table.

Table 3-1 – SAMPLED SITE CHARACTERISTICS

SOURCE	DIMENSION(S) Stack (m)	DIAMETER NUMBER)		NUMBER OF SAMPLING POINTS	
		A_D	B_D	Number of port used and sampling points	Total
Incinerator outlet	0.826	5.0	2.0	2 x 6	12

3.3 Sampling methodology

Sampling methods used in this project are methods approved and recommended by known organisms such as the United States Environmental Protection Agency (US EPA) and Environment Canada (EC).

The following table shows the sampling methods that were used during testing.

Table 3-2 – SAMPLING METHODS

PARAMETERS	METHODS	SAMPLING DURATION (min)
Manual sampling methods		
Temperature	Thermometer or thermocouple	With isokinetic value
Gas flow	SPE 1/RM/8, method B – Environment Canada	With isokinetic value
O_2, CO_2, CO	SPE 1/RM/8, method C – Environment Canada	With isokinetic value
Moisture content	SPE 1/RM/8, method D – Environment Canada	With isokinetic value
Particulate matter (PM)	SPE 1/RM/8, method E – Environment Canada	120 / 170 / 180
HCl	SPE 1/RM/1 – Environment Canada	
Metals	USEPA, CFR 40, Part 60, Method 29	
SVOC (PCDD/F)	SPE 1/RM/2 – Environment Canada	240 / 150 / 180
Instrumental sampling method		
NO_X	USEPA, CFR 40, Part 60, Method 7E	60
SO_2	USEPA, CFR 40, Part 60, Method 6C	60

The distribution of parameters within the sampling train is presented in the following table.

Table 3-3 – DISTRIBUTION OF PARAMETERS FOR EACH SAMPLING SYSTEM

SAMPLING TRAIN	PARAMETERS
Metals & Particulate matter & HCl	PM & Metals & HCl
SVOC	PCDD/F

3.4 Temperature, moisture content and flowrate

Gas temperature, flowrate, velocity and moisture content will be measured at the sampling sites according to "Reference methods for source testing: measurement of releases of particulate from stationary sources". Methods B and D, Environment Canada, December 1993, EPS 1/RM/8.

3.5 Isokinetic sampling

Isokinetic sampling allows to collect particles in the sampling nozzle at the same velocity as the gas stack velocity. In non-isokinetic conditions, if the sampling velocity is inferior than the gas stack velocity, more large particles would be collected resulting in an overestimation of the true mass concentration. On the opposite, if the sampling velocity is superior than the gas stack velocity, less large particles would be collected resulting in underestimation of the true mass concentration. In either case, the sample collected would not be an accurate reflection of the gas stack stream.

The following table presents a test acceptance criteria according to the methods (sampling systems) used.

Table 3-4 – SAMPLING ACEPTANCE CRITERIA

PARAMETERS	METHOD	ACCEPTANCE CRITERIA
Particulate Matter	SPE 1/RM/8	• Isokinetic rate comprised between 90 % and 110 % • Less than 10% of the sampled points out of the 90 % to 110 % range
Metals	Method 29 from USEPA	
SVOC	SPE 1/RM/2	

3.5.1 Particulate matter (PM), metals & HCl

Particulate matter (PM) and metals (Al, Sb, Ag, As, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Sn, Fe, Li, Mg, Mn, Mo, Ni, Pb, K, Se, Na, Ti, V, Zn, Sr, Tl, Si (Silicium soluble), Hg) were sampled in accordance with the requirements of Environment Canada EPS 1/RM/8 sampling method entitled: "Reference methods for source testing: measurement of releases of particulate from stationary sources". This method was combined with USEPA method 29 entitled “Metals emissions from stationary sources" in order to allow for metals sampling (including Hg). HCl was analyzed in the first impinger of that sampling train.

Table 3-5 – MAIN COMPONENTS OF THE PM/HCl/METALS SAMPLING SYSTEM

SAMPLING PROBE	SAMPLING TRAIN	CONTROL UNIT
• Quartz nozzle; • Quartz probe; • S type Pitot tube for the gas velocity attached to the sample probe; • Thermocouple for temperature attached to the sample probe.	• A 0.3 µm porosity pre-weighted quartz filter mounted in a Pyrex filter holder and placed in a heated oven to avoid moisture condensation; • Seven impingers placed in series and containing: ○ # 1: 100 mL H_2O; ○ # 2 and # 3: 100 mL HNO_3 (5%) / H_2O_2 (10%) solution; ○ # 4: empty; ○ # 5 and # 6: 100 mL $KMnO_4$ (4%) / H_2SO_4 (10%) solution; ○ # 7: silica gel; • Impingers placed in an ice bath to condense all the flue gas moisture.	• Sampling cord that connects the train to the sampling console; • Sampling console with oil manometer, a dry gas meter, an orifice, a temperature reader and temperature controllers; • Diaphragm vacuum pump.

3.5.2 Semivolatile organic compounds (SVOC) (PCDD/DF)

Semi Volatile Organic Compounds (SVOC) are defined as organic compounds with boiling points greater than 100 °C. This class of compounds includes PCDD (PolyChlorinated Dibenzo p Dioxins), PCDF (PolyChlorinated DibenzoFurans),

SVOCs (PCDD/F) were sampled in accordance with the requirements of Environment Canada EPS 1/RM/2 sampling method entitled: " Reference Method for Source Testing: Measurement of Releases of Selected Semi-Volatile Organic Compounds from Stationary Sources ". For this project, SVOCs included polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). A minimal volume of at least 3.0 Rm³ was sampled during each run.

For one series of three SVOC tests, a blank train was taken to the stack sampling site. A volume of ambient air equal to the sum of all leak check volumes during the SVOC test was pumped through the blank train, according to the requirements of reference method EPS 1/RM/2.

The following table shows the various components of the sampling system for PCDD/F.

Table 3-6 – MAIN COMPONENTS OF A SVOC SAMPLING SYSTEM

SAMPLING PROBE	SAMPLING TRAIN	CONTROL UNIT

• Glass nozzle of a precisely measured diameter to allow isokinetic sampling;
• Glass heated probe to avoid moisture condensation;
• Probe is fastened to an "S" type Pitot tube for gas velocity measurement and to a thermocouple for temperature measurement.
	• A 0.3 µm porosity pre-weighted fiber glass filter mounted on an accurate holder and placed in a heated oven to avoid moisture condensation;
	• Condenser;
	• XAD-2 resin cartridge;
	• Condensate trap;
	• Three impingers placed in series and containing:
	  ○ # 1: 100 mL ethylene glycol;
	  ○ # 2: empty;
	  ○ # 3: silica gel;
	• Impingers placed in an ice bath to condense all the flue gas moisture.
		• Sampling cord that connects the train to the sampling console;
		• Sampling console with oil manometer, a dry gas meter, an orifice, a temperature reader and temperature controllers;
		• Diaphragm vaccum pump.

3.6 Gaseous parameters (O_2, CO_2, CO, SO_2 & NO_X)

One CEM (Continuous Emission Monitoring) systems was used to determine the concentration of O_2, CO_2, CO, SO_2 & NO_X. The CEM system includes a gas extraction system, one analyzer and a data acquisition system. The moisture-free gas was analysed for O_2, CO_2, CO, SO_2 & NO_X with an analyzer as described in the following table.

Graphics of continuous measurements of gas are presented in Appendix 2 of the report.

Table 3-7 – GAS ANALYZER

ANALYZER	O_2/CO_2	CO	SO_2	NO_X
Method	USEPA 3A	USEPA 10	USEPA 6C	USEPA 7E
Brand	Horiba	Horiba	Horiba	Horiba
Model	PG250	PG 250	PG 250	PG 250
Detector	Galvanic Cell / Infrared	Infrared	Infrared	Chemiluminescence
Zero gas	Nitrogen			
Working Scale	0 - 30 %v	0 – 100 ppmv	0 – 500 ppmv	0 – 1,000 ppmv

3.7 Testing schedule

Table 3-8 – TESTING SCHEDULE

SOURCE	DATE	TIME	TEST
Outlet of incinerator	2018-09-22	13:44-17:44	GAS & SVOC # 1
	2018-09-28	11:32-14:02	GAS & SVOC # 2
	2018-09-29	16:13-19:13	GAS & SVOC # 3
	2018-09-22	14:45-16:45	PM/Metal/HCl # 1
	2018-09-28	11:33-14:23	PM/Metal/HCl # 2
	2018-09-29	16:14-19:14	PM/Metal/HCl # 3

3.8 LAWS AND REGULATIONS

The government of Nunavut presented a guideline document in October 2010, which was revised in January 2012, for the burning and incineration of solid waste. The following emission standards apply to existing, new or expanding solid waste incinerators operating in Nunavut and have been adopted from the Canadian Council of Ministers of the Environment (CCME) Canada - Wide Standards for Dioxins and Furans and Mercury Emissions. The document presented two criteria for air emission which are applicable in the current project. A standard for Dioxins and Furans is stated at 80 pg I-TEQ/m^3 and another standard for mercury is stated at 20 µg/Rm^3. The R conditions are stated at 101.3 kPa and 25°C. Both standards are corrected to 11% O_2.

4 QUALITY CONTROL PROCEDURES (QA/QC)

The quality insurance program and control at Consulair has several elements to validate the methodologies used during sampling. The main points are detailed within this section.

4.1 QA/QC – PRE-TEST

4.1.1 Equipment, instruments and reagents

The sampling train glassware and sample containers were cleaned and checked according to the applicable reference methods.

The instruments used were subject of regular maintenance and are calibrated for less than a year. The calibration constants of the equipment used are shown in Tables 4-1 to 4-3. Calibration certificates of equipment are presented in Appendix 3 of the report.

The gas standards used for calibration of the analyzer were valid at the time of use considering the retention periods imposed by the supplier. The standard gases are certified to ± 2% by the supplier.

4.1.2 Field forms

The forms that present field data for the target parameters are shown in Appendix 5.

4.2 Sample tracking

A clean room inside the incinerator building was used for the assembly and the different stages of recovery of sampling trains. Recovery of samples was performed according to the procedures recommended by the methods.

The samples were collected in suitable containers as specified by the methods. All samples were kept cool during the sampling period and until the delivery of samples to analytical laboratories. Consulair used an identification system for the samples that allowed tracking the origin easily by a unique code coupled to a lookup table. Each sample number includes the date, test number, the precise location of the sampling, the nature and destination (analysis, archiving). This information is indicated on the chain of custody listing and the information is available on the analysis reports.

4.3 Validation criteria

Consulair ensured that each step of the air emission characterization program (including QA / QC program) will achieve the defined objectives, while respecting the deadline set by the customer.

4.3.1 Analytical laboratory

The particulate samples analysis was done in the laboratory of Consulair. This laboratory is accredited by the *Centre d'Expertise en Analyse Environnementale du Québec* (CEAEQ) for particulate matter (domain 400 of the air chemical section). The metals samples were analysed by Maxxam's laboratory, which is accredited by the *Centre d'Expertise en Analyse Environnementale du Québec* (CEAEQ) for metallic analysis (domain 404 of the air chemical section). The PCDD/F samples were analysed by AGAT's laboratory, which is accredited by the *Centre d'Expertise en Analyse Environnementale du Québec* (CEAEQ) for PCDD/F analysis (domain 510 of the air chemical section).

The analytical reports have been signed by a chemist and are presented in appendix 4. The laboratory also made available, in its report, the QA/QC program specific to the analysed contaminants.

4.3.2 Validation criteria – Particulate matter / Metals / HCl (PM/ME/HCl)

The following tables show the validation criteria of the methodology used.

Table 4-1 – QA/QC METHODOLOGY – PM/METALS/HCl

SPE 1/RM/8 METHODOLOGICAL INFORMATION				
TEST	ME-1	ME-2	ME-3	**CRITERIA**
CYCLONIC FLOW	0			≤ 15°
REVERSE FLOW	NO			NO
STACK DIAMETER (m)	0.826			≥ 0.3
A_0	2.0			≥ 0.5
B_0	5.0			≥ 2.0
SAMPLING TIME (min)	120	170	180	≥ 120
VOLUME SAMPLED (Rm^3)	2.76	2.83	3.77	≥ 2.8
ISOKINETICITY AVERAGE (%)	102	101	102	90 ≤ ISO ≤ 110
POURCENTAGE OF ISOKINETIC POINTS	100%	100%	100%	≥ 90
SAMPLING VELOCITY	OK	OK	OK	3.0 ≤ V ≤ 30 m/s
PROBE TEMPERATURE	NOT MEASURED			223 ≤ T ≤ 273 °F
FILTER TEMPERATURE	OK	OK	OK	223 ≤ T ≤ 273 °F
OUTLET TEMPERATURE	OK	OK	OK	32 ≤ T ≤ 68 °F
4% D_{MOY} (pi^3/min)	0.03	0.02	0.03	---
FLOW LEAK BEFORE at -15in Hg (ft^3/min)	0.020	0.020	0.020	≤ 0.02 or 4% Dmoy
FLOW LEAK AFTER (ft^3/min)	0.020	0.020	0.020	≤ 0.02 or 4% Dmoy
EQUIPMENT INFORMATION				
SAMPLING MODULE NO.	25	25	25	
METER FACTOR K_C	0.999	0.999	0.999	$0.95 < K_C < 1.05$
ORIFICE FACTOR K_O	0.733	0.733	0.733	
Δh@	2.529	2.529	2.529	
PITOT ID	05-07 5Q-501	05-07 5Q-501	05-07 5Q-501	
PITOT FACTOR	0.774	0.774	0.774	
NOZZLE ID	5Q-502	5Q-434	5Q-434	
NOZZLE DIAMETER (in)	0.4684	0.4366	0.4366	
R: Reference conditions at 101.3 kPa et 25°C, and dry basis.				

The sampling volume for the first test run is slightly lower than the 2.8 m^3 limit of the test method but should not have any impact on the result.

Table 4-2 – QA/QC METHODOLOGY – SVOC

TEST	PCDD/DF-1	PCDD/DF-2	PCDD/DF-3	CRITERIA
EQUIPEMENT INFORMATION				
SAMPLING MODULE NO.	19	19	19	N/A
METER FACTOR K_C	0.997	0.997	0.997	0.95 - 1.05
ORIFICE FACTOR K_O	0.994	0.994	0.994	N/A
PITOT ID	03-06 3Q-371	03-06 3Q-503	03-06 3Q-503	N/A
PITOT FACTOR	0.778	0.781	0.781	N/A
NOZZLE ID	3Q-371	3Q-503	3Q-503	N/A
NOZZLE DIAMETER (in)	0.3741	0.4958	0.4958	N/A
METHODOLOGICAL INFORMATION				
SAMPLING POINTS NUMBER	12	12	12	24
GAS VELOCITY (m/s)	11.7	10.6	13.9	3.0 - 30
SAMPLING TIME (min)	240	150	180	≥ 180
VOLUME SAMPLED (Rm^3)	3.38	3.39	4.99	≥ 3
SAMPLING RATE (pi^3/min)	0.48	0.78	0.95	N/A
ISOKINETICITY AVERAGE (%)	101	101	101	90 - 110
POURCENTAGE OF ISOKINETIC POINTS	100	100	100	≥ 90
PROBE TEMPERATURE (°F)	NOT MEASURED			223 - 273
FILTER TEMPERATURE (°F)	240 - 258	246 – 253	246 - 257	223 - 273
OUTLET TEMPERATURE (°F)	39 - 58	56 - 91	40 - 63	32 - 68
TRAP TEMPERATURE (°F)	46 - 69	38 - 63	41 - 69	33 - 68
FLOW LEAK BEFORE at -15in Hg (ft^3/min)	< 0.020	< 0.020	< 0.020	< 0.02
FLOW LEAK AFTER (ft^3/min)	< 0.020	< 0.020	< 0.020	< 0.02
R: Reference conditions at 101.3 kPa et 25°C, and dry basis.				

The sampling time for the second run of SVOC is under the 180 minutes limit of the method because of a process malfunction and the sampling had to be stopped. However, since the sampling volume for this test run is higher than the 3.0 m^3 limit of the method, this should have no impact on the result.

5 RESULTS

The reference values are reported at a temperature of 25°C and an atmospheric pressure of 101.3 kPa, on a dry basis.

For the inorganic results, a laboratory analysis value preceded of "<" means that the laboratory result is less than the detection limit reported (LDR) and represents a maximum result. In this case, the detection limit reported (LDR) is the value used.

The PCDD / F result tables include all toxic congeners (17) calculated with TEF (Toxic Equivalency Factor). The term "toxic equivalency (TEQ)" is the sum of the 17 toxic congeners calculated according to the TEF and when a congener was not detected by the laboratory analysis, it was replaced by "zero".

Unless otherwise indicated, the averages indicated in the tables below are the average of all tests carried out to the same source for the same operating condition.

Computer compiled data is presented in Appendix 1.

Table 5-1 – STACK GAS PROPERTIES

TESTS SCHEDULE				
TEST	RUN-1	RUN-2	RUN-3	AVERAGE
DATE	2018-09-22	2018-09-28	2018-09-29	(1 to 3)
START HOUR OF THE FIELD TEST	14:45	11:33	16:14	
END HOUR OF THE FIELD TEST	16:45	14:23	19:14	
STACK GAS PROPERTIES – METAL SAMPLING TRAIN				
TEMPERATURE (°C)	727	724	782	744
MOISTURE (% v/v)	6.2	5.5	6.3	6.0
VELOCITY (m/s)	12.0	10.2	13.5	11.9
STACK GAS FLOW RATE (m^3/h)	23 080	19 600	25 932	22 871
STACK GAS FLOW RATE (ft^3/min) (ACFM)	6 498	5 503	6 844	6 282
STACK GAS FLOW RATE (Rm^3/h)	13 585	11 536	15 263	13 461
STACK GAS FLOW RATE (Rft^3/min) (SCFM)	3 825	3 239	4 028	3 697
STACK GAS PROPERTIES – SVOC SAMLING TRAIN				
TEMPERATURE (°C)	726	723	780	743
MOISTURE (% v/v)	6.6	5.1	6.6	6.1
VELOCITY (m/s)	11.7	10.6	13.9	12.1
STACK GAS FLOW RATE (m^3/h)	22 509	20 452	26 796	23 252
STACK GAS FLOW RATE (ft^3/min) (ACFM)	13 248	12 038	15 771	13 686
STACK GAS FLOW RATE (Rm^3/h)	6 314	5 774	7 070	6 386
STACK GAS FLOW RATE (Rft^3/min) (SCFM)	3 717	3 398	4 161	3 759
GAS COMPOSITION				
CO_2 (% v/v d)	5.2	4.4	5.6	5.1
O_2 (% v/v d)	14.1	15.1	13.6	14.3
CO (ppmvd)	3	3	3	3
R: Reference conditions at 101.3 kPa and 25°C on a dry basis.				

Table 5-2 – RESULTS PM – HCL

TESTS SCHEDULE				
TEST	MEL-ME-1	MEL-ME-2	MEL-ME-3	AVERAGE
DATE	2018-09-22	2018-09-28	2018-09-29	(1 to 3)
START HOUR OF THE FIELD TEST	14:45	11:33	16:14	
END HOUR OF THE FIELD TEST	16:45	14:23	19:14	
DURATION OF THE TEST (MINUTES)	120	170	180	
PARTICULATE MATTER				
PARTICULATE MATTER (mg/Rm^3)	30.9	35.8	13.6	26.8
PARTICULATE MATTER (mg/Rm^3) at 7 % O_2	63.4	85.7	25.9	58.3
PARTICULATE MATTER (mg/Rm^3) at 11 % O_2	45.2	61.0	18.4	41.5
PARTICULATE MATTER (kg/h)	0.20	0.20	0.093	0.16
HCl				
HCl (mg/Rm^3)	32.4	12.0	32.6	25.7
HCl (mg/Rm^3) at 11 % O_2	**47.4**	**20.5**	**44.1**	**37.3**
HCl (ppm)	21.7	8.1	21.8	17.2
HCl (kg/h)	0.210	0.066	0.223	0.167
HCl (g/s)	0.0584	0.0184	0.0619	0.0463
R: Reference conditions at 101.3 kPa and 25°C on a dry basis.				

Table 5-3 – METALS CONCENTRATION

SCHEDULE OF TESTS				
TEST	MEL-ME-1	MEL-ME-1	MEL-ME-1	AVERAGE
DATE	2018-09-22	2018-09-28	2018-09-29	(1 to 3)
START HOUR OF THE FIELD TEST	14:45	11:33	16:14	
END HOUR OF THE FIELD TEST	16:45	14:23	19:14	
DURATION OF THE TEST (MINUTES)	120	170	180	
METALS (µg/Rm^3) @ 11% O_2				
Aluminium (Al)	307	24	21	118
Antimony(Sb)	129	2.3	78	70
Silver (Ag)	1.5	< 1.6	1.2	1.4
Arsenic (As)	9.2	0.96	11	7.1
Baryum (Ba)	4.1	0.72	0.45	1.7
Beryllium (Be)	< 0.13	< 0.16	< 0.089	< 0.13
Bismuth (Bi)	0.55	0.19	1.8	0.85
Boron (B)	14	8.6	37	20
Cadmium (Cd)	2.0	0.57	3.5	2.0
Calcium (Ca)	1,095	239	142	492
Chromium (Cr)	9.8	3.2	26	13
Cobalt (Co)	0.42	< 0.24	0.18	0.28
Copper (Cu)	48	15	48	37
Tin (Sn)	54	16	68	46
Iron (Fe)	576	331	49	318
Lithium (Li)	5.8	21	13	13
Magnesium (Mg)	167	28	27	74
Manganese (Mn)	36	14	2.1	17
Mercury (Hg)	0.47	0.21	0.018	0.23
Molybdenum (Mo)	3.6	< 1.6	3.9	3.0
Nickel (Ni)	4.6	0.48	0.82	2.0
Lead (Pb)	68	23	160	83
Potassium (K)	5,348	716	3,662	3,242
Selenium (Se)	0.74	0.48	0.36	0.52
Silicium (Si)	409	107	212	243
Sodium (Na)	4,180	520	2,473	2,391
Strontium (Sr)	2.8	0.42	0.25	1.2
Thallium (Tl)	< 0.21	< 0.24	< 0.14	< 0.20
Titanium (Ti)	29	4.2	3.2	12
Vanadium (V)	0.79	< 0.48	0.39	0.55
Zinc (Zn)	274	34	385	231
DETECTED METAL	**12,780**	**2,111**	**7,430**	**7,440**
TOTAL METALS	**12,780**	**2,115**	**7,430**	**7,442**
R: Reference conditions at 101.3 kPa and 25°C on a dry basis.				

Table 5-4 – METALS EMISSION RATE

SCHEDULE OF TESTS				
TEST	MEL-ME-2	MEL-ME-1	MEL-ME-3	AVERAGE
DATE	2018-09-22	2018-09-28	2018-09-29	(1 to 3)
START HOUR OF THE FIELD TEST	14:45	11:33	16:14	
END HOUR OF THE FIELD TEST	16:45	14:23	19:14	
DURATION OF THE TEST (MINUTES)	120	170	180	
METALS (g/h)				
Aluminium (Al)	1.4	0.078	0.11	0.52
Antimony(Sb)	0.58	0.0076	0.40	0.33
Silver (Ag)	0.0068	< 0.0051	0.0060	0.0060
Arsenic (As)	0.041	0.0031	0.057	0.034
Baryum (Ba)	0.018	0.0023	0.0023	0.0076
Beryllium (Be)	< 0.00059	< 0.00051	< 0.00045	< 0.00052
Bismuth (Bi)	0.0024	0.00062	0.0091	0.0041
Boron (B)	0.063	0.028	0.19	0.093
Cadmium (Cd)	0.0091	0.0018	0.018	0.0096
Calcium (Ca)	4.9	0.78	0.72	2.1
Chromium (Cr)	0.044	0.010	0.13	0.063
Cobalt (Co)	0.0019	< 0.00078	0.00091	0.0012
Copper (Cu)	0.22	0.050	0.24	0.17
Tin (Sn)	0.24	0.051	0.34	0.21
Iron (Fe)	2.6	1.1	0.25	1.3
Lithium (Li)	0.026	0.070	0.064	0.053
Magnesium (Mg)	0.75	0.091	0.14	0.32
Manganese (Mn)	0.16	0.045	0.011	0.072
Mercury (Hg)	0.0021	0.00070	0.000091	0.00096
Molybdenum (Mo)	0.016	< 0.0051	0.020	0.014
Nickel (Ni)	0.020	0.0016	0.0042	0.0087
Lead (Pb)	0.30	0.074	0.81	0.40
Potassium (K)	24	2.3	19	15
Selenium (Se)	0.0033	0.0016	0.0018	0.0022
Silicium (Si)	1.8	0.35	1.1	1.1
Sodium (Na)	19	1.7	13	11
Strontium (Sr)	0.012	0.0014	0.0013	0.0050
Thallium (Tl)	< 0.00094	< 0.00078	< 0.00073	< 0.00082
Titanium (Ti)	0.13	0.014	0.016	0.053
Vanadium (V)	0.0035	< 0.0016	0.0020	0.0024
Zinc (Zn)	1.2	0.11	2.0	1.1
DETECTED METAL	**57**	**6.9**	**38**	**34**
TOTAL METALS	**57**	**6.9**	**38**	**34**
R: Reference conditions at 101.3 kPa and 25°C on a dry basis.				

Table 5-5 – CONCENTRATION - PCDD/F CONGENERS

SCHEDULE OF TESTS				
SERIAL NUMBER TEST	MEL-COSV-1	MEL-COSV-2	MEL-COSV-3	**AVERAGE**
DATE	2018-09-22	2018-09-28	2018-09-29	**(1 to 3)**
START OF TEST	13:44	11:32	16:13	
END OF TEST	17:44	14:02	19:13	
DURATION OF THE TEST (MINUTES)	240	150	180	
PCDD/DF CONGENERS (ng/Rm^3)				
2,3,7,8 - Tetra CDD	< 0.00030	0.0015	< 0.0014	0.0011
1,2,3,7,8 - Penta CDD	< 0.00089	0.014	0.0046	0.0065
1,2,3,4,7,8 - Hexa CDD	< 0.00089	0.016	0.0056	0.0074
1,2,3,6,7,8 - Hexa CDD	0.00089	0.021	0.013	0.011
1,2,3,7,8,9 - Hexa CDD	< 0.00089	0.024	0.013	0.013
1,2,3,4,6,7,8 - Hepta CDD	0.0050	0.093	0.061	0.053
1,2,3,4,6,7,8,9 - Octa CDD	0.0098	0.047	0.060	0.039
2, 3, 7, 8 - Tetra CDF	0.0044	0.014	0.043	0.021
1,2,3,7,8 - Penta CDF	< 0.0024	0.0062	0.012	0.0070
2,3,4,7,8 - Penta CDF	0.0027	0.013	0.033	0.016
1,2,3,4,7,8 - Hexa CDF	0.0039	0.018	0.065	0.029
1,2,3,6,7,8 - Hexa CDF	0.0027	0.0074	0.024	0.011
2,3,4,6,7,8 - Hexa CDF	0.0024	0.015	0.055	0.024
1,2,3,7,8,9 - Hexa CDF	< 0.0018	< 0.0059	0.0060	0.0046
1,2,3,4,6,7,8 - Hepta CDF	0.0047	0.019	0.095	0.040
1,2,3,4,7,8,9 - Hepta CDF	< 0.0018	0.0024	0.020	0.0081
1,2,3,4,6,7,8,9 - Octa CDF	0.0059	0.0050	0.045	0.019
Total Tetra CDD	0.0027	0.047	0.043	0.031
Total Penta CDD	0.0033	0.13	0.081	0.072
Total Hexa CDD	0.0074	0.27	0.14	0.14
Total Hepta CDD	0.0059	0.099	0.063	0.056
CDD TOTALS	**0.029**	**0.59**	**0.39**	**0.34**
Total Tetra CDF	0.030	0.083	0.23	0.11
Total Penta CDF	0.021	0.12	0.31	0.15
Total Hexa CDF	0.0095	0.051	0.19	0.084
Total Hepta CDF	0.0083	0.036	0.18	0.074
CDF TOTALS	**0.075**	**0.30**	**0.95**	**0.44**
CONGENERS TOTALS TOXIC	**0.051**	**0.32**	**0.56**	**0.31**
TOTAL HOMOLOGUOUS GROUPS	**0.19**	**1.7**	**2.6**	**1.5**
R: Reference conditions at 101.3 kPa and 25°C on a dry basis.				

Table 5-6 – CONCENTRATION - PCDD/F TEQ

SCHEDULE OF TESTS				
SERIAL NUMBER TEST	MEL-COSV-1	MEL-COSV-2	MEL-COSV-3	**AVERAGE**
TEQ - PCDD/F (ng/Rm^3) at 11 % O_2				
2,3,7,8 - Tetra CDD	< LD	0.0025	< LD	0.0016
1,2,3,7,8 - Penta CDD	< LD	0.024	0.0062	0.010
1,2,3,4,7,8 - Hexa CDD	< LD	0.0027	0.00076	0.0012
1,2,3,6,7,8 - Hexa CDD	0.00013	0.0036	0.0017	0.0018
1,2,3,7,8,9 - Hexa CDD	< LD	0.0041	0.0018	0.0020
1,2,3,4,6,7,8 - Hepta CDD	0.000074	0.0016	0.00083	0.00083
1,2,3,4,6,7,8,9 - Octa CDD	0.0000014	0.0000080	0.0000081	0.0000059
2, 3, 7, 8 - Tetra CDF	0.00065	0.0024	0.0059	0.0030
1,2,3,7,8 - Penta CDF	< LD	0.00053	0.00084	0.00051
2,3,4,7,8 - Penta CDF	0.0020	0.011	0.022	0.012
1,2,3,4,7,8 - Hexa CDF	0.00056	0.0031	0.0088	0.0042
1,2,3,6,7,8 - Hexa CDF	0.00039	0.0013	0.0033	0.0016
2,3,4,6,7,8 - Hexa CDF	0.00035	0.0025	0.0074	0.0034
1,2,3,7,8,9 - Hexa CDF	< LD	< LD	0.00081	0.00069
1,2,3,4,6,7,8 - Hepta CDF	0.000069	0.00032	0.0013	0.00056
1,2,3,4,7,8,9 - Hepta CDF	< LD	0.000040	0.00027	0.00011
1,2,3,4,6,7,8,9 - Octa CDF	0.00000087	0.00000085	0.0000062	0.0000026
TOXIC EQUIVALENT TOTAL	**0.0042**	**0.059**	**0.062**	**0.042**
STANDARD (ng/Nm^3) at 11% O_2	**0.08**			
TEQ / % OF THE STANDARD	5.2	73.8	77.8	52.3
TEQ - PCDD/F (µg/h)				
2,3,7,8 - Tetra CDD	< LD	0.0085	< LD	0.0068
1,2,3,7,8 - Penta CDD	< LD	0.080	0.033	0.039
1,2,3,4,7,8 - Hexa CDD	< LD	0.0090	0.0040	0.0045
1,2,3,6,7,8 - Hexa CDD	0.00056	0.012	0.0089	0.0072
1,2,3,7,8,9 - Hexa CDD	< LD	0.014	0.0092	0.0079
1,2,3,4,6,7,8 - Hepta CDD	0.00032	0.0054	0.0043	0.0034
1,2,3,4,6,7,8,9 - Octa CDD	0.0000062	0.000027	0.000042	0.000025
2, 3, 7, 8 - Tetra CDF	0.0028	0.0082	0.031	0.014
1,2,3,7,8 - Penta CDF	< LD	0.0018	0.0044	0.0023
2,3,4,7,8 - Penta CDF	0.0084	0.037	0.12	0.054
1,2,3,4,7,8 - Hexa CDF	0.0024	0.011	0.046	0.020
1,2,3,6,7,8 - Hexa CDF	0.0017	0.0043	0.017	0.0076
2,3,4,6,7,8 - Hexa CDF	0.0015	0.0085	0.039	0.016
1,2,3,7,8,9 - Hexa CDF	< LD	< LD	0.0042	0.0029
1,2,3,4,6,7,8 - Hepta CDF	0.00030	0.0011	0.0067	0.0027
1,2,3,4,7,8,9 - Hepta CDF	< LD	0.00014	0.0014	0.00055
1,2,3,4,6,7,8,9 - Octa CDF	0.0000037	0.0000029	0.000032	0.000013
TOXIC EQUIVALENT	**0.018**	**0.20**	**0.33**	**0.18**
R: Reference conditions at 101.3 kPa and 25°C, and dry basis.				

Table 5-7 – STACK GAS MEASUREMENTS

SCHEDULE OF TESTS			
SERIAL NUMBER TEST	MEL GAZ E1	MEL GAZ E2	MEL GAZ E3
DATE	2018-09-22	2018-09-28	2018-09-29
START OF TEST	13:50	11:35	16:15
END OF TEST	17:40	14:25	19:05
DURATION OF THE TEST (MINUTES)	230	170	170
OXYGEN (O_2)			
O_2 (% v/v d) average	14.1	15.1	13.6
O_2 (% v/v d) minimum	13.0	14.1	12.6
O_2 (% v/v d) maximum	15.4	15.8	14.6
CARBON DIOXIDE (CO_2)			
CO_2 (% v/v d) average	5.2	4.4	5.6
CO_2 (% v/v d) minimum	4.4	4.0	4.9
CO_2 (% v/v d) maximum	6.0	5.0	6.3
CARBON MONOXIDE (CO)			
CO (ppmvd) average	2.6	3.4	2.6
CO (ppmvd) minimum	1.9	2.6	1.3
CO (ppmvd) maximum	3.9	4.4	3.5
CO (mg/Rm^3)	3.0	3.9	3.0
AVERAGE EMISSION (kg/h)	0.019	0.022	0.021
NITROGEN OXIDES (NO_X as NO_2)			
NO_X (ppmvd) average	44	49	66
NO_X (ppmvd) minimum	28	42	56
NO_X (ppmvd) maximum	59	58	77
NO_X equivalent NO_2 (mg/Rm^3)	84	93	124
AVERAGE EMISSION (kg/h)	0.53	0.54	0.87
SULPHUR DIOXIDES (SO_2)			
SO_2 (ppmvd) average	0	0	0.6
SO_2 (ppmvd) minimum	0	0	0
SO_2 (ppmvd) maximum	0	0	3.6
SO_2 equivalent NO_2 (mg/Rm^3)	0	0	1.7
AVERAGE EMISSION (kg/h)	0	0	0.012
R: Reference conditions at 101.3 kPa et 25°C, and dry basis.			

6 CONCLUSION

According to the sampling methods and procedures combined with a rigorous quality control, the results of concentrations and / or emission rates presented in this report are valid and representative of the process operation conditions sampled for period test results.

The final results obtained are valid and representative of the operating conditions during the tests.

The sampling was made in compliance with the rules of the requirements of the Report No. EPS 3/UP/2, including methods recommended by “Environment and Climate Change Canada” (ECCC) of the Government of Canada inside “Environment Canada, The National Incinerator Testing and Evaluation Program: Air Pollution Control Technology”. Report No. EPS 3/UP/2, Ottawa, 1986.

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7 REFERENCES

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USEPA (1971), method 10, Determination of carbon monoxide emissions from stationary sources, 5 pages.

APPENDIX 1
COMPUTED DATA

AEM Meliadine
18-5528
Incinérateur
ME

HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
DONNEES DES EQUIPEMENTS D'ECHANTILLONNAGE				
PRESSION BAROMÉTRIQUE ("Hg)	30.10	29.73	29.83	29.89
PRESSION STATIQUE ("H2O)	-0.08	-0.05	-0.05	-0.06
PRESSION STATIQUE (kPa)	-0.02	-0.01	-0.01	-0.01
COEFFICIENT DU COMPTEUR (25,25,25,25,	0.999	0.999	0.999	0.999
COEFFICIENT DU PITOT (05-07 5Q-501,05-(	0.774	0.774	0.774	0.774
DIAMÈTRE DE LA BUSE (po) (5Q-502,5Q-43	0.4684	0.4366	0.4366	0.4472
TEMPÉRATURE COMPTEUR (°F)	91	91	92	91
TEMPÉRATURE COMPTEUR (°C)	33	33	33	33
HUMIDITE DES GAZ & VOLUME ECHANTILLONNE				
VOLUME D'EAU (g)	133.3	121.6	186.7	147.2
VOLUME D'EAU (pi^3)	6.40	5.84	8.96	7.07
HUMIDITÉ GAZ (BWO)	0.062	0.055	0.063	0.060
HUMIDITÉ GAZ (%v)	6.2	5.5	6.3	6.0
VOLUME GAZ REFERENCE (pi^3R)	97.44	100.04	133.02	110.17
VOLUME GAZ REFERENCE (m^3R)	**2.759**	**2.833**	**3.767**	**3.120**
CARACTERISTIQUES DU CONDUIT				
DIAMÈTRES AVANT LES TROUS D'ÉCHANT	5.0	5.0	5.0	
DIAMÈTRES APRÈS LES TROUS D'ÉCHANT	2.0	2.0	2.0	
DIAMÈTRE DU CONDUIT (pi)	2.71	2.71	2.71	
DIAMÈTRE DU CONDUIT (m)	0.826	0.826	0.826	
ÉPAISSEUR DU PORT D'ÉCHANTILLONNAC	7.5	7.5	7.5	
LONGUEUR DU CONDUIT (pi)	0.0	0.0	0.0	
LARGEUR DU CONDUIT (pi)	0.0	0.0	0.0	
DIAMÈTRE ÉQUIVALENT (pi)	#VALEUR!	#VALEUR!	#VALEUR!	
DIAMÈTRE ÉQUIVALENT (m)	#VALEUR!	#VALEUR!	#VALEUR!	
PRESSION CONDUIT ("Hg)	30.09	29.73	29.83	29.88
PRESSION COMPTEUR ("Hg)	30.25	29.81	29.95	30.00
SURFACE DU CONDUIT (pi^2)	5.8	5.8	5.8	5.8
SURFACE DU CONDUIT (m^2)	0.54	0.54	0.54	0.54
CARACTERISTIQUES DES GAZ				
TEMPÉRATURE CHEMINÉE (°F)	1340	1336	1440	1372
TEMPÉRATURE CHEMINÉE (°C)	727	724	782	744
CO_2 (%vs)	5.2	4.4	5.6	5.1
O_2 (%vs)	14.1	15.1	13.6	14.3
O_2 (%vh)	13.3	14.3	12.7	13.4
CO (ppmvs)	3	3	3	3
SO_2 (%vs)	0	0	0	0
N_2 (%vs)	80.6	80.5	80.8	80.6
Ar (%vs)	0.00	0.00	0.00	0.00
POIDS MOLECULAIRE SEC	29.40	29.31	29.44	29.39
POIDS MOLECULAIRE HUMIDE	28.70	28.69	28.72	28.70
VITESSE DES GAZ (pi/s)	39.3	33.4	44.2	38.9
VITESSE DES GAZ (m/s)	12.0	10.2	13.5	11.9
DEBITS GAZ ACTUELS (pi^3/h)	815 078	692 166	915 770	807 671
DEBITS GAZ ACTUELS (m^3/h)	23 080	19 600	25 932	22 871
DEBITS GAZ ACTUELS (pi^3/min)(APCM)	13 585	11 536	15 263	13 461
DEBITS GAZ NORMALISES (pi^3R/h)	229 478	194 320	241 695	221 831
DEBITS GAZ NORMALISES (m^3R/h)	**6 498**	**5 503**	**6 844**	**6 282**
DEBITS GAZ NORMALISES (pi^3R/min) (RPCI	3 825	3 239	4 028	3 697

AEM Meliadine
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HORAIRE DES ESSAIS				
ESSAI NUMERO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
INFORMATIONS D'ECHANTILLONNAGE				
COEFFICIENT DE L'ORIFICE DU COMPTEU	0.733	0.733	0.733	
VITESSE MAXIMALE (m/s)	12.75	11.35	14.34	
VITESSE MINIMALE (m/s)	10.47	9.17	12.30	
10%Vmax (pi/s)	1.28	1.14	1.43	
Pourcentage >10%Vmax	100%	100%	100%	
NOMBRE POINTS ΔP 20% et + de ΔPmoy	2	3	0	
ISOCINETISME MOYEN (%)	102.2	100.8	101.6	
% PTS RESPECT CRITERE ISO	100%	100%	100%	
DEBIT DE POMPAGE MAX (pi³/min)	0.91	0.65	0.82	
PRESSION DE VIDE MAX DURANT ESSAI (-	-2	-9	-4	
TEMPÉRATURE SONDE MAX (°F)	250	252	250	
TEMPÉRATURE SONDE MIN (°F)	250	243	250	
TEMPÉRATURE FILTRE MAX (°F)	260	261	250	
TEMPÉRATURE FILTRE MIN (°F)	260	246	250	
TEMPÉRATURE SORTIE MAX (°F)	67	67	40	
TEMPÉRATURE SORTIE MIN (°F)	40	67	40	
TEMPÉRATURE TRAPPE MAX (°F)	0	0	0	
TEMPÉRATURE TRAPPE MIN (°F)	0	0	0	
TEMPÉRATURE AUX 3 MAX (°F)	0	0	0	
TEMPÉRATURE AUX 3 MIN (°F)	0	0	0	
TEMPÉRATURE MODULE MAX (°F)	0	0	0	
TEMPÉRATURE MODULE MIN (°F)	0	0	0	
DEBIT DE POMPAGE MOYEN (pi³/min)	0.82	0.61	0.76	
4% DEBIT DE POMPAGE MOYEN (pi³/min)	0.033	0.024	0.030	
TEST DE FUITE AVANT LES ESSAIS À 15 "H	< 0.020	< 0.020	< 0.020	
TEST DE FUITE APRÈS LES ESSAIS (pi³/mi	< 0.020	< 0.020	< 0.020	
PARTICULES FILTRABLES SPE 1/RM/8				
MASSE FILTRE (mg)	48.2	48.4	46.0	47.5
MASSE SONDE (mg)	37.0	53.1	5.3	31.8
MASSE BLANC ACÉTONE (mg)	< 1			
VOLUME BLANC ACÉTONE (mL)	91			
RÉSIDUS ACÉTONE (%)	0.001			
MASSE SONDE (mg)	37.0	53.1	5.30	31.8
MASSE TOTALE (mg)	85.2	101.5	51.3	79.3
CONCENTRATION (mg/m³R)	**30.9**	**35.8**	**13.6**	**26.8**
CONCENTRATION (mg/m³R) à 7% O₂	**63.4**	**85.7**	**25.9**	**58.3**
CONCENTRATION (mg/m³R) à 11% O₂	**45.2**	**61.0**	**18.4**	**41.5**
TAUX D'ÉMISSION (kg/h)	0.20	0.20	0.093	0.16
TAUX D'ÉMISSION (g/s)	0.056	0.055	0.026	0.045
ACIDE CHLORHYDRIQUE (HCl)				
BLANC HCl (mg)	< 0.040			
CHLORURES (mg)	86.87	33.16	119.33	
HCl (mg)	89.34	34.10	122.72	82.1
HCl (mg/m³R)	32.4	12.0	32.6	25.67
HCl (ppmvs)	21.7	8.1	21.8	17.21
HCl (mg/m³R) 11% O₂	47.4	20.5	44.1	37.32
HCl (kg/h)	0.21	0.07	0.22	0.167

AEM Meliadine
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HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX				
MÉTAUX PARTICULAIRES (µg)				
Aluminium (Al)	570.0	30.0	46.0	215.3
Antimoine (Sb)	245.0	3.60	219.0	155.9
Argent (Ag)	0.90	< 0.60	1.30	0.93
Arsenic (As)	17.2	1.30	30.9	16.5
Baryum (Ba)	7.28	0.65	1.06	3.00
Béryllium (Be)	< 0.050	< 0.060	< 0.050	< 0.053
Bismuth (Bi)	0.84	0.12	4.83	1.93
Bore (B)	4	4	4	4
Cadmium (Cd)	2.47	0.45	9.52	4.15
Calcium (Ca)	1930.0	309.0	243.0	827.3
Chrome (Cr)	18.20	5	73.4	32.2
Cobalt (Co)	0.50	< 0.10	0.20	0.27
Cuivre (Cu)	89.1	24.7	131.0	81.6
Étain (Sn)	77.4	4.00	166.0	82.5
Fer (Fe)	1070.0	33.0	82.0	395.0
Lithium (Li)	8.00	33.0	32.0	24.3
Magnésium (Mg)	216.0	34.0	36.0	95.3
Manganèse (Mn)	16.5	15.7	4.30	12.2
Molybdène (Mo)	4.80	< 0.60	8.90	4.77
Nickel (Ni)	8.10	0.40	2.00	3.50
Phosphore (P)				
Plomb (Pb)	127.0	36.0	444.0	202.3
Potassium (K)	10100.0	1170.0	10200.0	7156.7
Sélénium (Se)	< 0.50	< 0.50	0.50	0.50
Silicium (Si)	717.0	148.0	397.0	420.7
Sodium (Na)	7900.0	851.0	6890.0	5213.7
Strontium (Sr)	5.00	0.40	0.40	1.93
Tellurium (Te)				
Thallium (Tl)	< 0.10	< 0.10	< 0.10	< 0.10
Titane (Ti)	52.0	4.00	6.00	20.7
Uranium (U)				
Vanadium (V)	0.80	< 0.20	0.40	0.47
Zinc (Zn)	509.0	54.0	1070.0	544.3
Mercure (Hg)				
MÉTAUX DÉTECTÉS	**23697.2**	**2762.4**	**20103.4**	**15521.0**
MÉTAUX TOTAUX	**23697.8**	**2764.6**	**20103.6**	**15522.0**
Proportion de métaux versus particules (%	**27.8**	**2.7**	**39.2**	**23.2**

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HORAIRE DES ESSAIS				
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FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX GAZEUX (µg)				
Aluminium (Al)	12.00	10.00	14.0	12.00
Antimoine (Sb)	< 0.30	< 0.30	< 0.30	< 0.30
Argent (Ag)	< 2.00	< 2.00	< 2.00	< 2.00
Arsenic (As)	< 0.30	< 0.30	< 0.30	< 0.30
Baryum (Ba)	0.45	0.55	0.20	0.40
Béryllium (Be)	< 0.20	< 0.20	< 0.20	< 0.20
Bismuth (Bi)	< 0.20	< 0.20	< 0.20	< 0.20
Bore (B)	22.5	10.40	99.3	44.1
Cadmium (Cd)	1.40	0.5	0.3	0.73
Calcium (Ca)	144.0	92.0	154.0	130.0
Chrome (Cr)	< 0.30	< 0.30	< 0.30	< 0.30
Cobalt (Co)	< 0.30	< 0.30	< 0.30	< 0.30
Cuivre (Cu)	2.60	1.10	2.30	2.00
Étain (Sn)	24.0	22.00	23.0	23.00
Fer (Fe)	21.00	521.0	54.0	198.7
Lithium (Li)	< 3.00	< 3.00	< 3.00	< 3.00
Magnésium (Mg)	101.0	13.00	39.0	51.0
Manganèse (Mn)	51.2	7.50	1.50	20.1
Molybdène (Mo)	< 2.00	< 2.00	< 2.00	< 2.00
Nickel (Ni)	0.60	0.40	0.30	0.43
Phosphore (P)				
Plomb (Pb)	< 2.00	< 2.00	< 2.00	< 2.00
Potassium (K)	34.0	< 30.0	< 30.0	< 31.3
Sélénium (Se)	0.90	0.30	0.50	0.57
Silicium (Si)	58.0	32.0	196.0	95.3
Sodium (Na)	< 20.0	< 20.0	< 20.0	< 20.0
Strontium (Sr)	< 0.30	< 0.30	< 0.30	< 0.30
Tellurium (Te)				
Thallium (Tl)	< 0.30	< 0.30	< 0.30	< 0.30
Titane (Ti)	< 3.00	< 3.00	< 3.00	< 3.00
Uranium (U)				
Vanadium (V)	< 0.70	< 0.60	< 0.70	< 0.67
Zinc (Zn)	9.70	2.60	5.10	5.80
Mercure (Hg)				
MÉTAUX DÉTECTÉS	**483**	**745**	**622**	**617**
MÉTAUX TOTAUX	**518**	**778**	**654**	**650**

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DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
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FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX TOTAUX (µg)				
Aluminium (Al)	582.0	40.0	60.0	227.3
Antimoine (Sb)	245.3	3.90	219.3	156.2
Argent (Ag)	2.90	< 2.60	3.30	2.93
Arsenic (As)	17.5	1.60	31.2	16.8
Baryum (Ba)	7.73	1.20	1.26	3.40
Béryllium (Be)	< 0.250	< 0.260	< 0.250	< 0.253
Bismuth (Bi)	1.04	0.32	5.03	2.13
Bore (B)	27	14	103	48
Cadmium (Cd)	3.87	0.95	9.82	4.88
Calcium (Ca)	2074.0	401.0	397.0	957.3
Chrome (Cr)	18.50	5	73.7	32.5
Cobalt (Co)	0.80	< 0.40	0.50	0.57
Cuivre (Cu)	91.7	25.8	133.3	83.6
Étain (Sn)	101.4	26.00	189.0	105.5
Fer (Fe)	1091.0	554.0	136.0	593.7
Lithium (Li)	11.00	36.0	35.0	27.3
Magnésium (Mg)	317.0	47.0	75.0	146.3
Manganèse (Mn)	67.7	23.2	5.80	32.2
Molybdène (Mo)	6.80	< 2.60	10.90	6.77
Nickel (Ni)	8.70	0.80	2.30	3.93
Phosphore (P)				
Plomb (Pb)	129.0	38.0	446.0	204.3
Potassium (K)	10134.0	1200.0	10230.0	7188.0
Sélénium (Se)	1.40	0.80	1.00	1.07
Silicium (Si)	775.0	180.0	593.0	516.0
Sodium (Na)	7920.0	871.0	6910.0	5233.7
Strontium (Sr)	5.30	0.70	0.70	2.23
Tellurium (Te)				
Thallium (Tl)	< 0.40	< 0.40	< 0.40	< 0.40
Titane (Ti)	55.0	7.00	9.00	23.7
Uranium (U)				
Vanadium (V)	1.50	< 0.80	1.10	1.13
Zinc (Zn)	518.7	56.6	1075.1	550.1
Mercure (Hg)	0.89	0.36	0.05	0
MÉTAUX DÉTECTÉS	**24 216**	**3 536**	**20 757**	**16 170**
MÉTAUX TOTAUX	**24 217**	**3 543**	**20 758**	**16 173**

AEM Meliadine
18-5528
Incinérateur
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HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX PARTICULAIRE (µg/m^{3}R)				
Aluminium (Al)	207	11	12	76
Antimoine (Sb)	89	1.3	58	49
Argent (Ag)	0.33	< 0.21	0.35	0.29
Arsenic (As)	6.2	0.46	8.2	5.0
Baryum (Ba)	2.6	0.23	0.28	1.0
Béryllium (Be)	< 0.018	< 0.021	< 0.013	< 0.018
Bismuth (Bi)	0.30	0.042	1.3	0.54
Bore (B)	1.5	1.4	0.98	1.3
Cadmium (Cd)	0.90	0.16	2.5	1.2
Calcium (Ca)	699	109	65	291
Chrome (Cr)	6.6	1.8	19	9.3
Cobalt (Co)	0.18	< 0.035	0.053	0.090
Cuivre (Cu)	32	8.7	35	25
Étain (Sn)	28	1.4	44	25
Fer (Fe)	388	12	22	140
Lithium (Li)	2.9	12	8.5	7.7
Magnésium (Mg)	78	12	9.6	33
Manganèse (Mn)	6.0	5.5	1.1	4.2
Molybdène (Mo)	1.7	< 0.21	2.4	1.4
Nickel (Ni)	2.9	0.14	0.53	1.2
Phosphore (P)				
Plomb (Pb)	46	13	118	59
Potassium (K)	3660	413	2708	2260
Sélénium (Se)	< 0.18	< 0.18	0.13	0.16
Silicium (Si)	260	52	105	139
Sodium (Na)	2863	300	1829	1664
Strontium (Sr)	1.8	0.14	0.11	0.69
Tellurium (Te)				
Thallium (Tl)	< 0.036	< 0.035	< 0.027	< 0.033
Titane (Ti)	19	1.4	1.6	7.3
Uranium (U)				
Vanadium (V)	0.29	< 0.071	0.11	0.16
Zinc (Zn)	184	19	284	163
Mercure (Hg)				
MÉTAUX DÉTECTÉS	**8588**	**975**	**5337**	**4967**
MÉTAUX TOTAUX	**8588**	**976**	**5337**	**4967**

AEM Meliadine
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HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX GAZEUX (ug/m^{3}R)				
Aluminium (Al)	4.3	3.5	3.7	3.9
Antimoine (Sb)	< 0.11	< 0.11	< 0.080	< 0.098
Argent (Ag)	< 0.72	< 0.71	< 0.53	< 0.65
Arsenic (As)	< 0.11	< 0.11	< 0.080	< 0.098
Baryum (Ba)	0.16	0.19	0.053	0.14
Béryllium (Be)	< 0.072	< 0.071	< 0.053	< 0.065
Bismuth (Bi)	< 0.072	< 0.071	< 0.053	< 0.065
Bore (B)	8.2	3.7	26	13
Cadmium (Cd)	0.51	0.18	0.080	0.25
Calcium (Ca)	52	32	41	42
Chrome (Cr)	< 0.11	< 0.11	< 0.080	< 0.098
Cobalt (Co)	< 0.11	< 0.11	< 0.080	< 0.098
Cuivre (Cu)	0.94	0.39	0.61	0.65
Étain (Sn)	8.7	7.8	6.1	7.5
Fer (Fe)	7.6	184	14	69
Lithium (Li)	< 1.1	< 1.1	< 0.80	< 0.98
Magnésium (Mg)	37	4.6	10	17
Manganèse (Mn)	19	2.6	0.40	7.2
Molybdène (Mo)	< 0.72	< 0.71	< 0.53	< 0.65
Nickel (Ni)	0.22	0.14	0.080	0.15
Phosphore (P)				
Plomb (Pb)	< 0.72	< 0.71	< 0.53	< 0.65
Potassium (K)	12	< 11	< 8.0	< 10
Sélénium (Se)	0.33	0.11	0.13	0.19
Silicium (Si)	21	11	52	28
Sodium (Na)	< 7.2	< 7.1	< 5.3	< 6.5
Strontium (Sr)	< 0.11	< 0.11	< 0.080	< 0.098
Tellurium (Te)				
Thallium (Tl)	< 0.11	< 0.11	< 0.080	< 0.098
Titane (Ti)	< 1.1	< 1.1	< 0.80	< 0.98
Uranium (U)				
Vanadium (V)	< 0.25	< 0.21	< 0.19	< 0.22
Zinc (Zn)	3.5	0.92	1.4	1.9
Mercure (Hg)				
MÉTAUX DÉTECTÉS	**175**	**263**	**165**	**201**
MÉTAUX TOTAUX	**188**	**275**	**174**	**212**

AEM Meliadine
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HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX TOTAUX (µg/m^{3}R)				
Aluminium (Al)	211	14	16	80
Antimoine (Sb)	89	1.4	58	49
Argent (Ag)	1.1	< 0.92	0.88	0.95
Arsenic (As)	6.3	0.56	8.3	5.1
Baryum (Ba)	2.8	0.42	0.33	1.2
Béryllium (Be)	< 0.091	< 0.092	< 0.066	< 0.083
Bismuth (Bi)	0.38	0.11	1.3	0.61
Bore (B)	9.6	5.1	27	14
Cadmium (Cd)	1.4	0.34	2.6	1.4
Calcium (Ca)	752	142	105	333
Chrome (Cr)	6.7	1.9	20	9.4
Cobalt (Co)	0.29	< 0.14	0.13	0.19
Cuivre (Cu)	33	9.1	35	26
Étain (Sn)	37	9.2	50	32
Fer (Fe)	395	196	36	209
Lithium (Li)	4.0	13	9.3	8.7
Magnésium (Mg)	115	17	20	50
Manganèse (Mn)	25	8.2	1.5	11
Molybdène (Mo)	2.5	< 0.92	2.9	2.1
Nickel (Ni)	3.2	0.28	0.61	1.3
Phosphore (P)				
Plomb (Pb)	47	13	118	60
Potassium (K)	3673	424	2716	2271
Sélénium (Se)	0.51	0.28	0.27	0.35
Silicium (Si)	281	64	157	167
Sodium (Na)	2870	307	1834	1671
Strontium (Sr)	1.9	0.25	0.19	0.78
Tellurium (Te)				
Thallium (Tl)	< 0.14	< 0.14	< 0.11	< 0.13
Titane (Ti)	20	2.5	2.4	8.3
Uranium (U)				
Vanadium (V)	0.54	< 0.28	0.29	0.37
Zinc (Zn)	188	20	285	164
Mercure (Hg)	0.32	0.13	0.013	0.15
MÉTAUX DÉTECTÉS	**8776**	**1248**	**5511**	**5178**
MÉTAUX TOTAUX	**8777**	**1251**	**5511**	**5179**

AEM Meliadine
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Incinérateur
ME

HORAIRE DES ESSAIS				
ESSAI NUMÉRO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX TOTAUX (ug/m^{3}R) À 11 % DE O_2				
Aluminium (Al)	307	24	21	118
Antimoine (Sb)	129	2.3	78	70
Argent (Ag)	1.5	< 1.6	1.2	1.4
Arsenic (As)	9.2	0.96	11	7.1
Baryum (Ba)	4.1	0.72	0.45	1.7
Béryllium (Be)	< 0.13	< 0.16	< 0.089	< 0.13
Bismuth (Bi)	0.55	0.19	1.8	0.85
Bore (B)	14	8.6	37	20
Cadmium (Cd)	2.0	0.57	3.5	2.0
Calcium (Ca)	1095	239	142	492
Chrome (Cr)	9.8	3.2	26	13
Cobalt (Co)	0.42	< 0.24	0.18	0.28
Cuivre (Cu)	48	15	48	37
Étain (Sn)	54	16	68	46
Fer (Fe)	576	331	49	318
Lithium (Li)	5.8	21	13	13
Magnésium (Mg)	167	28	27	74
Manganèse (Mn)	36	14	2.1	17
Molybdène (Mo)	3.6	< 1.6	3.9	3.0
Nickel (Ni)	4.6	0.48	0.82	2.0
Phosphore (P)				
Plomb (Pb)	68	23	160	83
Potassium (K)	5348	716	3662	3242
Sélénium (Se)	0.74	0.48	0.36	0.52
Silicium (Si)	409	107	212	243
Sodium (Na)	4180	520	2473	2391
Strontium (Sr)	2.8	0.42	0.25	1.2
Tellurium (Te)				
Thallium (Tl)	< 0.21	< 0.24	< 0.14	< 0.20
Titane (Ti)	29	4.2	3.2	12
Uranium (U)				
Vanadium (V)	0.79	< 0.48	0.39	0.55
Zinc (Zn)	274	34	385	231
Mercure (Hg)	0.47	0.21	0.018	0.23
MÉTAUX DÉTECTÉS	**12780**	**2111**	**7430**	**7440**
MÉTAUX TOTAUX	**12780**	**2115**	**7430**	**7442**
CLASSE I (Cu, Pb, V & Zn)	**391**	**72**	**593**	**352**
LIGNE DIRECTRICE DU CCME		**1500**		
CLASSE II (As, Cr & Ni)	**24**	**4.7**	**38**	**22**
LIGNE DIRECTRICE DU CCME		**500**		
CLASSE III (Cd, Hg & Tl)	**2.5**	**0.78**	**3.5**	**2.3**
LIGNE DIRECTRICE DU CCME		**150**		
AUTRES MÉTAUX (Al, Ag, Ba, Be, B, Sn, Fe,	**12363**	**2033**	**6795**	**7064**

AEM Meliadine
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HORAIRE DES ESSAIS				
ESSAI NUMERO	MEL-ME-1	MEL-ME-2	MEL-ME-3	MOYENNE
DATE DE L'ESSAI	2018-09-22	2018-09-28	2018-09-29	(1 à 3)
DÉBUT DE L'ESSAI	14:45	11:33	16:14	
FIN DE L'ESSAI	16:45	14:23	19:14	
DUREE DE L'ESSAI (minutes)	120	170	180	
NOMBRE DE POINTS	24	34	36	
MÉTAUX TOTAUX (g/h)				
Aluminium (Al)	1.4	0.078	0.11	0.52
Antimoine (Sb)	0.58	0.0076	0.40	0.33
Argent (Ag)	0.0068	< 0.0051	0.0060	0.0060
Arsenic (As)	0.041	0.0031	0.057	0.034
Baryum (Ba)	0.018	0.0023	0.0023	0.0076
Béryllium (Be)	< 0.00059	< 0.00051	< 0.00045	< 0.00052
Bismuth (Bi)	0.0024	0.00062	0.0091	0.0041
Bore (B)	0.063	0.028	0.19	0.093
Cadmium (Cd)	0.0091	0.0018	0.018	0.0096
Calcium (Ca)	4.9	0.78	0.72	2.1
Chrome (Cr)	0.044	0.010	0.13	0.063
Cobalt (Co)	0.0019	< 0.00078	0.00091	0.0012
Cuivre (Cu)	0.22	0.050	0.24	0.17
Étain (Sn)	0.24	0.051	0.34	0.21
Fer (Fe)	2.6	1.1	0.25	1.3
Lithium (Li)	0.026	0.070	0.064	0.053
Magnésium (Mg)	0.75	0.091	0.14	0.32
Manganèse (Mn)	0.16	0.045	0.011	0.072
Molybdène (Mo)	0.016	< 0.0051	0.020	0.014
Nickel (Ni)	0.020	0.0016	0.0042	0.0087
Phosphore (P)				
Plomb (Pb)	0.30	0.074	0.81	0.40
Potassium (K)	24	2.3	19	15
Sélénium (Se)	0.0033	0.0016	0.0018	0.0022
Silicium (Si)	1.8	0.35	1.1	1.1
Sodium (Na)	19	1.7	13	11
Strontium (Sr)	0.012	0.0014	0.0013	0.0050
Tellurium (Te)				
Thallium (Tl)	< 0.00094	< 0.00078	< 0.00073	< 0.00082
Titane (Ti)	0.13	0.014	0.016	0.053
Uranium (U)				
Vanadium (V)	0.0035	< 0.0016	0.0020	0.0024
Zinc (Zn)	1.2	0.11	2.0	1.1
Mercure (Hg)	0.0021	0.00070	0.000091	0.00096
MÉTAUX DÉTECTÉS	**57**	**6.9**	**38**	**34**
MÉTAUX TOTAUX	**57**	**6.9**	**38**	**34**

R : Conditions de référence à 101.3 kPa et 25 °C, sur base sèche.

RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - ME - ESSAI# MEL-ME-1

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg)	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
14 h 45	1	1	5	0.15	1.75	1300	79	79	79	534.62	538.31	**3.69**	11.1	98	14.1	5.2	3	-2.0	250	260	40	-	-	-
		1	5	0.15	1.76	1300	82	82	82	538.31	541.93	**3.62**	11.1	96				-2.0	250	260	40	-	-	-
		2	5	0.15	1.77	1300	83	83	83	541.93	545.49	**3.56**	11.1	94				-2.0	250	260	40	-	-	-
		2	5	0.14	1.65	1300	84	84	84	545.49	549.01	**3.52**	10.8	96				-2.0	250	260	40	-	-	-
		3	5	0.18	2.07	1348	84	84	84	549.01	553.11	**4.10**	12.4	100				-2.0	250	260	40	-	-	-
		3	5	0.18	2.07	1349	85	85	85	553.11	557.22	**4.11**	12.4	100				-2.0	250	260	40	-	-	-
		4	5	0.18	2.07	1354	86	86	86	557.22	561.31	**4.09**	12.4	100				-2.0	250	260	40	-	-	-
		4	5	0.18	2.08	1346	88	88	88	561.31	565.42	**4.11**	12.4	100				-2.0	250	260	40	-	-	-
		5	5	0.18	2.08	1348	88	88	88	565.42	569.51	**4.09**	12.4	99				-2.0	250	260	40	-	-	-
		5	5	0.18	2.08	1350	89	89	89	569.51	573.61	**4.10**	12.4	99				-2.0	250	260	40	-	-	-
		6	5	0.18	2.07	1361	89	89	89	573.61	577.68	**4.07**	12.4	99				-2.0	250	260	40	-	-	-
		6	5	0.18	2.07	1362	89	89	89	577.68	581.77	**4.09**	12.4	99				-2.0	250	260	40	-	-	-
	2	6	5	0.19	2.19	1364	92	92	92	581.77	586.08	**4.31**	12.8	102				-2.0	250	260	40	-	-	-
		6	5	0.19	2.21	1352	92	92	92	586.08	590.50	**4.42**	12.7	104				-2.0	250	260	40	-	-	-
		5	5	0.19	2.21	1356	94	94	94	590.50	595.00	**4.50**	12.7	105				-2.0	250	260	40	-	-	-
		5	5	0.19	2.22	1348	94	94	94	595.00	599.50	**4.50**	12.7	105				-2.0	250	260	40	-	-	-
		4	5	0.19	2.22	1352	95	95	95	599.50	604.03	**4.53**	12.7	106				-2.0	250	260	40	-	-	-
		4	5	0.19	2.22	1352	96	96	96	604.03	608.50	**4.47**	12.7	104				-2.0	250	260	40	-	-	-
		3	5	0.18	2.11	1355	97	97	97	608.50	613.00	**4.50**	12.4	108				-2.0	250	260	40	-	-	-
		3	5	0.18	2.11	1355	97	97	97	613.00	617.49	**4.49**	12.4	107				-2.0	250	260	40	-	-	-
		2	5	0.15	1.78	1337	98	98	98	617.49	621.69	**4.20**	11.2	109				-2.0	250	260	67	-	-	-
		2	5	0.15	1.82	1295	98	98	98	621.69	625.82	**4.13**	11.1	106				-2.0	250	260	67	-	-	-
		1	5	0.13	1.54	1337	99	99	99	625.82	629.70	**3.88**	10.5	108				-2.0	250	260	67	-	-	-
		1	5	0.13	1.54	1345	99	99	99	629.70	633.54	**3.84**	10.5	107				-2.0	250	260	67	-	-	-

RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - ME - ESSAI# MEL-ME-2

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg)	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
11 h 33	1	1	5	0.15	1.31	1290	71	71	71	636.82	640.06	3.24	11.2	99	15.1	4.4	3	-7.0	247	250	67	-	-	-
		1	5	0.15	1.28	1341	72	72	72	640.06	643.25	3.19	11.3	99				-7.5	247	256	67	-	-	-
		1	5	0.15	1.27	1349	73	73	73	643.25	646.52	3.27	11.4	101				-8.5	250	252	67	-	-	-
		2	5	0.14	1.19	1352	74	74	74	646.52	649.71	3.19	11.0	102				-8.0	247	255	67	-	-	-
		2	5	0.14	1.19	1354	76	76	76	649.71	652.87	3.16	11.0	101				-7.5	251	252	67	-	-	-
		2	5	0.14	1.20	1354	78	78	78	652.87	656.06	3.19	11.0	102				-7.5	247	253	67	-	-	-
		3	5	0.13	1.12	1344	80	80	80	656.06	659.14	3.08	10.6	101				-7.0	247	252	67	-	-	-
		3	5	0.13	1.13	1340	82	82	82	659.14	662.29	3.15	10.5	103				-7.0	248	249	67	-	-	-
		3	5	0.13	1.13	1348	83	83	83	662.29	665.39	3.10	10.6	101				-9.0	248	250	67	-	-	-
		4	5	0.13	1.13	1347	85	85	85	665.39	668.50	3.11	10.6	101				-9.0	246	250	67	-	-	-
		4	5	0.13	1.13	1345	86	86	86	668.50	671.62	3.12	10.6	101				-6.5	252	253	67	-	-	-
		4	5	0.13	1.14	1348	88	88	88	671.62	674.77	3.15	10.6	102				-6.5	252	253	67	-	-	-
		5	5	0.13	1.15	1334	89	89	89	674.77	677.84	3.07	10.5	99				-9.0	246	249	67	-	-	-
		5	5	0.13	1.15	1330	91	91	91	677.84	680.96	3.12	10.5	100				-9.0	243	249	67	-	-	-
		5	5	0.13	1.15	1337	92	92	92	680.96	684.09	3.13	10.5	100				-9.0	252	252	67	-	-	-
		6	5	0.12	1.07	1334	93	93	93	684.09	687.13	3.04	10.1	101				-9.0	251	255	67	-	-	-
		6	5	0.12	1.07	1335	94	94	94	687.13	690.18	3.05	10.1	101				-9.0	249	251	67	-	-	-
		6	5	0.12	1.07	1340	95	95	95	690.18	693.21	3.03	10.1	101				-9.0	246	255	67	-	-	-
	2	6	5	0.12	1.07	1338	96	96	96	693.21	696.26	3.05	10.1	101				-9.0	248	259	67	-	-	-
		6	5	0.12	1.07	1338	97	97	97	696.26	699.31	3.05	10.1	101				-9.0	246	246	67	-	-	-
		6	5	0.12	1.08	1328	97	97	97	699.31	702.37	3.06	10.1	101				-9.0	251	250	67	-	-	-
		5	5	0.12	1.07	1344	98	98	98	702.37	705.44	3.07	10.1	101				-9.0	251	261	67	-	-	-
		5	5	0.12	1.07	1344	98	98	98	705.44	708.51	3.07	10.1	101				-9.0	249	252	67	-	-	-
		5	5	0.12	1.07	1345	99	99	99	708.51	711.60	3.09	10.1	102				-9.0	249	252	67	-	-	-
		4	5	0.12	1.07	1342	99	99	99	711.60	714.66	3.06	10.1	101				-9.0	249	252	67	-	-	-
		4	5	0.10	0.90	1329	100	100	100	714.66	717.50	2.84	9.2	102				-9.0	249	252	67	-	-	-
		4	5	0.10	0.91	1326	101	101	101	717.50	720.31	2.81	9.2	101				-9.0	249	252	67	-	-	-
		3	5	0.10	0.91	1326	101	101	101	720.31	723.10	2.79	9.2	100				-9.0	249	252	67	-	-	-
		3	5	0.10	0.90	1330	102	102	102	723.10	725.88	2.78	9.2	99				-9.0	249	252	67	-	-	-
		3	5	0.10	0.90	1330	102	102	102	725.88	728.68	2.80	9.2	100				-9.0	249	252	67	-	-	-
		2	5	0.10	0.91	1326	103	103	103	728.68	731.49	2.81	9.2	100				-9.0	249	252	67	-	-	-
		2	5	0.10	0.92	1316	104	104	104	731.49	734.29	2.80	9.2	99				-9.0	249	252	67	-	-	-
		2	5	0.10	0.91	1317	104	104	104	734.29	737.13	2.84	9.2	101				-9.0	249	252	67	-	-	-
		1	5	0.10	0.92	1311	105	105	105	737.13	740.00	2.87	9.2	102				-9.0	249	252	67	-	-	-

RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - ME - ESSAI# MEL-ME-3

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
16:14	1	1	5	0.20	1.74	1327	78	78	78	747.13	750.85	3.72	13.0	99	13.6	5.6	3	-3.0	250	250	40	-	-	-
		1	5	0.20	1.72	1347	79	79	79	750.85	754.60	3.75	13.1	101				-3.0	250	250	40	-	-	-
		1	5	0.20	1.72	1350	80	80	80	754.60	758.43	3.83	13.1	103				-3.0	250	250	40	-	-	-
		2	5	0.20	1.71	1360	81	81	81	758.43	762.18	3.75	13.1	101				-3.0	250	250	40	-	-	-
		2	5	0.20	1.70	1374	81	81	81	762.18	765.96	3.78	13.2	102				-3.0	250	250	40	-	-	-
		2	5	0.20	1.70	1378	82	82	82	765.96	769.75	3.79	13.2	102				-3.0	250	250	40	-	-	-
		3	5	0.22	1.87	1380	83	83	83	769.75	773.68	3.93	13.8	101				-3.0	250	250	40	-	-	-
		3	5	0.23	1.95	1393	84	84	84	773.68	777.76	4.08	14.2	103				-3.0	250	250	40	-	-	-
		3	5	0.23	1.94	1401	85	85	85	777.76	781.76	4.00	14.2	101				-3.0	250	250	40	-	-	-
		4	5	0.23	1.93	1410	85	85	85	781.76	785.75	3.99	14.3	101				-3.0	250	250	40	-	-	-
		4	5	0.23	1.92	1420	86	86	86	785.75	789.77	4.02	14.3	101				-3.0	250	250	40	-	-	-
		4	5	0.23	1.93	1423	87	87	87	789.77	793.77	4.00	14.3	101				-3.0	250	250	40	-	-	-
		5	5	0.23	1.92	1431	88	88	88	793.77	797.79	4.02	14.3	101				-3.0	250	250	40	-	-	-
		5	5	0.20	1.68	1418	89	89	89	797.79	801.59	3.80	13.3	102				-3.0	250	250	40	-	-	-
		5	5	0.20	1.68	1430	90	90	90	801.59	805.38	3.79	13.4	102				-3.0	250	250	40	-	-	-
		6	5	0.20	1.69	1418	90	90	90	805.38	809.19	3.81	13.3	102				-3.0	250	250	40	-	-	-
		6	5	0.20	1.67	1440	90	90	90	809.19	813.00	3.81	13.4	103				-3.0	250	250	40	-	-	-
		6	5	0.20	1.67	1445	91	91	91	813.00	816.78	3.78	13.4	102				-4.0	250	250	40	-	-	-
	2	6	5	0.20	1.66	1451	91	91	91	816.78	820.57	3.79	13.4	102				-4.0	250	250	40	-	-	-
		6	5	0.20	1.66	1460	92	92	92	820.57	824.36	3.79	13.5	102				-4.0	250	250	40	-	-	-
		6	5	0.20	1.65	1467	93	93	93	824.36	828.17	3.81	13.5	103				-4.0	250	250	40	-	-	-
		5	5	0.19	1.57	1476	94	94	94	828.17	831.88	3.71	13.2	103				-4.0	250	250	40	-	-	-
		5	5	0.19	1.57	1479	95	95	95	831.88	835.60	3.72	13.2	103				-4.0	250	250	40	-	-	-
		5	5	0.19	1.57	1481	96	96	96	835.60	839.27	3.67	13.2	101				-4.0	250	250	40	-	-	-
		5	5	0.19	1.55	1502	97	97	97	839.27	842.94	3.67	13.3	102				-4.0	250	250	40	-	-	-
		5	5	0.21	1.71	1518	99	99	99	842.94	846.82	3.88	14.0	103				-4.0	250	250	40	-	-	-
		5	5	0.21	1.71	1518	99	99	99	846.82	850.70	3.88	14.0	103				-4.0	250	250	40	-	-	-
		5	5	0.21	1.71	1520	100	100	100	850.70	854.57	3.87	14.0	102				-4.0	250	250	40	-	-	-
		5	5	0.21	1.72	1518	101	101	101	854.57	858.43	3.86	14.0	102				-4.0	250	250	40	-	-	-
		5	5	0.21	1.71	1525	102	102	102	858.43	862.27	3.84	14.0	101				-4.0	250	250	40	-	-	-
		5	5	0.21	1.72	1522	103	103	103	862.27	866.14	3.87	14.0	102				-4.0	250	250	40	-	-	-
		5	5	0.17	1.39	1522	104	104	104	866.14	869.62	3.48	12.6	101				-4.0	250	250	40	-	-	-
		5	5	0.17	1.44	1460	105	105	105	869.62	873.16	3.54	12.4	101				-4.0	250	250	40	-	-	-
		5	5	0.17	1.46	1436	106	106	106	873.16	876.67	3.51	12.3	100				-4.0	250	250	40	-	-	-
		5	5	0.17	1.47	1429	106	106	106	876.67	880.25	3.58	12.3	101				-4.0	250	250	40	-	-	-
		5	5	0.17	1.48	1421	107	107	107	880.25	883.85	3.60	12.3	102				-4.0	250	250	40	-	-	-

AEM Meliadine
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HORAIRE DES ESSAIS									
ESSAI NUMÉRO	FACTEUR	MEL-COSV-1	QUANTITÉ	MEL-COSV-2	QUANTITÉ	MEL-COSV-3	QUANTITÉ	**MOYENNE**	**MOYENNE**
DATE DE L'ESSAI	DE TOXICITÉ	2018-09-22	PRÉLEVÉE,	2018-09-28	PRÉLEVÉE,	2018-09-29	PRÉLEVÉE,	**(1 à 3)**	**(1 à 3)**
DÉBUT DE L'ESSAI		13:44	EN	11:32	EN	16:13	EN	**ÉQUIVALENT**	**AVANT**
FIN DE L'ESSAI		17:44	EQUIVALENT	14:02	EQUIVALENT	19:13	EQUIVALENT	**TOTAUX**	**CORRECTION**
DUREE DE L'ESSAI (minutes)		240		150		180			
NOMBRE DE POINTS		48		30		36			
DONNÉES DES ÉQUIPEMENTS D'ÉCHANTILLONNAGE									
PRESSION BAROMÉTRIQUE ("Hg)		30.10		29.73		29.83			29.89
PRESSION STATIQUE ("H2O)		-0.08		-0.05		-0.05			-0.06
PRESSION STATIQUE (kPa)		-0.02		-0.01		-0.01			-0.01
COEFFICIENT DU COMPTEUR (19)		0.997		0.997		0.997			0.997
COEFFICIENT DU PITOT (03-06 3Q-371,03-06 3Q-503)		0.778		0.781		0.781			0.780
DIAMÈTRE DE LA BUSE (po) (3Q-371,3Q-503)		0.3741		0.4958		0.4958			0.4552
TEMPÉRATURE COMPTEUR (°F)		60		60		60			60
TEMPÉRATURE COMPTEUR (°C)		16		16		16			16
HUMIDITÉ DES GAZ & VOLUME ÉCHANTILLONNÉ									
MASSE D'EAU (g)		174.8		134.8		259.1			189.6
VOLUME D'EAU (pi^3)		8.39		6.47		12.44			9.10
HUMIDITÉ GAZ (BWO)		0.066		0.051		0.066			0.061
HUMIDITÉ GAZ (% v/v)		6.6		5.1		6.6			6.1
VOLUME GAZ REFERENCE (pi^3R)		119.19		119.67		176.29			138.38
VOLUME GAZ REFERENCE (m^3R)		**3.375**		**3.389**		**4.992**			**3.919**
CARACTERISTIQUES DU CONDUIT									
DIAMETRES AVANT LES TROUS D'ECHANTILLONNAG		5.0		5.0		5.00			5.0
DIAMÈTRES APRÈS LES TROUS D'ÉCHANTILLONNAG		2.0		2.0		2.00			2.0
DIAMÈTRE DU CONDUIT (pi)		2.71		2.71		2.71			2.71
DIAMÈTRE DU CONDUIT (m)		0.826		0.826		0.826			0.83
ÉPAISSEUR DU PORT D'ÉCHANTILLONNAGE (po)		7.5		7.5		7.5			
LONGUEUR DU CONDUIT (pi)		0.0		0.0		0.0			
LARGEUR DU CONDUIT (pi)		0.0		0.0		0.0			
PRESSION CONDUIT ("Hg)		30.09		29.73		29.83			29.88
PRESSION COMPTEUR ("Hg)		30.13		29.81		29.95			29.96
SURFACE DU CONDUIT (pi^2)		5.8		5.8		5.8			5.8
SURFACE DU CONDUIT (m^2)		0.54		0.54		0.54			0.54
CARACTERISTIQUES DES GAZ									
TEMPERATURE CHEMINEE (°F)		1339		1333		1435			1369
TEMPÉRATURE CHEMINÉE (°C)		726.0		722.8		779.5			742.7
CO_2 (%vs)		5.2		4.4		5.6			5.1
O_2 (%vs)		14.1		15.1		13.6			14.3
O_2 (%vh)		13.2		14.3		12.7			13.4
CO (ppmvs)		3		3		3			3
SO_2 (%vs)		0		0		0			
N_2 (%vs)		80.6		80.5		80.8			81
Ar (%vs)		0.00		0.00		0.00			0.0
POIDS MOLECULAIRE SEC		29.40		29.31		29.44			29.39
POIDS MOLECULAIRE HUMIDE		28.65		28.73		28.69			28.69
VITESSE DES GAZ (pi/s)		38.3		34.8		45.6			39.6
VITESSE DES GAZ (m/s)		11.7		10.6		13.9			12.1
DEBIT GAZ ACTUELS (pi^3/h)		794 892		722 251		946 277			821 140
DEBIT GAZ ACTUELS (m^3/h)		22 509		20 452		26 796			23 252
DEBIT GAZ ACTUELS (pi^3/min)(APCM)		13 248		12 038		15 771			13 686
DEBIT GAZ NORMALISES (pi^3R/h)		222 994		203 892		249 680			225 522
DEBIT GAZ NORMALISES (m^3R/h)		**6 314**		**5 774**		**7 070**			**6 386**
DEBIT GAZ NORMALISES (pi^3R/min) (RPCM)		3 717		3 398		4 161			3 759
INFORMATIONS D'ÉCHANTILLONNAGE									
VITESSE MAXIMALE (m/s)		13.55		11.89		15.22			13.6
VITESSE MINIMALE (m/s)		9.45		9.25		12.42			10.4
10%Vmax (m/s)		1.35		1.19		1.52			1.4
Pourcentage >10%Vmax		75%		100%		100%			92%
NOMBRE POINTS ΔP 20% et + de ΔPmoy		12		5		0			
ISOCINÉTISME MOYEN (%)		101.1		100.9		101.2			101
% PTS RESPECT CRITERE ISO		100%		100%		100%			100%
DEBIT DE POMPAGE MAX (pi^3/min)		≤ 0.54		≤ 0.89		≤ 1.03			0.8
PRESSION DE VIDE MAX DURANT ESSAI (-"Hg)		-2		-6		-5			-4.00
TEMPÉRATURE SONDE MAX (°F)		250		250		254			251.33
TEMPÉRATURE SONDE MIN (°F)		250		235		238			241
TEMPÉRATURE FILTRE MAX (°F)		250		260		262			257
TEMPÉRATURE FILTRE MIN (°F)		250		244		243			246
TEMPÉRATURE SORTIE MAX (°F)		40		68		68			59
TEMPÉRATURE SORTIE MIN (°F)		40		68		66			58
TEMPÉRATURE TRAPPE MAX (°F)		40		58		56			51
TEMPÉRATURE TRAPPE MIN (°F)		40		43		40			41
DEBIT DE POMPAGE MOYEN (pi^3/min)		0.48		0.78		0.95			
4% DEBIT DE POMPAGE MOYEN (pi^3/min)		0.019		0.031		0.038			
TEST DE FUITE AVANT LES ESSAIS À 15 "Hg (pi^3/min)		< 0.020		< 0.020		< 0.020			
TEST DE FUITE APRÈS LES ESSAIS (pi^3/min)		< 0.020		< 0.020		< 0.020			0.020

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HORAIRE DES ESSAIS									
ESSAI NUMÉRO	FACTEUR	MEL-COSV-1	QUANTITÉ	MEL-COSV-2	QUANTITÉ	MEL-COSV-3	QUANTITÉ	**MOYENNE**	**MOYENNE**
DATE DE L'ESSAI	DE TOXICITÉ	2018-09-22	PRÉLEVÉE,	2018-09-28	PRÉLEVÉE,	2018-09-29	PRÉLEVÉE,	**(1 à 3)**	**(1 à 3)**
DÉBUT DE L'ESSAI		13:44	EN	11:32	EN	16:13	EN	**ÉQUIVALENT**	**AVANT**
FIN DE L'ESSAI		17:44	EQUIVALENT	14:02	EQUIVALENT	19:13	EQUIVALENT	**TOTAUX**	**CORRECTION**
DUREE DE L'ESSAI (minutes)		240		150		180			
NOMBRE DE POINTS		48		30		36			
DIOXINES ET FURANNES LIMITES DE DETECTION (pg)									
2,3,7,8 - Tetra CDD		1		2		7			3.3
1,2,3,7,8 - Penta CDD		3		9		10			7.3
1,2,3,4,7,8 - Hexa CDD		3		7		10			6.7
1,2,3,6,7,8 - Hexa CDD		3		6		10			6.3
1,2,3,7,8,9 - Hexa CDD		3		7		10			6.7
1,2,3,4,6,7,8 - Hepta CDD		6		10		10			8.7
1,2,3,4,6,7,8,9 - Octa CDD		20		10		20			16.7
2, 3, 7, 8 - Tetra CDF		4		6		9			6.3
1,2,3,7,8 - Penta CDF		8		9		20			12.3
2,3,4,7,8 - Penta CDF		6		7		10			7.7
1,2,3,4,7,8 - Hexa CDF		4		10		10			8.0
1,2,3,6,7,8 - Hexa CDF		4		10		10			8.0
2,3,4,6,7,8 - Hexa CDF		4		10		10			8.0
1,2,3,7,8,9 - Hexa CDF		6		20		20			15.3
1,2,3,4,6,7,8 - Hepta CDF		3		5		20			9.3
1,2,3,4,7,8,9 - Hepta CDF		6		8		20			11.3
1,2,3,4,6,7,8,9 - Octa CDF		9		7		30			15.3
Total Tetra CDD		1		2		7			3.3
Total Penta CDD		3		9		10			7.3
Total Hexa CDD		3		7		10			6.7
Total Hepta CDD		6		10		10			8.7
Sommation des PCDDs		20		10		20			16.7
Total Tetra CDF		4		6		9			6.3
Total Penta CDF		8		9		20			12.3
Total Hexa CDF		6		20		20			15.3
Total Hepta CDF		6		8		20			11.3
Sommation des PCDFs		9		20		30			19.7
DIOXINES ET FURANNES (pg)									
2,3,7,8 - Tetra CDD	**1**	< 1.00	< LD	5.00	5.00	< 7.00	< LD	4.3	4.3
1,2,3,7,8 - Penta CDD	**1**	< 3.00	< LD	47.0	47.0	23.0	23.0	24.3	24.3
1,2,3,4,7,8 - Hexa CDD	**0.1**	< 3.00	< LD	53.0	5.30	28.0	2.80	2.80	28.0
1,2,3,6,7,8 - Hexa CDD	**0.1**	3.0	0.3	71.0	7.10	63.0	6.30	4.57	45.7
1,2,3,7,8,9 - Hexa CDD	**0.1**	< 3.00	< LD	81.0	8.10	65.0	6.50	4.97	49.7
1,2,3,4,6,7,8 - Hepta CDD	**0.01**	17.0	0.17	316.0	3.16	307.0	3.07	2.13	213.3
1,2,3,4,6,7,8,9 - Octa CDD	**0.0001**	33.0	0.0033	160.0	0.016	300.0	0.030	0.016	164.3
2, 3, 7, 8 - Tetra CDF	**0.1**	15.0	1.50	48.0	4.80	216.0	21.6	9.30	93.0
1,2,3,7,8 - Penta CDF	**0.05**	< 8.00	< LD	21.0	1.05	62.0	3.10	1.52	30.3
2,3,4,7,8 - Penta CDF	**0.5**	9.00	4.50	43.0	21.5	165.0	82.5	36.2	72.3
1,2,3,4,7,8 - Hexa CDF	**0.1**	13.0	1.30	62.0	6.20	326.0	32.6	13.4	133.7
1,2,3,6,7,8 - Hexa CDF	**0.1**	9.00	0.90	25.0	2.50	120.0	12.0	5.13	51.3
2,3,4,6,7,8 - Hexa CDF	**0.1**	8.00	0.80	50.0	5.00	273.0	27.3	11.0	110.3
1,2,3,7,8,9 - Hexa CDF	**0.1**	< 6.00	< LD	< 20.0	< LD	30.0	3.00	1.9	18.7
1,2,3,4,6,7,8 - Hepta CDF	**0.01**	16.0	0.16	64.0	0.64	474.0	4.74	1.85	184.7
1,2,3,4,7,8,9 - Hepta CDF	**0.01**	< 6.00	< LD	8.0	0.08	100.0	1.00	0.38	38.0
1,2,3,4,6,7,8,9 - Octa CDF	**0.0001**	20.0	0.0020	17.0	0.0017	227.0	0.023	0.0088	88.0
Total Tetra CDD	**MDDEFP**	9.00		159.0		214.0			127.3
Total Penta CDD		11.0		446.0		406.0			287.7
Total Hexa CDD		25.0		900.0		718.0			547.7
Total Hepta CDD		20.0		334.0		315.0			223.0
Sommation des PCDDs		99.0		2000.0		1950.0			1349.7
Total Tetra CDF		100.0		282.0		1140.0			507.3
Total Penta CDF		72.0		406.0		1540.0			672.7
Total Hexa CDF		32.0		172.0		963.0			389.0
Total Hepta CDF		28.0		123.0		880.0			343.7
Sommation des PCDFs		253.0		1000.0		4750.0			2001.0
ÉQUIVALENCE TOXIQUE TOTALE			**9.64**		**117.4**		**229.6**	**118.9**	
CONGÉNÈRES TOXIQUES TOTAUX		**173.0**		**1091.0**		**2786.0**			**1350.0**
GROUPES HOMOLOGUES TOTAUX		**649.0**		**5822.0**		**12876.0**			**6449.0**

AEM Meliadine
18-5528
Incinérateur
COSV

HORAIRE DES ESSAIS									
ESSAI NUMÉRO	FACTEUR	MEL-COSV-1	QUANTITÉ	MEL-COSV-2	QUANTITÉ	MEL-COSV-3	QUANTITÉ	**MOYENNE**	**MOYENNE**
DATE DE L'ESSAI	DE TOXICITÉ	2018-09-22	PRÉLEVÉE,	2018-09-28	PRÉLEVÉE,	2018-09-29	PRÉLEVÉE,	**(1 à 3)**	**(1 à 3)**
DÉBUT DE L'ESSAI		13:44	EN	11:32	EN	16:13	EN	**ÉQUIVALENT**	**AVANT**
FIN DE L'ESSAI		17:44	EQUIVALENT	14:02	EQUIVALENT	19:13	EQUIVALENT	**TOTAUX**	**CORRECTION**
DUREE DE L'ESSAI (minutes)		240		150		180			
NOMBRE DE POINTS		48		30		36			
DIOXINES ET FURANNES (ng/m³R)									
2,3,7,8 - Tetra CDD	**1**	< 0.00030	< LD	0.0015	0.0015	< 0.0014	< LD	0.0011	0.0011
1,2,3,7,8 - Penta CDD	**1**	< 0.00089	< LD	0.014	0.014	0.0046	0.0046	0.0065	0.0065
1,2,3,4,7,8 - Hexa CDD	**0.1**	< 0.00089	< LD	0.016	0.0016	0.0056	0.00056	0.00074	0.0074
1,2,3,6,7,8 - Hexa CDD	**0.1**	0.00089	0.000089	0.021	0.0021	0.013	0.0013	0.0011	0.011
1,2,3,7,8,9 - Hexa CDD	**0.1**	< 0.00089	< LD	0.024	0.0024	0.013	0.0013	0.0013	0.013
1,2,3,4,6,7,8 - Hepta CDD	**0.01**	0.0050	0.000050	0.093	0.00093	0.061	0.00061	0.00053	0.053
1,2,3,4,6,7,8,9 - Octa CDD	**0.0001**	0.0098	0.0000010	0.047	0.0000047	0.060	0.0000060	0.0000039	0.039
2, 3, 7, 8 - Tetra CDF	**0.1**	0.0044	0.00044	0.014	0.0014	0.043	0.0043	0.0021	0.021
1,2,3,7,8 - Penta CDF	**0.05**	< 0.0024	< LD	0.0062	0.00031	0.012	0.00062	0.00035	0.0070
2,3,4,7,8 - Penta CDF	**0.5**	0.0027	0.0013	0.013	0.0063	0.033	0.017	0.0081	0.016
1,2,3,4,7,8 - Hexa CDF	**0.1**	0.0039	0.00039	0.018	0.0018	0.065	0.0065	0.0029	0.029
1,2,3,6,7,8 - Hexa CDF	**0.1**	0.0027	0.00027	0.0074	0.00074	0.024	0.0024	0.0011	0.011
2,3,4,6,7,8 - Hexa CDF	**0.1**	0.0024	0.00024	0.015	0.0015	0.055	0.0055	0.0024	0.024
1,2,3,7,8,9 - Hexa CDF	**0.1**	< 0.0018	< LD	< 0.0059	< LD	0.0060	0.00060	0.00046	0.0046
1,2,3,4,6,7,8 - Hepta CDF	**0.01**	0.0047	0.000047	0.019	0.00019	0.095	0.00095	0.00040	0.040
1,2,3,4,7,8,9 - Hepta CDF	**0.01**	< 0.0018	< LD	0.0024	0.000024	0.020	0.00020	0.000081	0.0081
1,2,3,4,6,7,8,9 - Octa CDF	**0.0001**	0.0059	0.00000059	0.0050	0.00000050	0.045	0.0000045	0.0000019	0.019
Total Tetra CDD	**MDDEFP**	0.0027		0.047		0.043			0.031
Total Penta CDD		0.0033		0.13		0.081			0.072
Total Hexa CDD		0.0074		0.27		0.14			0.14
Total Hepta CDD		0.0059		0.099		0.063			0.056
Sommation des PCDDs		0.029		0.59		0.39			0.34
Total Tetra CDF		0.030		0.083		0.23			0.11
Total Penta CDF		0.021		0.12		0.31			0.15
Total Hexa CDF		0.0095		0.051		0.19			0.084
Total Hepta CDF		0.0083		0.036		0.18			0.074
Sommation des PCDFs		0.075		0.30		0.95			0.44
ÉQUIVALENCE TOXIQUE TOTALE			**0.0029**		**0.035**		**0.046**	**0.028**	
CONGÉNÈRES TOXIQUES TOTAUX		**0.051**		**0.32**		**0.56**			**0.31**
GROUPES HOMOLOGUES TOTAUX		**0.19**		**1.72**		**2.58**			**1.50**
DIOXINES ET FURANNES (ng/m³R) 11 % D'OXYGÈNE									
2,3,7,8 - Tetra CDD	**1**	< 0.00043	< LD	0.0025	0.0025	< 0.0019	< LD	0.0016	0.0016
1,2,3,7,8 - Penta CDD	**1**	< 0.0013	< LD	0.024	0.024	0.0062	0.0062	0.010	0.010
1,2,3,4,7,8 - Hexa CDD	**0.1**	< 0.0013	< LD	0.027	0.0027	0.0076	0.00076	0.0012	0.012
1,2,3,6,7,8 - Hexa CDD	**0.1**	0.0013	0.00013	0.036	0.0036	0.017	0.0017	0.0018	0.018
1,2,3,7,8,9 - Hexa CDD	**0.1**	< 0.0013	< LD	0.041	0.0041	0.018	0.0018	0.0020	0.020
1,2,3,4,6,7,8 - Hepta CDD	**0.01**	0.0074	0.000074	0.16	0.0016	0.083	0.00083	0.00083	0.083
1,2,3,4,6,7,8,9 - Octa CDD	**0.0001**	0.014	0.0000014	0.080	0.0000080	0.081	0.0000081	0.0000059	0.059
2, 3, 7, 8 - Tetra CDF	**0.1**	0.0065	0.00065	0.024	0.0024	0.059	0.0059	0.0030	0.030
1,2,3,7,8 - Penta CDF	**0.05**	< 0.0035	< LD	0.011	0.00053	0.017	0.00084	0.00051	0.010
2,3,4,7,8 - Penta CDF	**0.5**	0.0039	0.0020	0.022	0.011	0.045	0.022	0.012	0.023
1,2,3,4,7,8 - Hexa CDF	**0.1**	0.0056	0.00056	0.031	0.0031	0.088	0.0088	0.0042	0.042
1,2,3,6,7,8 - Hexa CDF	**0.1**	0.0039	0.00039	0.013	0.0013	0.033	0.0033	0.0016	0.016
2,3,4,6,7,8 - Hexa CDF	**0.1**	0.0035	0.00035	0.025	0.0025	0.074	0.0074	0.0034	0.034
1,2,3,7,8,9 - Hexa CDF	**0.1**	< 0.0026	< LD	< 0.010	< LD	0.0081	0.00081	0.00069	0.0069
1,2,3,4,6,7,8 - Hepta CDF	**0.01**	0.0069	0.000069	0.032	0.00032	0.13	0.0013	0.00056	0.056
1,2,3,4,7,8,9 - Hepta CDF	**0.01**	< 0.0026	< LD	0.0040	0.000040	0.027	0.00027	0.00011	0.011
1,2,3,4,6,7,8,9 - Octa CDF	**0.0001**	0.0087	0.00000087	0.0085	0.00000085	0.062	0.0000062	0.0000026	0.026
Total Tetra CDD	**MDDEFP**	0.0039		0.080		0.058			0.047
Total Penta CDD		0.0048		0.22		0.11			0.11
Total Hexa CDD		0.011		0.45		0.19			0.22
Total Hepta CDD		0.0087		0.17		0.085			0.087
Sommation des PCDDs		0.043		1.01		0.53			0.53
Total Tetra CDF		0.043		0.14		0.31			0.16
Total Penta CDF		0.031		0.20		0.42			0.22
Total Hexa CDF		0.014		0.086		0.26			0.12
Total Hepta CDF		0.012		0.062		0.24			0.10
Sommation des PCDFs		0.11		0.50		1.29			0.63
ÉQUIVALENCE TOXIQUE TOTALE			**0.0042**		**0.059**		**0.062**	**0.042**	
NORME AU PRMRQA	**0.08**								
CONGÉNÈRES TOXIQUES TOTAUX		**0.075**		**0.55**		**0.76**			**0.46**
GROUPES HOMOLOGUES TOTAUX		**0.28**		**2.93**		**3.49**			**2.23**

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HORAIRE DES ESSAIS									
ESSAI NUMÉRO	FACTEUR	MEL-COSV-1	QUANTITÉ	MEL-COSV-2	QUANTITÉ	MEL-COSV-3	QUANTITÉ	**MOYENNE**	**MOYENNE**
DATE DE L'ESSAI	DE TOXICITÉ	2018-09-22	PRÉLEVÉE,	2018-09-28	PRÉLEVÉE,	2018-09-29	PRÉLEVÉE,	**(1 à 3)**	**(1 à 3)**
DÉBUT DE L'ESSAI		13:44	EN	11:32	EN	16:13	EN	**ÉQUIVALENT**	**AVANT**
FIN DE L'ESSAI		17:44	EQUIVALENT	14:02	EQUIVALENT	19:13	EQUIVALENT	**TOTAUX**	**CORRECTION**
DUREE DE L'ESSAI (minutes)		240		150		180			
NOMBRE DE POINTS		48		30		36			
DIOXINES ET FURANNES (µg/h)									
2,3,7,8 - Tetra CDD	**1**	< 0.0019	< LD	0.0085	0.0085	< 0.0099	< LD	0.0068	0.0068
1,2,3,7,8 - Penta CDD	**1**	< 0.0056	< LD	0.080	0.080	0.033	0.033	0.039	0.039
1,2,3,4,7,8 - Hexa CDD	**0.1**	< 0.0056	< LD	0.090	0.0090	0.040	0.0040	0.0045	0.045
1,2,3,6,7,8 - Hexa CDD	**0.1**	0.0056	0.00056	0.12	0.012	0.089	0.0089	0.0072	0.072
1,2,3,7,8,9 - Hexa CDD	**0.1**	< 0.0056	< LD	0.14	0.014	0.092	0.0092	0.0079	0.079
1,2,3,4,6,7,8 - Hepta CDD	**0.01**	0.032	0.00032	0.54	0.0054	0.43	0.0043	0.0034	0.34
1,2,3,4,6,7,8,9 - Octa CDD	**0.0001**	0.062	0.0000062	0.27	0.000027	0.42	0.000042	0.000025	0.25
2, 3, 7, 8 - Tetra CDF	**0.1**	0.028	0.0028	0.082	0.0082	0.31	0.031	0.014	0.14
1,2,3,7,8 - Penta CDF	**0.05**	< 0.015	< LD	0.036	0.0018	0.088	0.0044	0.0023	0.046
2,3,4,7,8 - Penta CDF	**0.5**	0.017	0.0084	0.073	0.037	0.23	0.12	0.054	0.11
1,2,3,4,7,8 - Hexa CDF	**0.1**	0.024	0.0024	0.11	0.011	0.46	0.046	0.020	0.20
1,2,3,6,7,8 - Hexa CDF	**0.1**	0.017	0.0017	0.043	0.0043	0.17	0.017	0.0076	0.076
2,3,4,6,7,8 - Hexa CDF	**0.1**	0.015	0.0015	0.085	0.0085	0.39	0.039	0.016	0.16
1,2,3,7,8,9 - Hexa CDF	**0.1**	< 0.011	< LD	< 0.034	< LD	0.042	0.0042	0.0029	0.029
1,2,3,4,6,7,8 - Hepta CDF	**0.01**	0.030	0.00030	0.11	0.0011	0.67	0.0067	0.0027	0.27
1,2,3,4,7,8,9 - Hepta CDF	**0.01**	< 0.011	< LD	0.014	0.00014	0.14	0.0014	0.00055	0.055
1,2,3,4,6,7,8,9 - Octa CDF	**0.0001**	0.037	0.0000037	0.029	0.0000029	0.32	0.000032	0.000013	0.13
Total Tetra CDD	**MDDELCC**	0.017		0.27		0.30			0.20
Total Penta CDD		0.021		0.76		0.58			0.45
Total Hexa CDD		0.047		1.5		1.0			0.87
Total Hepta CDD		0.037		0.57		0.45			0.35
Sommation des PCDDs		0.19		3.4		2.8			2.1
Total Tetra CDF		0.19		0.48		1.6			0.76
Total Penta CDF		0.13		0.69		2.2			1.0
Total Hexa CDF		0.060		0.29		1.4			0.57
Total Hepta CDF		0.052		0.21		1.2			0.50
Sommation des PCDFs		0.47		1.7		6.7			3.0
ÉQUIVALENCE TOXIQUE TOTALE			**0.018**		**0.20**		**0.33**	**0.18**	
CONGÉNÈRES TOXIQUES TOTAUX		**0.32**		**1.86**		**3.95**			**2.04**
GROUPES HOMOLOGUES TOTAUX		**1.21**		**9.92**		**18.2**			**9.79**

RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - COSV - ESSAI# MEL-COSV-1

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg)	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
13 h 44	1	1	5	0.18	0.45	1330	60	60	76	483.04	485.51	2.47	12.4	98	14.1	5.2	3	-1.0	250	250	40	40	-	-
		1	5	0.17	0.43	1345	60	60	77	485.51	488.00	2.49	12.1	102				-1.0	250	250	40	40	-	-
		1	5	0.17	0.43	1345	60	60	77	488.00	490.46	2.46	12.1	101				-1.0	250	250	40	40	-	-
		1	5	0.17	0.43	1345	60	60	77	490.46	492.97	2.51	12.1	103				-1.0	250	250	40	40	-	-
		2	5	0.17	0.43	1352	60	60	78	492.97	495.48	2.51	12.1	103				-1.0	250	250	40	40	-	-
		2	5	0.17	0.43	1356	60	60	79	495.48	497.85	2.37	12.1	97				-1.0	250	250	40	40	-	-
		2	5	0.18	0.45	1354	60	60	80	497.85	500.35	2.50	12.5	100				-1.0	250	250	40	40	-	-
		2	5	0.18	0.45	1353	60	60	80	500.35	502.87	2.52	12.4	100				-1.0	250	250	40	40	-	-
		3	5	0.18	0.45	1361	60	60	82	502.87	505.38	2.51	12.5	100				-1.0	250	250	40	40	-	-
		3	5	0.21	0.53	1366	60	60	82	505.38	508.08	2.70	13.5	100				-1.0	250	250	40	40	-	-
		3	5	0.21	0.52	1381	60	60	84	508.08	510.79	2.71	13.5	101				-1.0	250	250	40	40	-	-
		3	5	0.21	0.52	1377	60	60	83	510.79	513.50	2.71	13.5	101				-1.5	250	250	40	40	-	-
		4	5	0.21	0.52	1379	60	60	84	513.50	516.20	2.70	13.5	100				-1.5	250	250	40	40	-	-
		4	5	0.21	0.52	1380	60	60	85	516.20	518.88	2.68	13.5	100				-1.5	250	250	40	40	-	-
		4	5	0.21	0.53	1373	60	60	85	518.88	521.61	2.73	13.5	101				-1.5	250	250	40	40	-	-
		4	5	0.21	0.53	1373	60	60	85	521.61	524.28	2.67	13.5	99				-1.5	250	250	40	40	-	-
		5	5	0.18	0.46	1347	60	60	87	524.28	526.84	2.56	12.4	102				-1.5	250	250	40	40	-	-
		5	5	0.18	0.46	1348	60	60	87	526.84	529.27	2.43	12.4	97				-1.5	250	250	40	40	-	-
		5	5	0.18	0.46	1350	60	60	88	529.27	531.82	2.55	12.4	101				-1.5	250	250	40	40	-	-
		5	5	0.18	0.46	1354	60	60	88	531.82	534.26	2.44	12.5	97				-1.5	250	250	40	40	-	-
		6	5	0.18	0.46	1355	60	60	88	534.26	536.79	2.53	12.5	101				-1.5	250	250	40	40	-	-
		6	5	0.18	0.46	1359	60	60	90	536.79	539.34	2.55	12.5	102				-1.5	250	250	40	40	-	-
		6	5	0.18	0.46	1361	60	60	90	539.34	541.87	2.53	12.5	101				-1.5	250	250	40	40	-	-
		6	5	0.17	0.44	1350	60	60	90	541.87	544.36	2.49	12.1	102				-1.5	250	250	40	40	-	-
	2	6	5	0.15	0.38	1357	60	60	93	544.36	546.67	2.31	11.4	101				-1.5	250	250	40	40	-	-
		6	5	0.16	0.41	1350	60	60	93	546.67	549.00	2.33	11.7	98				-1.5	250	250	40	40	-	-
		6	5	0.16	0.41	1355	60	60	94	549.00	551.26	2.26	11.7	96				-1.5	250	250	40	40	-	-
		6	5	0.16	0.41	1352	60	60	96	551.26	553.57	2.31	11.7	98				-1.5	250	250	40	40	-	-
		5	5	0.16	0.42	1348	60	60	97	553.57	555.93	2.36	11.7	100				-1.5	250	250	40	40	-	-
		5	5	0.16	0.41	1350	60	60	97	555.93	558.42	2.49	11.7	105				-1.5	250	250	40	40	-	-
		5	5	0.16	0.42	1345	60	60	97	558.42	560.77	2.35	11.7	99				-1.5	250	250	40	40	-	-
		5	5	0.15	0.39	1340	60	60	98	560.77	563.08	2.31	11.3	100				-1.5	250	250	40	40	-	-
		4	5	0.15	0.39	1332	60	60	99	563.08	565.37	2.29	11.3	99				-1.5	250	250	40	40	-	-
		4	5	0.13	0.35	1280	60	60	100	565.37	567.67	2.30	10.4	106				-1.5	250	250	40	40	-	-
		4	5	0.13	0.35	1300	60	60	100	567.67	569.98	2.31	10.4	107				-1.5	250	250	40	40	-	-
		4	5	0.11	0.29	1306	60	60	101	569.98	572.08	2.10	9.6	106				-1.5	250	250	40	40	-	-
		3	5	0.11	0.29	1304	60	60	101	572.08	574.08	2.00	9.6	100				-0.5	250	250	40	40	-	-
		3	5	0.11	0.30	1280	60	60	102	574.08	576.10	2.02	9.5	101				0.5	250	250	40	40	-	-
		3	5	0.11	0.30	1250	60	60	102	576.10	578.09	1.99	9.5	98				1.5	250	250	40	40	-	-
		3	5	0.11	0.30	1266	60	60	103	578.09	580.17	2.08	9.5	103				2.5	250	250	40	40	-	-
		2	5	0.13	0.35	1318	60	60	103	580.17	582.40	2.23	10.5	103				3.5	250	250	40	40	-	-
		2	5	0.13	0.35	1320	60	60	103	582.40	584.62	2.22	10.5	103				4.5	250	250	40	40	-	-
		2	5	0.13	0.35	1324	60	60	103	584.62	586.87	2.25	10.5	105				5.5	250	250	40	40	-	-
		2	5	0.13	0.35	1310	60	60	102	586.87	589.10	2.23	10.5	103				6.5	250	250	40	40	-	-
		1	5	0.13	0.35	1317	60	60	102	589.10	591.32	2.22	10.5	103				7.5	250	250	40	40	-	-
		1	5	0.13	0.35	1317	60	60	102	591.32	593.56	2.24	10.5	104				8.5	250	250	40	40	-	-
		1	5	0.13	0.35	1318	60	60	102	593.56	595.76	2.20	10.5	102				9.5	250	250	40	40	-	-
		1	5	0.13	0.35	1326	60	60	103	595.76	598.00	2.24	10.5	104				10.5	250	250	40	40	-	-

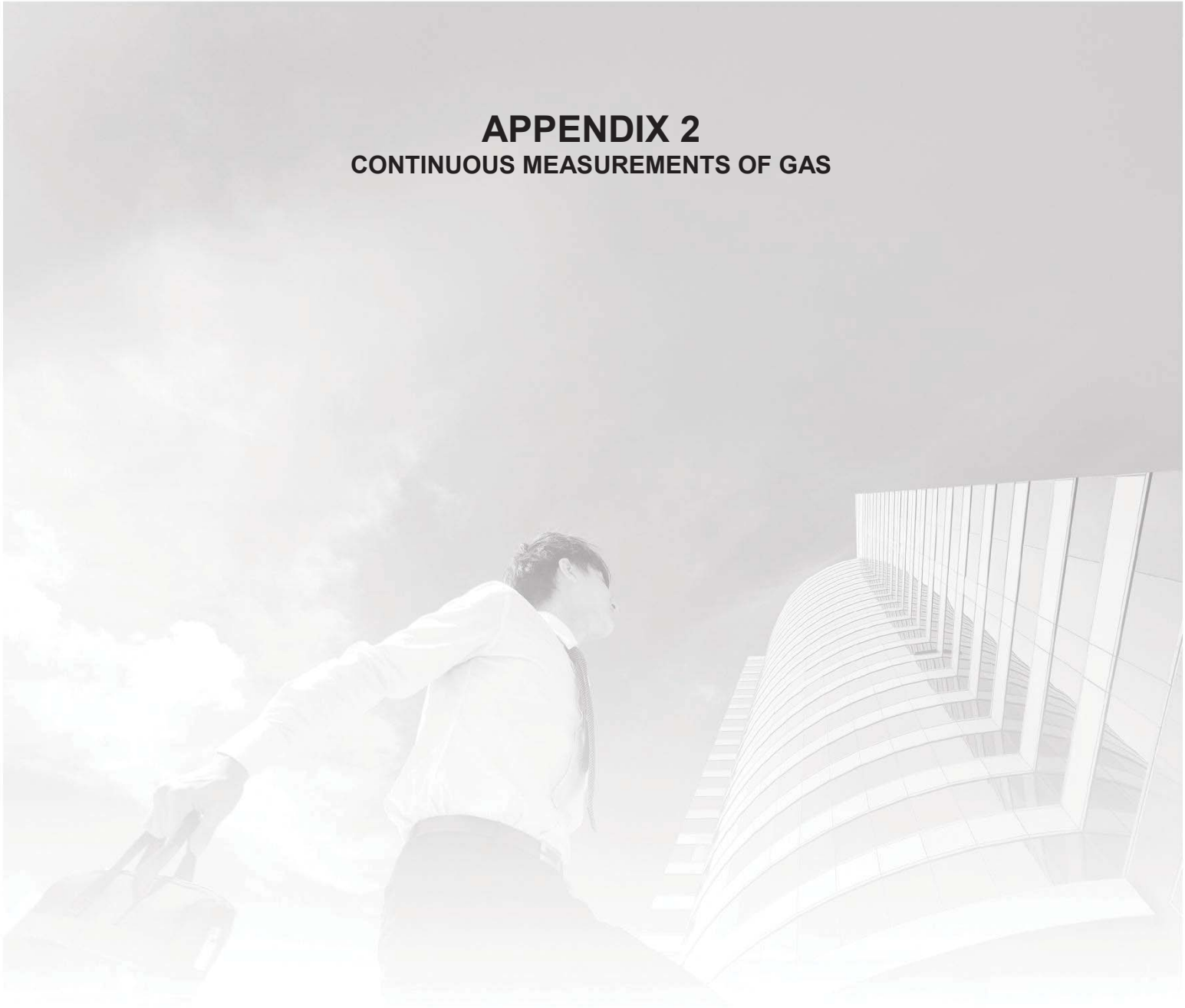
RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - COSV - ESSAI# MEL-COSV-2

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg)	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
11 h 32	1	6	5	0.16	1.28	1275	60	60	72	600.12	604.57	4.45	11.6	102	15.1	4.4	3	-5.0	246	253	68	44	-	-
		6	5	0.15	1.15	1353	60	60	73	604.57	608.84	4.27	11.5	104				-5.0	246	247	68	48	-	-
		6	5	0.15	1.15	1360	60	60	73	608.84	612.97	4.13	11.5	101				-5.0	247	253	68	49	-	-
		5	5	0.15	1.15	1362	60	60	74	612.97	617.11	4.14	11.5	101				-5.0	247	246	68	51	-	-
		5	5	0.15	1.15	1369	60	60	75	617.11	621.25	4.14	11.5	101				-5.5	249	251	68	52	-	-
		5	5	0.15	1.16	1362	60	60	77	621.25	625.40	4.15	11.5	101				-5.5	245	253	68	57	-	-
		4	5	0.16	1.23	1369	60	60	77	625.40	629.66	4.26	11.9	101				-5.5	248	250	68	52	-	-
		4	5	0.15	1.16	1371	60	60	79	629.66	633.81	4.15	11.5	101				-5.5	249	256	68	46	-	-
		4	5	0.15	1.16	1372	60	60	80	633.81	637.92	4.11	11.5	100				-5.5	249	255	68	47	-	-
		3	5	0.15	1.16	1369	60	60	81	637.92	642.08	4.16	11.5	102				-5.5	247	254	68	47	-	-
		3	5	0.15	1.17	1370	60	60	83	642.08	646.17	4.09	11.5	100				-5.5	247	247	68	48	-	-
		3	5	0.15	1.17	1373	60	60	84	646.17	650.31	4.14	11.5	101				-5.5	245	251	68	49	-	-
		2	5	0.13	1.05	1315	60	60	86	650.31	654.36	4.05	10.6	105				-5.5	249	249	68	50	-	-
		2	5	0.13	1.04	1320	60	60	86	654.36	658.15	3.79	10.6	98				-5.5	246	250	68	52	-	-
		2	5	0.12	0.97	1316	60	60	88	658.15	661.97	3.82	10.1	103				-5.5	248	251	68	55	-	-
		1	5	0.12	0.97	1314	60	60	89	661.97	665.75	3.78	10.1	102				-5.5	247	246	68	58	-	-
		1	5	0.12	0.97	1318	60	60	90	665.75	669.50	3.75	10.2	101				-5.5	250	251	68	54	-	-
		1	5	0.12	0.97	1318	60	60	91	669.50	673.25	3.75	10.2	101				-5.0	235	253	68	46	-	-
	2	1	5	0.12	0.98	1318	60	60	92	673.25	677.00	3.75	10.2	101				-5.0	250	249	68	43	-	-
		1	5	0.12	0.98	1311	60	60	94	677.00	680.74	3.74	10.1	100				-5.0	249	256	68	43	-	-
		1	5	0.12	0.99	1300	60	60	94	680.74	684.49	3.75	10.1	100				-4.5	249	251	68	44	-	-
		2	5	0.12	0.98	1317	60	60	95	684.49	688.23	3.74	10.1	101				-5.5	250	250	68	46	-	-
		2	5	0.12	0.98	1322	60	60	96	688.23	691.97	3.74	10.2	101				-5.5	246	253	68	48	-	-
		2	5	0.12	0.98	1318	60	60	96	691.97	695.73	3.76	10.2	101				-5.5	247	258	68	50	-	-
		3	5	0.12	0.98	1325	60	60	97	695.73	699.41	3.68	10.2	99				-5.5	250	244	68	52	-	-
		3	5	0.11	0.90	1320	60	60	98	699.41	703.00	3.59	9.7	101				-5.5	249	260	68	56	-	-
		3	5	0.11	0.90	1318	60	60	98	703.00	706.58	3.58	9.7	101				-5.5	249	247	68	58	-	-
		4	5	0.10	0.83	1310	60	60	100	706.58	709.94	3.36	9.2	99				-5.5	248	247	68	52	-	-
		4	5	0.10	0.83	1310	60	60	100	709.94	713.35	3.41	9.2	100				-5.5	249	250	68	45	-	-
		4	5	0.10	0.83	1314	60	60	101	713.35	716.79	3.44	9.3	101				-5.5	248	249	68	44	-	-

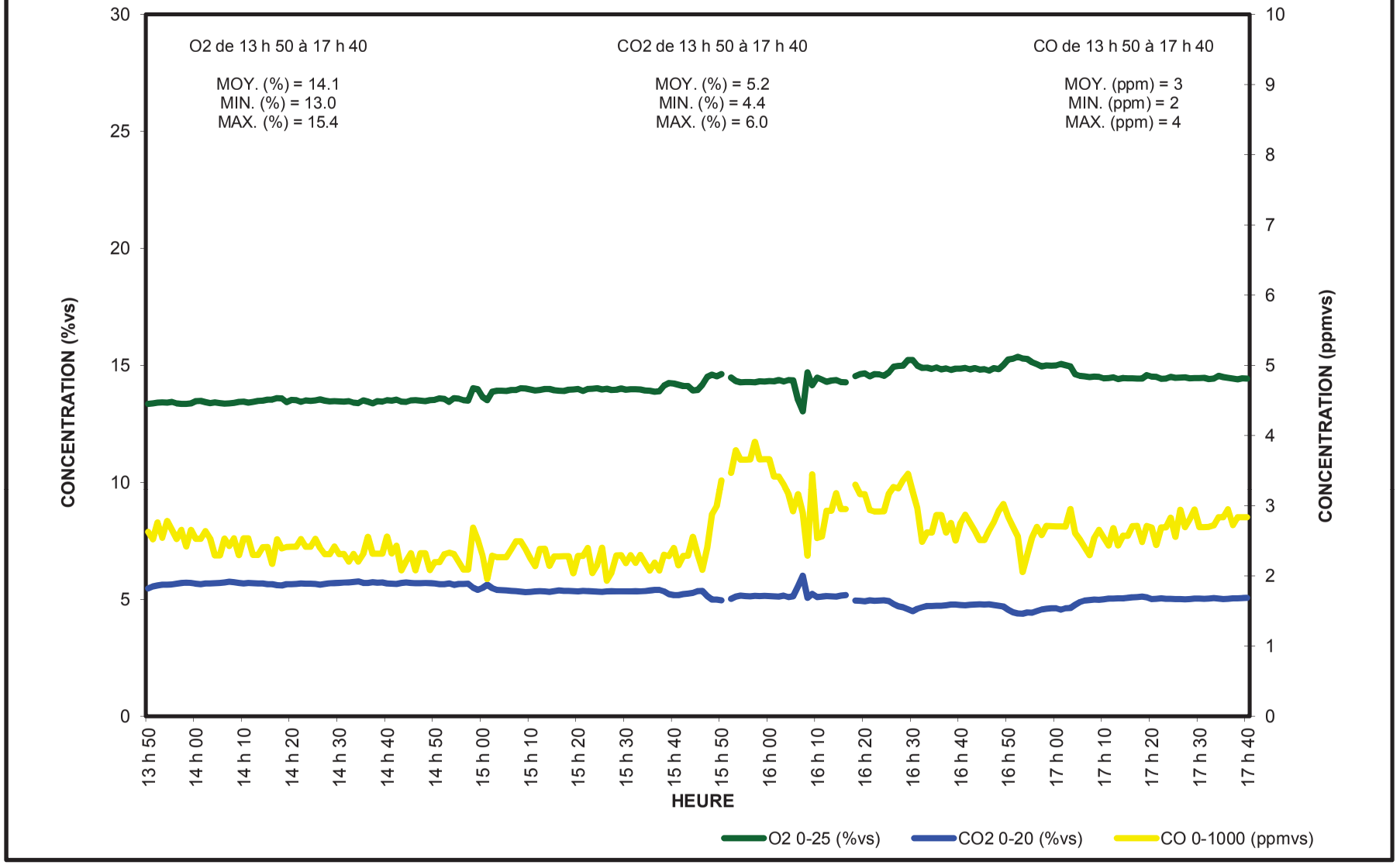
RELEVÉ D'ÉCHANTILLONNAGE: Incinérateur - COSV - ESSAI# MEL-COSV-3

Heure	Trav. #	Point #	Durée de pompage (min)	Différence de pression ("H_2O) ΔP	ΔH	Températures (°F) Cheminé	Compteu Entrée	Compteu Sortie	Orifice	Volume de gaz (pi³) Début	Fin	Total	Vitesse (m/s)	Iso. (%)	O_2 (%v)	CO_2 (%v)	CO (ppmv)	Vacuum (po Hg)	Températures (°F) Sonde	Filtre	Sortie	Trappe F Cond	Aux3	Module
16 h 13	1	6	5	0.24	1.85	1356	60	60	75	729.20	734.29	5.09	14.5	100	13.6	5.6	3	-4.5	250	251	68	52	-	-
		6	5	0.24	1.83	1377	60	60	76	734.29	739.45	5.16	14.6	102				-4.5	244	252	68	42	-	-
		6	5	0.24	1.82	1386	60	60	76	739.45	744.61	5.16	14.6	102				-4.5	247	252	68	40	-	-
		5	5	0.24	1.83	1385	60	60	78	744.61	749.76	5.15	14.6	102				-4.5	253	250	68	40	-	-
		5	5	0.24	1.82	1405	60	60	79	749.76	754.91	5.15	14.7	102				-4.5	247	253	68	40	-	-
		5	5	0.24	1.81	1410	60	60	80	754.91	760.08	5.17	14.7	103				-4.5	245	247	68	41	-	-
		4	5	0.21	1.63	1366	60	60	81	760.08	764.98	4.90	13.6	103				-4.5	240	247	67	41	-	-
		4	5	0.23	1.77	1380	60	60	82	764.98	770.00	5.02	14.3	101				-4.5	252	252	66	42	-	-
		4	5	0.23	1.77	1387	60	60	82	770.00	775.00	5.00	14.3	101				-4.0	252	243	66	42	-	-
		3	5	0.23	1.76	1396	60	60	83	775.00	780.01	5.01	14.3	101				-4.0	251	262	66	42	-	-
		3	5	0.23	1.76	1403	60	60	84	780.01	785.00	4.99	14.4	101				-4.0	249	250	66	43	-	-
		3	5	0.23	1.75	1409	60	60	84	785.00	789.95	4.95	14.4	100				-4.5	254	244	66	44	-	-
		2	5	0.18	1.39	1382	60	60	84	789.95	794.45	4.50	12.6	102				-4.5	244	251	66	44	-	-
		2	5	0.19	1.48	1381	60	60	86	794.45	799.04	4.59	13.0	102				-4.5	249	250	67	45	-	-
		2	5	0.18	1.40	1387	60	60	87	799.04	803.50	4.46	12.7	102				-4.5	250	251	67	48	-	-
		1	5	0.18	1.40	1380	60	60	87	803.50	807.95	4.45	12.6	101				-4.0	253	250	68	50	-	-
		1	5	0.18	1.39	1400	60	60	88	807.95	812.39	4.44	12.7	101				-4.0	238	250	66	41	-	-
		1	5	0.18	1.38	1410	60	60	89	812.39	816.86	4.47	12.7	102				-4.5	252	253	66	40	-	-
	2	1	5	0.18	1.38	1413	60	60	90	816.86	821.26	4.40	12.8	101				-4.5	250	252	68	40	-	-
		1	5	0.18	1.38	1417	60	60	90	821.26	825.67	4.41	12.8	101				-4.5	250	252	68	47	-	-
		1	5	0.17	1.30	1423	60	60	91	825.67	829.97	4.30	12.4	102				-4.5	245	248	68	49	-	-
		2	5	0.17	1.30	1440	60	60	94	829.97	834.30	4.33	12.5	103				-4.0	247	251	68	49	-	-
		2	5	0.17	1.29	1438	60	60	92	834.30	838.54	4.24	12.5	101				-4.0	252	247	68	49	-	-
		2	5	0.17	1.30	1443	60	60	94	838.54	842.77	4.23	12.5	101				-4.0	249	251	68	51	-	-
		3	5	0.17	1.29	1450	60	60	95	842.77	847.00	4.23	12.5	101				-4.0	250	250	68	51	-	-
		3	5	0.24	1.75	1529	60	60	95	847.00	851.90	4.90	15.2	100				-4.0	243	251	68	54	-	-
		3	5	0.24	1.75	1535	60	60	97	851.90	856.84	4.94	15.2	101				-4.0	245	251	68	54	-	-
		4	5	0.24	1.76	1533	60	60	97	856.84	861.77	4.93	15.2	101				-4.0	253	255	68	56	-	-
		4	5	0.24	1.76	1533	60	60	98	861.77	866.72	4.95	15.2	102				-4.0	241	250	68	56	-	-
		4	5	0.24	1.75	1542	60	60	98	866.72	871.64	4.92	15.2	101				-4.0	252	249	68	56	-	-
		5	5	0.24	1.76	1541	60	60	99	871.64	876.54	4.90	15.2	101				-5.0	248	249	68	56	-	-
		5	5	0.23	1.68	1548	60	60	101	876.54	881.29	4.75	14.9	100				-5.0	251	248	68	51	-	-
		5	5	0.22	1.65	1500	60	60	101	881.29	886.00	4.71	14.4	100				-4.0	252	252	68	50	-	-
		6	5	0.22	1.68	1463	60	60	102	886.00	890.71	4.71	14.3	99				-4.0	254	251	68	51	-	-
		6	5	0.22	1.69	1457	60	60	103	890.71	895.49	4.78	14.3	100				-5.0	254	251	68	54	-	-
		6	5	0.22	1.69	1460	60	60	103	895.49	900.26	4.77	14.3	100				-5.0	248	255	68	55	-	-

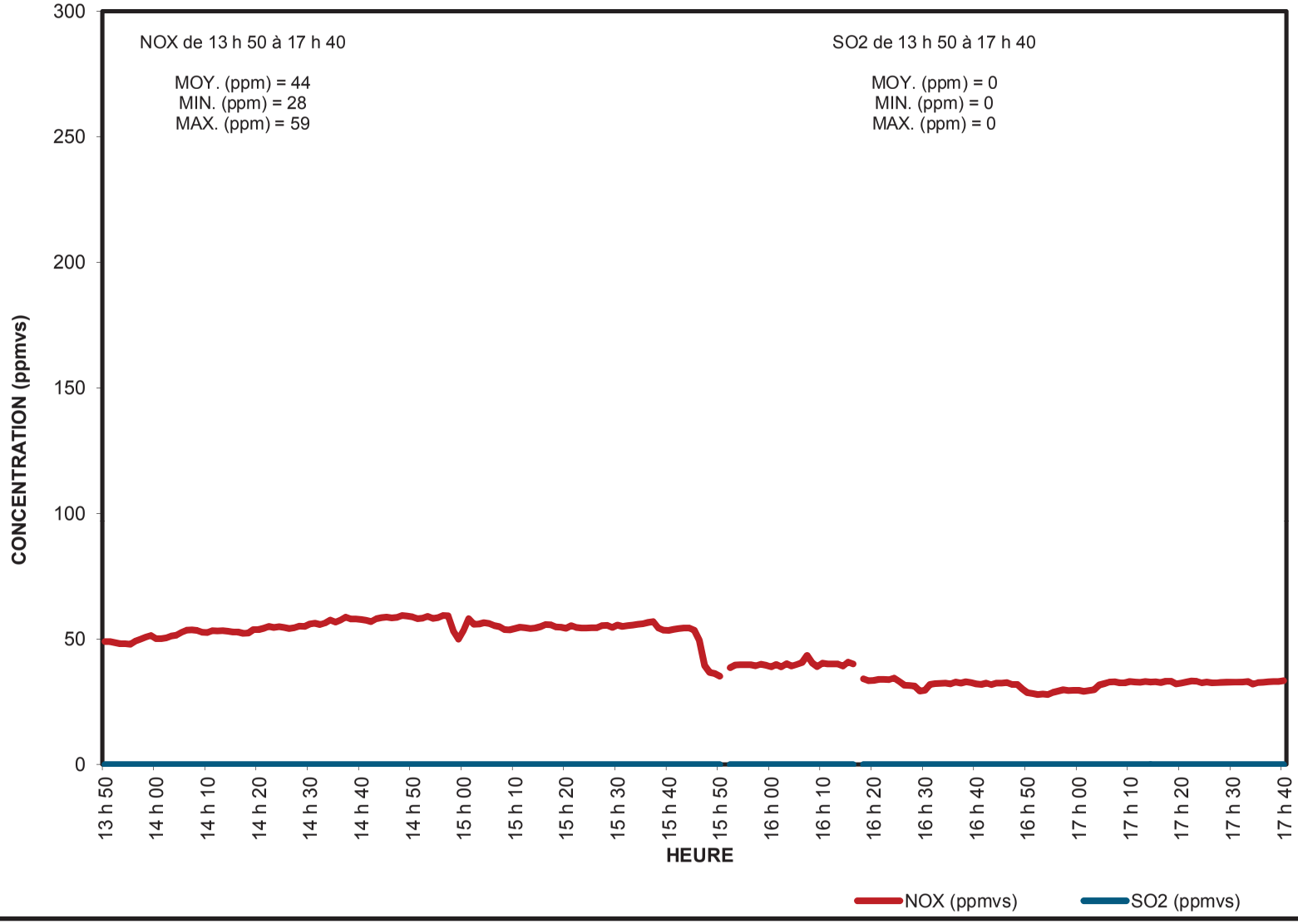
APPENDIX 2
CONTINUOUS MEASUREMENTS OF GAS



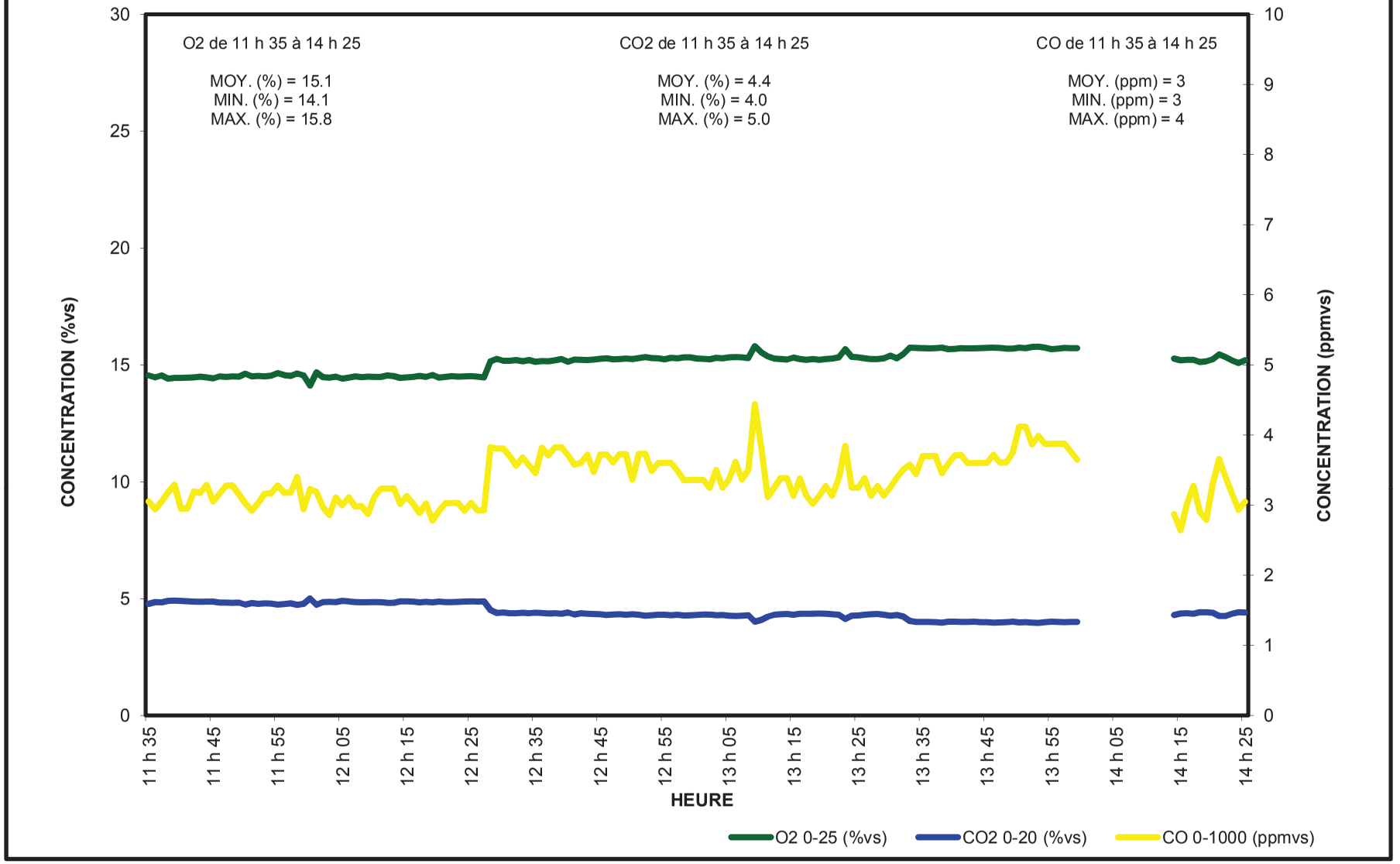
INCINÉRATEUR - MESURES D'OXYGÈNE, DE DIOXYDE DE CARBONE ET DE MONOXYDE DE CARBONE - 22 SEPTEMBRE 2018 - ESSAI MEL GAZ E1

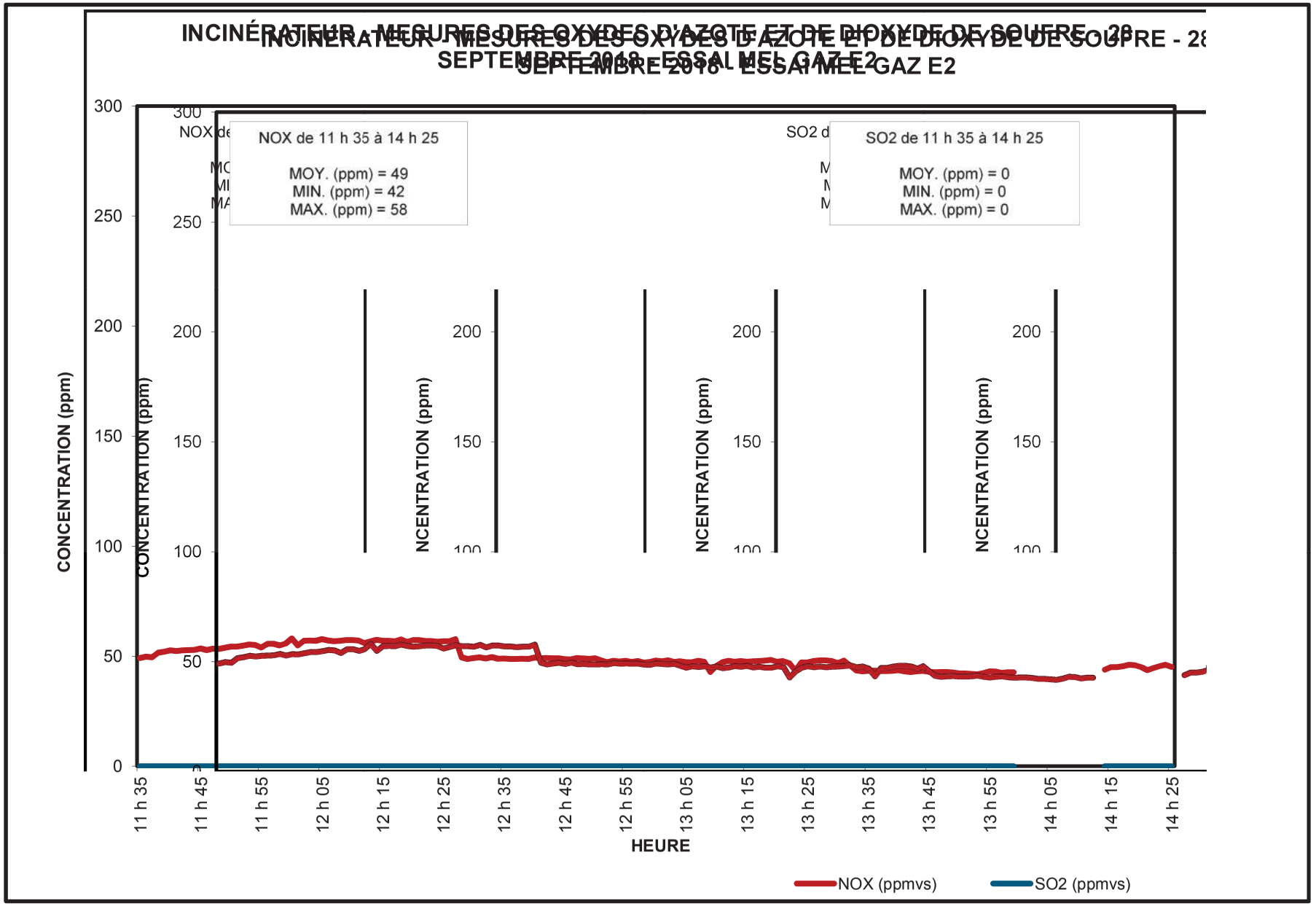


INCINÉRATEUR - MESURES DES OXYDES D'AZOTE ET DE DIOXYDE DE SOUFRE - 22 SEPTEMBRE 2018 - ESSAI MEL GAZ E1

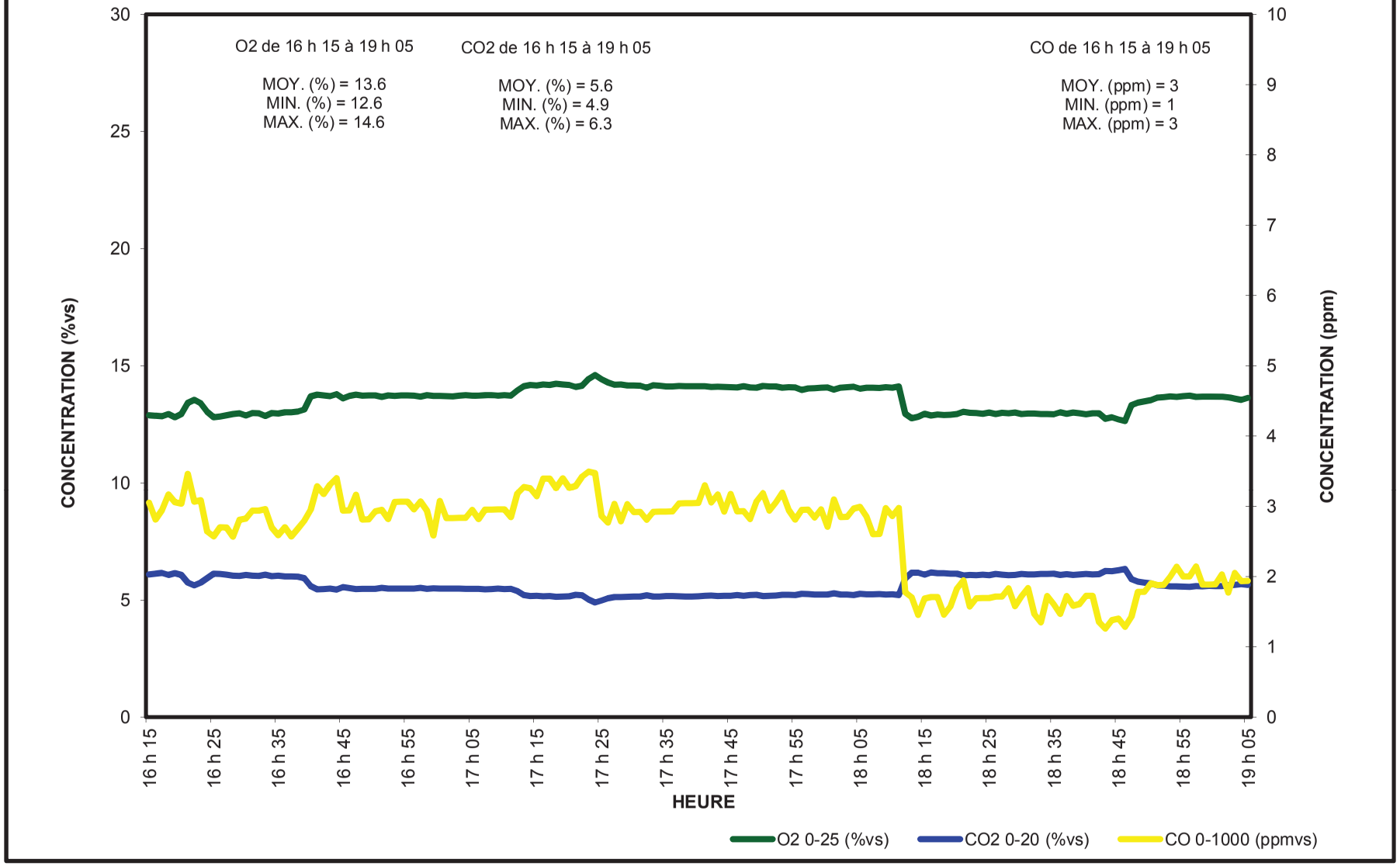


INCINÉRATEUR - MESURES D'OXYGÈNE, DE DIOXYDE DE CARBONE ET DE MONOXYDE DE CARBONE - 28 SEPTEMBRE 2018 - ESSAI MEL GAZ E2

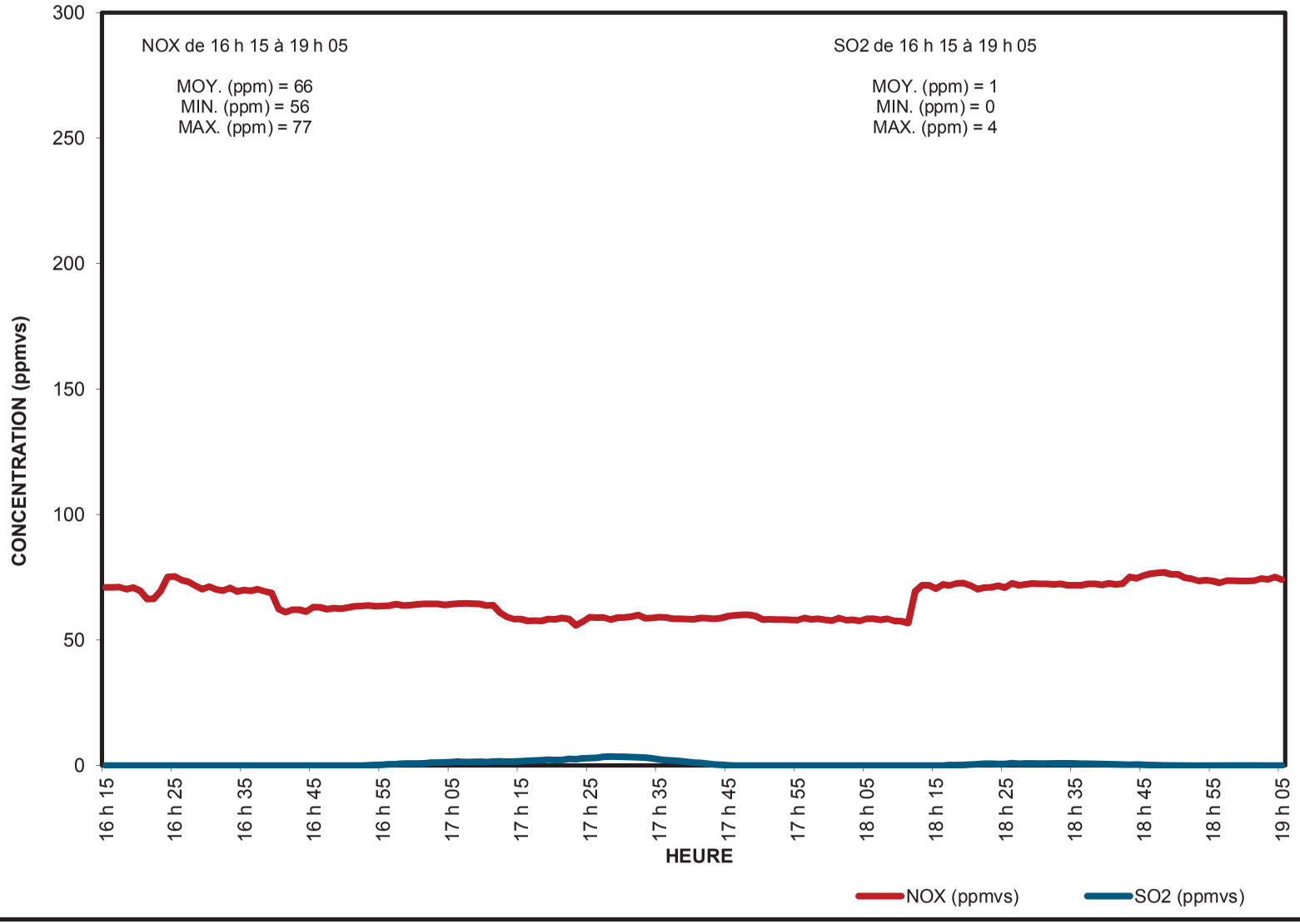



INCINÉRATEUR - MESURES DES OXYDES D'AZOTE ET DE DIOXYDE DE SOUFRE - 28 SEPTEMBRE 2018 - ESSAI MEL GAZ E2
NOX de 11 h 35 à 14 h 25
MOY. (ppm) = 49
MIN. (ppm) = 42
MAX. (ppm) = 58
SO2 de 11 h 35 à 14 h 25
MOY. (ppm) = 0
MIN. (ppm) = 0
MAX. (ppm) = 0
CONCENTRATION (ppm)
HEURE
NOX (ppmvs)
SO2 (ppmvs)

INCINÉRATEUR - MESURES D'OXYGÈNE, DE DIOXYDE DE CARBONE ET DE MONOXYDE DE CARBONE - 29 SEPTEMBRE 2018 - ESSAI MEL GAZ E3



INCINÉRATEUR - MESURES DES OXYDES D'AZOTE ET DE DIOXYDE DE SOUFRE - 29 SEPTEMBRE 2018 - ESSAI MEL GAZ E3



	AQ	AR	AS	AT
1		Graphique		
2	**22 sept. 2018**	**2018-09-22**	**2018-09-28**	**2018-09-29**
3	**ESSAIS**	**MEL GAZ E1**	**MEL GAZ E2**	**MEL GAZ E3**
4	**Début**	13 h 50	11 h 35	16 h 15
5	**Fin**	17 h 40	14 h 25	19 h 05
6	**O2 0-25 (%vs) corrigé**	**#1**	**#2**	**#3**
7	**MOY.**	14.1	15.1	13.6
8	**MIN**	13.0	14.1	12.6
9	**MAX**	15.4	15.8	14.6
10	**CO2 0-20 (%vs) corrigé**	**#1**	**#2**	**#3**
11	**MOY.**	5.2	4.4	5.6
12	**MIN**	4.4	4.0	4.9
13	**MAX**	6.0	5.0	6.3
14	**CO 0-1000 (ppmvs) corrigé**	**#1**	**#2**	**#3**
15	**MOY.**	2.6	3.4	2.6
16	**MIN**	1.9	2.6	1.3
17	**MAX**	3.9	4.4	3.5
18	**SO2 (ppmvs) corrigé**	**#1**	**#2**	**#3**
19	**MOY.**	0.0	0.0	0.6
20	**MIN**	0.0	0.0	0.0
21	**MAX**	0.0	0.0	3.6
22	**NOX (ppmvs) corrigé**	**#1**	**#2**	**#3**
23	**MOY.**	44.5	49.3	65.8
24	**MIN**	27.9	41.8	55.8
25	**MAX**	59.4	58.1	76.9

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
7	22-09-2018 13:50:15	13 h 50	13.4	5.5	2.6	0.0	49.0
8	22-09-2018 13:51:15	13 h 51	13.4	5.6	2.5	0.0	49.0
9	22-09-2018 13:52:15	13 h 52	13.4	5.6	2.8	0.0	48.6
10	22-09-2018 13:53:15	13 h 53	13.4	5.6	2.5	0.0	48.1
11	22-09-2018 13:54:15	13 h 54	13.4	5.6	2.8	0.0	48.2
12	22-09-2018 13:55:15	13 h 55	13.4	5.6	2.7	0.0	47.9
13	22-09-2018 13:56:15	13 h 56	13.4	5.7	2.5	0.0	49.2
14	22-09-2018 13:57:15	13 h 57	13.4	5.7	2.7	0.0	49.9
15	22-09-2018 13:58:15	13 h 58	13.4	5.7	2.4	0.0	50.8
16	22-09-2018 13:59:15	13 h 59	13.4	5.7	2.7	0.0	51.4
17	22-09-2018 14:00:15	14 h 00	13.5	5.7	2.5	0.0	50.1
18	22-09-2018 14:01:15	14 h 01	13.5	5.6	2.5	0.0	50.1
19	22-09-2018 14:02:15	14 h 02	13.4	5.7	2.6	0.0	50.4
20	22-09-2018 14:03:15	14 h 03	13.4	5.7	2.5	0.0	51.1
21	22-09-2018 14:04:15	14 h 04	13.4	5.7	2.3	0.0	51.5
22	22-09-2018 14:05:15	14 h 05	13.4	5.7	2.3	0.0	52.6
23	22-09-2018 14:06:15	14 h 06	13.4	5.7	2.5	0.0	53.5
24	22-09-2018 14:07:15	14 h 07	13.4	5.8	2.4	0.0	53.7
25	22-09-2018 14:08:15	14 h 08	13.4	5.7	2.5	0.0	53.4
26	22-09-2018 14:09:15	14 h 09	13.4	5.7	2.3	0.0	52.7
27	22-09-2018 14:10:15	14 h 10	13.4	5.7	2.5	0.0	52.6
28	22-09-2018 14:11:15	14 h 11	13.4	5.7	2.5	0.0	53.3
29	22-09-2018 14:12:15	14 h 12	13.4	5.7	2.3	0.0	53.2
30	22-09-2018 14:13:15	14 h 13	13.5	5.7	2.3	0.0	53.3
31	22-09-2018 14:14:15	14 h 14	13.5	5.7	2.4	0.0	53.0
32	22-09-2018 14:15:15	14 h 15	13.5	5.7	2.4	0.0	52.8
33	22-09-2018 14:16:15	14 h 16	13.5	5.6	2.2	0.0	52.8
34	22-09-2018 14:17:15	14 h 17	13.6	5.6	2.5	0.0	52.2
35	22-09-2018 14:18:15	14 h 18	13.6	5.6	2.4	0.0	52.4
36	22-09-2018 14:19:15	14 h 19	13.4	5.6	2.4	0.0	53.7
37	22-09-2018 14:20:15	14 h 20	13.5	5.7	2.4	0.0	53.7
38	22-09-2018 14:21:15	14 h 21	13.5	5.7	2.4	0.0	54.3
39	22-09-2018 14:22:15	14 h 22	13.4	5.7	2.5	0.0	55.0
40	22-09-2018 14:23:15	14 h 23	13.5	5.7	2.4	0.0	54.6
41	22-09-2018 14:24:15	14 h 24	13.5	5.7	2.4	0.0	54.9
42	22-09-2018 14:25:15	14 h 25	13.5	5.7	2.5	0.0	54.6
43	22-09-2018 14:26:15	14 h 26	13.5	5.6	2.4	0.0	54.2
44	22-09-2018 14:27:15	14 h 27	13.5	5.7	2.3	0.0	54.5
45	22-09-2018 14:28:15	14 h 28	13.5	5.7	2.3	0.0	55.1
46	22-09-2018 14:29:15	14 h 29	13.5	5.7	2.4	0.0	55.0
47	22-09-2018 14:30:15	14 h 30	13.5	5.7	2.3	0.0	56.0
48	22-09-2018 14:31:15	14 h 31	13.4	5.7	2.3	0.0	56.3
49	22-09-2018 14:32:15	14 h 32	13.5	5.7	2.2	0.0	55.7
50	22-09-2018 14:33:15	14 h 33	13.4	5.7	2.3	0.0	56.3
51	22-09-2018 14:34:15	14 h 34	13.4	5.8	2.2	0.0	57.5
52	22-09-2018 14:35:15	14 h 35	13.5	5.7	2.3	0.0	56.6
53	22-09-2018 14:36:15	14 h 36	13.4	5.7	2.6	0.0	57.5
54	22-09-2018 14:37:15	14 h 37	13.4	5.7	2.3	0.0	58.7
55	22-09-2018 14:38:15	14 h 38	13.5	5.7	2.3	0.0	58.0
56	22-09-2018 14:39:15	14 h 39	13.4	5.7	2.3	0.0	58.0
57	22-09-2018 14:40:15	14 h 40	13.5	5.7	2.6	0.0	57.7
58	22-09-2018 14:41:15	14 h 41	13.5	5.7	2.3	0.0	57.5
59	22-09-2018 14:42:15	14 h 42	13.5	5.7	2.4	0.0	56.9
60	22-09-2018 14:43:15	14 h 43	13.5	5.7	2.1	0.0	58.1
61	22-09-2018 14:44:15	14 h 44	13.4	5.7	2.2	0.0	58.5
62	22-09-2018 14:45:15	14 h 45	13.5	5.7	2.3	0.0	58.7
63	22-09-2018 14:46:15	14 h 46	13.5	5.7	2.1	0.0	58.4
64	22-09-2018 14:47:15	14 h 47	13.5	5.7	2.3	0.0	58.6
65	22-09-2018 14:48:15	14 h 48	13.5	5.7	2.3	0.0	59.4
66	22-09-2018 14:49:15	14 h 49	13.5	5.7	2.1	0.0	59.1
67	22-09-2018 14:50:15	14 h 50	13.5	5.7	2.2	0.0	58.8
68	22-09-2018 14:51:15	14 h 51	13.6	5.7	2.2	0.0	58.1
69	22-09-2018 14:52:15	14 h 52	13.6	5.6	2.3	0.0	58.3
70	22-09-2018 14:53:15	14 h 53	13.4	5.7	2.3	0.0	59.0
71	22-09-2018 14:54:15	14 h 54	13.6	5.6	2.3	0.0	58.2
72	22-09-2018 14:55:15	14 h 55	13.6	5.7	2.2	0.0	58.5
73	22-09-2018 14:56:15	14 h 56	13.5	5.7	2.1	0.0	59.4

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
74	22-09-2018 14:57:15	14 h 57	13.5	5.7	2.1	0.0	59.2
75	22-09-2018 14:58:15	14 h 58	14.0	5.5	2.7	0.0	53.1
76	22-09-2018 14:59:15	14 h 59	14.0	5.4	2.5	0.0	49.9
77	22-09-2018 15:00:15	15 h 00	13.6	5.5	2.3	0.0	53.4
78	22-09-2018 15:01:15	15 h 01	13.5	5.6	2.0	0.0	58.0
79	22-09-2018 15:02:15	15 h 02	13.9	5.5	2.3	0.0	55.8
80	22-09-2018 15:03:15	15 h 03	13.9	5.4	2.3	0.0	56.0
81	22-09-2018 15:04:15	15 h 04	13.9	5.4	2.3	0.0	56.4
82	22-09-2018 15:05:15	15 h 05	13.9	5.4	2.3	0.0	56.2
83	22-09-2018 15:06:15	15 h 06	13.9	5.4	2.4	0.0	55.3
84	22-09-2018 15:07:15	15 h 07	14.0	5.4	2.5	0.0	54.9
85	22-09-2018 15:08:15	15 h 08	14.0	5.3	2.5	0.0	53.8
86	22-09-2018 15:09:15	15 h 09	14.0	5.3	2.4	0.0	53.6
87	22-09-2018 15:10:15	15 h 10	14.0	5.3	2.3	0.0	54.1
88	22-09-2018 15:11:15	15 h 11	13.9	5.3	2.1	0.0	54.7
89	22-09-2018 15:12:15	15 h 12	14.0	5.4	2.4	0.0	54.5
90	22-09-2018 15:13:15	15 h 13	14.0	5.3	2.4	0.0	54.2
91	22-09-2018 15:14:15	15 h 14	14.0	5.3	2.1	0.0	54.4
92	22-09-2018 15:15:15	15 h 15	13.9	5.3	2.3	0.0	54.9
93	22-09-2018 15:16:15	15 h 16	13.9	5.4	2.3	0.0	55.8
94	22-09-2018 15:17:15	15 h 17	13.9	5.4	2.3	0.0	55.6
95	22-09-2018 15:18:15	15 h 18	14.0	5.4	2.3	0.0	54.8
96	22-09-2018 15:19:15	15 h 19	14.0	5.4	2.0	0.0	54.7
97	22-09-2018 15:20:15	15 h 20	14.0	5.3	2.3	0.0	54.2
98	22-09-2018 15:21:15	15 h 21	13.9	5.4	2.3	0.0	55.3
99	22-09-2018 15:22:15	15 h 22	14.0	5.4	2.4	0.0	54.6
100	22-09-2018 15:23:15	15 h 23	14.0	5.3	2.0	0.0	54.3
101	22-09-2018 15:24:15	15 h 24	14.0	5.3	2.2	0.0	54.3
102	22-09-2018 15:25:15	15 h 25	14.0	5.3	2.4	0.0	54.5
103	22-09-2018 15:26:15	15 h 26	14.0	5.3	1.9	0.0	54.5
104	22-09-2018 15:27:15	15 h 27	13.9	5.3	2.0	0.0	55.3
105	22-09-2018 15:28:15	15 h 28	14.0	5.3	2.3	0.0	55.4
106	22-09-2018 15:29:15	15 h 29	14.0	5.3	2.3	0.0	54.6
107	22-09-2018 15:30:15	15 h 30	14.0	5.3	2.2	0.0	55.5
108	22-09-2018 15:31:15	15 h 31	14.0	5.3	2.3	0.0	55.0
109	22-09-2018 15:32:15	15 h 32	14.0	5.3	2.2	0.0	55.3
110	22-09-2018 15:33:15	15 h 33	14.0	5.3	2.3	0.0	55.5
111	22-09-2018 15:34:15	15 h 34	13.9	5.3	2.2	0.0	55.8
112	22-09-2018 15:35:15	15 h 35	13.9	5.4	2.1	0.0	56.1
113	22-09-2018 15:36:15	15 h 36	13.9	5.4	2.2	0.0	56.6
114	22-09-2018 15:37:15	15 h 37	13.9	5.4	2.1	0.0	56.9
115	22-09-2018 15:38:15	15 h 38	14.1	5.3	2.3	0.0	54.4
116	22-09-2018 15:39:15	15 h 39	14.2	5.2	2.3	0.0	53.5
117	22-09-2018 15:40:15	15 h 40	14.2	5.2	2.4	0.0	53.4
118	22-09-2018 15:41:15	15 h 41	14.2	5.2	2.2	0.0	53.9
119	22-09-2018 15:42:15	15 h 42	14.1	5.2	2.3	0.0	54.2
120	22-09-2018 15:43:15	15 h 43	14.1	5.2	2.3	0.0	54.4
121	22-09-2018 15:44:15	15 h 44	13.9	5.3	2.6	0.0	54.4
122	22-09-2018 15:45:15	15 h 45	13.9	5.4	2.3	0.0	53.5
123	22-09-2018 15:46:15	15 h 46	14.2	5.4	2.1	0.0	49.5
124	22-09-2018 15:47:15	15 h 47	14.5	5.1	2.4	0.0	39.5
125	22-09-2018 15:48:15	15 h 48	14.6	5.0	2.9	0.0	36.6
126	22-09-2018 15:49:15	15 h 49	14.5	5.0	3.0	0.0	36.2
127	22-09-2018 15:50:15	15 h 50	14.6	5.0	3.4	0.0	35.2
128	22-09-2018 15:51:15	15 h 51					
129	22-09-2018 15:52:15	15 h 52	14.5	5.0	3.5	0.0	38.6
130	22-09-2018 15:53:15	15 h 53	14.3	5.1	3.8	0.0	39.7
131	22-09-2018 15:54:15	15 h 54	14.3	5.2	3.7	0.0	39.8
132	22-09-2018 15:55:15	15 h 55	14.3	5.1	3.7	0.0	39.8
133	22-09-2018 15:56:15	15 h 56	14.3	5.1	3.7	0.0	39.8
134	22-09-2018 15:57:15	15 h 57	14.3	5.2	3.9	0.0	39.3
135	22-09-2018 15:58:15	15 h 58	14.3	5.1	3.7	0.0	39.9
136	22-09-2018 15:59:15	15 h 59	14.3	5.2	3.7	0.0	39.5
137	22-09-2018 16:00:15	16 h 00	14.3	5.1	3.7	0.0	38.9
138	22-09-2018 16:01:15	16 h 01	14.3	5.1	3.4	0.0	39.8
139	22-09-2018 16:02:15	16 h 02	14.4	5.1	3.4	0.0	38.9
140	22-09-2018 16:03:15	16 h 03	14.3	5.2	3.3	0.0	40.1

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
141	22-09-2018 16:04:15	16 h 04	14.4	5.1	3.2	0.0	39.2
142	22-09-2018 16:05:15	16 h 05	14.4	5.1	2.9	0.0	39.8
143	22-09-2018 16:06:15	16 h 06	13.5	5.6	3.2	0.0	40.6
144	22-09-2018 16:07:15	16 h 07	13.0	6.0	2.9	0.0	43.4
145	22-09-2018 16:08:15	16 h 08	14.7	5.1	2.3	0.0	40.5
146	22-09-2018 16:09:15	16 h 09	14.1	5.2	3.4	0.0	39.0
147	22-09-2018 16:10:15	16 h 10	14.5	5.1	2.5	0.0	40.3
148	22-09-2018 16:11:15	16 h 11	14.4	5.1	2.6	0.0	40.0
149	22-09-2018 16:12:15	16 h 12	14.3	5.1	2.9	0.0	40.0
150	22-09-2018 16:13:15	16 h 13	14.3	5.1	2.9	0.0	40.1
151	22-09-2018 16:14:15	16 h 14	14.4	5.1	3.2	0.0	39.2
152	22-09-2018 16:15:15	16 h 15	14.3	5.2	3.0	0.0	40.8
153	22-09-2018 16:16:15	16 h 16	14.3	5.2	3.0	0.0	40.1
154	22-09-2018 16:17:15	16 h 17					
155	22-09-2018 16:18:15	16 h 18	14.5	4.9	3.3	0.0	34.2
156	22-09-2018 16:19:15	16 h 19	14.6	4.9	3.2	0.0	33.4
157	22-09-2018 16:20:15	16 h 20	14.7	4.9	3.2	0.0	33.5
158	22-09-2018 16:21:15	16 h 21	14.5	5.0	2.9	0.0	33.9
159	22-09-2018 16:22:15	16 h 22	14.6	4.9	2.9	0.0	33.9
160	22-09-2018 16:23:15	16 h 23	14.6	5.0	2.9	0.0	33.8
161	22-09-2018 16:24:15	16 h 24	14.6	5.0	2.9	0.0	34.4
162	22-09-2018 16:25:15	16 h 25	14.7	4.9	3.2	0.0	33.1
163	22-09-2018 16:26:15	16 h 26	14.9	4.8	3.3	0.0	31.6
164	22-09-2018 16:27:15	16 h 27	15.0	4.7	3.2	0.0	31.5
165	22-09-2018 16:28:15	16 h 28	15.0	4.7	3.4	0.0	31.3
166	22-09-2018 16:29:15	16 h 29	15.2	4.6	3.5	0.0	29.2
167	22-09-2018 16:30:15	16 h 30	15.2	4.5	3.2	0.0	29.6
168	22-09-2018 16:31:15	16 h 31	15.0	4.6	3.0	0.0	31.9
169	22-09-2018 16:32:15	16 h 32	14.9	4.7	2.5	0.0	32.2
170	22-09-2018 16:33:15	16 h 33	14.9	4.7	2.6	0.0	32.3
171	22-09-2018 16:34:15	16 h 34	14.8	4.7	2.6	0.0	32.4
172	22-09-2018 16:35:15	16 h 35	14.9	4.7	2.9	0.0	32.1
173	22-09-2018 16:36:15	16 h 36	14.8	4.7	2.9	0.0	32.9
174	22-09-2018 16:37:15	16 h 37	14.9	4.8	2.6	0.0	32.4
175	22-09-2018 16:38:15	16 h 38	14.8	4.8	2.8	0.0	32.9
176	22-09-2018 16:39:15	16 h 39	14.9	4.8	2.5	0.0	32.6
177	22-09-2018 16:40:15	16 h 40	14.9	4.8	2.8	0.0	32.1
178	22-09-2018 16:41:15	16 h 41	14.9	4.8	2.9	0.0	31.9
179	22-09-2018 16:42:15	16 h 42	14.8	4.8	2.8	0.0	32.4
180	22-09-2018 16:43:15	16 h 43	14.9	4.8	2.6	0.0	31.8
181	22-09-2018 16:44:15	16 h 44	14.8	4.8	2.5	0.0	32.4
182	22-09-2018 16:45:15	16 h 45	14.8	4.8	2.5	0.0	32.4
183	22-09-2018 16:46:15	16 h 46	14.8	4.8	2.7	0.0	32.6
184	22-09-2018 16:47:15	16 h 47	14.9	4.8	2.8	0.0	31.9
185	22-09-2018 16:48:15	16 h 48	14.8	4.7	2.9	0.0	31.9
186	22-09-2018 16:49:15	16 h 49	15.0	4.7	3.0	0.0	30.1
187	22-09-2018 16:50:15	16 h 50	15.2	4.6	2.8	0.0	28.6
188	22-09-2018 16:51:15	16 h 51	15.3	4.5	2.7	0.0	28.3
189	22-09-2018 16:52:15	16 h 52	15.4	4.4	2.6	0.0	27.9
190	22-09-2018 16:53:15	16 h 53	15.3	4.4	2.1	0.0	28.1
191	22-09-2018 16:54:15	16 h 54	15.3	4.4	2.3	0.0	27.9
192	22-09-2018 16:55:15	16 h 55	15.1	4.4	2.5	0.0	28.7
193	22-09-2018 16:56:15	16 h 56	15.1	4.5	2.7	0.0	29.2
194	22-09-2018 16:57:15	16 h 57	14.9	4.6	2.6	0.0	29.8
195	22-09-2018 16:58:15	16 h 58	15.0	4.6	2.7	0.0	29.5
196	22-09-2018 16:59:15	16 h 59	15.0	4.6	2.7	0.0	29.6
197	22-09-2018 17:00:15	17 h 00	15.0	4.6	2.7	0.0	29.6
198	22-09-2018 17:01:15	17 h 01	15.1	4.6	2.7	0.0	29.2
199	22-09-2018 17:02:15	17 h 02	15.0	4.6	2.7	0.0	29.5
200	22-09-2018 17:03:15	17 h 03	15.0	4.6	3.0	0.0	29.8
201	22-09-2018 17:04:15	17 h 04	14.6	4.8	2.6	0.0	31.7
202	22-09-2018 17:05:15	17 h 05	14.5	4.9	2.5	0.0	32.2
203	22-09-2018 17:06:15	17 h 06	14.5	4.9	2.4	0.0	32.8
204	22-09-2018 17:07:15	17 h 07	14.5	5.0	2.3	0.0	33.0
205	22-09-2018 17:08:15	17 h 08	14.5	5.0	2.5	0.0	32.5
206	22-09-2018 17:09:15	17 h 09	14.5	5.0	2.7	0.0	32.6
207	22-09-2018 17:10:15	17 h 10	14.4	5.0	2.5	0.0	33.0

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
208	22-09-2018 17:11:15	17 h 11	14.5	5.0	2.4	0.0	32.9
209	22-09-2018 17:12:15	17 h 12	14.5	5.0	2.7	0.0	32.8
210	22-09-2018 17:13:15	17 h 13	14.4	5.0	2.4	0.0	33.1
211	22-09-2018 17:14:15	17 h 14	14.5	5.0	2.6	0.0	32.8
212	22-09-2018 17:15:15	17 h 15	14.4	5.1	2.6	0.0	33.0
213	22-09-2018 17:16:15	17 h 16	14.4	5.1	2.7	0.0	32.7
214	22-09-2018 17:17:15	17 h 17	14.4	5.1	2.7	0.0	33.1
215	22-09-2018 17:18:15	17 h 18	14.4	5.1	2.5	0.0	33.2
216	22-09-2018 17:19:15	17 h 19	14.6	5.1	2.7	0.0	32.1
217	22-09-2018 17:20:15	17 h 20	14.5	5.0	2.7	0.0	32.4
218	22-09-2018 17:21:15	17 h 21	14.5	5.0	2.4	0.0	32.9
219	22-09-2018 17:22:15	17 h 22	14.4	5.0	2.7	0.0	33.3
220	22-09-2018 17:23:15	17 h 23	14.4	5.0	2.7	0.0	33.2
221	22-09-2018 17:24:15	17 h 24	14.5	5.0	2.8	0.0	32.6
222	22-09-2018 17:25:15	17 h 25	14.5	5.0	2.6	0.0	32.9
223	22-09-2018 17:26:15	17 h 26	14.5	5.0	2.9	0.0	32.6
224	22-09-2018 17:27:15	17 h 27	14.5	5.0	2.7	0.0	32.6
225	22-09-2018 17:28:15	17 h 28	14.4	5.0	2.8	0.0	32.7
226	22-09-2018 17:29:15	17 h 29	14.5	5.0	2.9	0.0	32.9
227	22-09-2018 17:30:15	17 h 30	14.5	5.0	2.7	0.0	32.7
228	22-09-2018 17:31:15	17 h 31	14.5	5.0	2.7	0.0	32.9
229	22-09-2018 17:32:15	17 h 32	14.4	5.0	2.7	0.0	32.9
230	22-09-2018 17:33:15	17 h 33	14.4	5.1	2.7	0.0	33.0
231	22-09-2018 17:34:15	17 h 34	14.6	5.0	2.8	0.0	32.0
232	22-09-2018 17:35:15	17 h 35	14.5	5.0	2.8	0.0	32.6
233	22-09-2018 17:36:15	17 h 36	14.5	5.0	3.0	0.0	32.8
234	22-09-2018 17:37:15	17 h 37	14.4	5.0	2.7	0.0	32.9
235	22-09-2018 17:38:15	17 h 38	14.4	5.0	2.8	0.0	33.1
236	22-09-2018 17:39:15	17 h 39	14.4	5.1	2.8	0.0	33.1
237	22-09-2018 17:40:15	17 h 40	14.4	5.1	2.8	0.0	33.4
238	28-09-2018 11:35:51	11 h 35	14.6	4.8	3.1	0.0	49.2
239	28-09-2018 11:36:51	11 h 36	14.5	4.9	2.9	0.0	49.8
240	28-09-2018 11:37:51	11 h 37	14.6	4.8	3.1	0.0	49.5
241	28-09-2018 11:38:51	11 h 38	14.4	4.9	3.2	0.0	51.6
242	28-09-2018 11:39:51	11 h 39	14.4	4.9	3.3	0.0	52.1
243	28-09-2018 11:40:51	11 h 40	14.4	4.9	3.0	0.0	52.7
244	28-09-2018 11:41:51	11 h 41	14.5	4.9	3.0	0.0	52.3
245	28-09-2018 11:42:51	11 h 42	14.5	4.9	3.2	0.0	52.7
246	28-09-2018 11:43:51	11 h 43	14.5	4.9	3.2	0.0	52.8
247	28-09-2018 11:44:51	11 h 44	14.5	4.9	3.3	0.0	52.8
248	28-09-2018 11:45:51	11 h 45	14.4	4.9	3.1	0.0	53.5
249	28-09-2018 11:46:51	11 h 46	14.5	4.8	3.2	0.0	52.8
250	28-09-2018 11:47:51	11 h 47	14.5	4.8	3.3	0.0	53.4
251	28-09-2018 11:48:51	11 h 48	14.5	4.8	3.3	0.0	53.3
252	28-09-2018 11:49:51	11 h 49	14.5	4.8	3.2	0.0	53.8
253	28-09-2018 11:50:51	11 h 50	14.6	4.8	3.0	0.0	54.3
254	28-09-2018 11:51:51	11 h 51	14.5	4.8	2.9	0.0	54.4
255	28-09-2018 11:52:51	11 h 52	14.5	4.8	3.0	0.0	54.8
256	28-09-2018 11:53:51	11 h 53	14.5	4.8	3.2	0.0	55.3
257	28-09-2018 11:54:51	11 h 54	14.5	4.8	3.2	0.0	55.1
258	28-09-2018 11:55:51	11 h 55	14.6	4.7	3.3	0.0	54.0
259	28-09-2018 11:56:51	11 h 56	14.6	4.8	3.2	0.0	55.6
260	28-09-2018 11:57:51	11 h 57	14.5	4.8	3.2	0.0	55.6
261	28-09-2018 11:58:51	11 h 58	14.6	4.7	3.4	0.0	54.9
262	28-09-2018 11:59:51	11 h 59	14.6	4.8	2.9	0.0	55.7
263	28-09-2018 12:00:51	12 h 00	14.1	5.0	3.2	0.0	58.1
264	28-09-2018 12:01:51	12 h 01	14.7	4.7	3.2	0.0	54.9
265	28-09-2018 12:02:51	12 h 02	14.5	4.8	3.0	0.0	57.0
266	28-09-2018 12:03:51	12 h 03	14.4	4.9	2.9	0.0	57.1
267	28-09-2018 12:04:51	12 h 04	14.5	4.9	3.1	0.0	57.0
268	28-09-2018 12:05:51	12 h 05	14.4	4.9	3.0	0.0	57.8
269	28-09-2018 12:06:51	12 h 06	14.5	4.9	3.1	0.0	57.1
270	28-09-2018 12:07:51	12 h 07	14.5	4.9	3.0	0.0	56.8
271	28-09-2018 12:08:51	12 h 08	14.5	4.9	3.0	0.0	57.0
272	28-09-2018 12:09:51	12 h 09	14.5	4.8	2.9	0.0	57.3
273	28-09-2018 12:10:51	12 h 10	14.5	4.9	3.1	0.0	57.3
274	28-09-2018 12:11:51	12 h 11	14.5	4.9	3.2	0.0	57.1

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
275	28-09-2018 12:12:51	12 h 12	14.6	4.8	3.2	0.0	55.9
276	28-09-2018 12:13:51	12 h 13	14.5	4.8	3.2	0.0	56.7
277	28-09-2018 12:14:51	12 h 14	14.4	4.9	3.0	0.0	57.5
278	28-09-2018 12:15:51	12 h 15	14.5	4.9	3.1	0.0	57.0
279	28-09-2018 12:16:51	12 h 16	14.5	4.9	3.0	0.0	57.1
280	28-09-2018 12:17:51	12 h 17	14.5	4.8	2.9	0.0	56.8
281	28-09-2018 12:18:51	12 h 18	14.5	4.9	3.0	0.0	57.7
282	28-09-2018 12:19:51	12 h 19	14.6	4.8	2.8	0.0	56.5
283	28-09-2018 12:20:51	12 h 20	14.5	4.9	2.9	0.0	57.3
284	28-09-2018 12:21:51	12 h 21	14.5	4.9	3.0	0.0	57.3
285	28-09-2018 12:22:51	12 h 22	14.5	4.9	3.0	0.0	56.9
286	28-09-2018 12:23:51	12 h 23	14.5	4.9	3.0	0.0	56.9
287	28-09-2018 12:24:51	12 h 24	14.5	4.9	2.9	0.0	56.6
288	28-09-2018 12:25:51	12 h 25	14.5	4.9	3.0	0.0	56.8
289	28-09-2018 12:26:51	12 h 26	14.5	4.9	2.9	0.0	56.8
290	28-09-2018 12:27:51	12 h 27	14.5	4.9	2.9	0.0	57.7
291	28-09-2018 12:28:51	12 h 28	15.1	4.5	3.8	0.0	49.5
292	28-09-2018 12:29:51	12 h 29	15.3	4.4	3.8	0.0	48.8
293	28-09-2018 12:30:51	12 h 30	15.2	4.4	3.8	0.0	49.2
294	28-09-2018 12:31:51	12 h 31	15.2	4.4	3.7	0.0	49.5
295	28-09-2018 12:32:51	12 h 32	15.2	4.4	3.6	0.0	48.9
296	28-09-2018 12:33:51	12 h 33	15.1	4.4	3.7	0.0	49.5
297	28-09-2018 12:34:51	12 h 34	15.2	4.4	3.6	0.0	48.8
298	28-09-2018 12:35:51	12 h 35	15.1	4.4	3.5	0.0	49.0
299	28-09-2018 12:36:51	12 h 36	15.2	4.4	3.8	0.0	48.7
300	28-09-2018 12:37:51	12 h 37	15.2	4.4	3.7	0.0	48.7
301	28-09-2018 12:38:51	12 h 38	15.2	4.4	3.8	0.0	48.9
302	28-09-2018 12:39:51	12 h 39	15.3	4.4	3.8	0.0	48.7
303	28-09-2018 12:40:51	12 h 40	15.1	4.4	3.7	0.0	49.3
304	28-09-2018 12:41:51	12 h 41	15.2	4.3	3.6	0.0	49.1
305	28-09-2018 12:42:51	12 h 42	15.2	4.4	3.6	0.0	49.2
306	28-09-2018 12:43:51	12 h 43	15.2	4.4	3.7	0.0	49.1
307	28-09-2018 12:44:51	12 h 44	15.2	4.3	3.5	0.0	49.1
308	28-09-2018 12:45:51	12 h 45	15.3	4.3	3.7	0.0	48.7
309	28-09-2018 12:46:51	12 h 46	15.3	4.3	3.7	0.0	48.5
310	28-09-2018 12:47:51	12 h 47	15.2	4.3	3.6	0.0	49.1
311	28-09-2018 12:48:51	12 h 48	15.2	4.3	3.7	0.0	49.0
312	28-09-2018 12:49:51	12 h 49	15.3	4.3	3.7	0.0	48.7
313	28-09-2018 12:50:51	12 h 50	15.2	4.3	3.4	0.0	49.0
314	28-09-2018 12:51:51	12 h 51	15.3	4.3	3.7	0.0	48.2
315	28-09-2018 12:52:51	12 h 52	15.3	4.3	3.7	0.0	47.3
316	28-09-2018 12:53:51	12 h 53	15.3	4.3	3.5	0.0	47.9
317	28-09-2018 12:54:51	12 h 54	15.3	4.3	3.6	0.0	47.6
318	28-09-2018 12:55:51	12 h 55	15.2	4.3	3.6	0.0	47.9
319	28-09-2018 12:56:51	12 h 56	15.3	4.3	3.6	0.0	47.3
320	28-09-2018 12:57:51	12 h 57	15.3	4.3	3.5	0.0	47.8
321	28-09-2018 12:58:51	12 h 58	15.3	4.3	3.4	0.0	47.1
322	28-09-2018 12:59:51	12 h 59	15.3	4.3	3.4	0.0	47.4
323	28-09-2018 13:00:51	13 h 00	15.3	4.3	3.4	0.0	48.0
324	28-09-2018 13:01:51	13 h 01	15.3	4.3	3.4	0.0	47.7
325	28-09-2018 13:02:51	13 h 02	15.2	4.3	3.2	0.0	48.1
326	28-09-2018 13:03:51	13 h 03	15.3	4.3	3.5	0.0	47.4
327	28-09-2018 13:04:51	13 h 04	15.3	4.3	3.3	0.0	47.7
328	28-09-2018 13:05:51	13 h 05	15.3	4.3	3.4	0.0	47.3
329	28-09-2018 13:06:51	13 h 06	15.3	4.3	3.6	0.0	47.3
330	28-09-2018 13:07:51	13 h 07	15.3	4.3	3.4	0.0	47.9
331	28-09-2018 13:08:51	13 h 08	15.3	4.3	3.5	0.0	47.4
332	28-09-2018 13:09:51	13 h 09	15.8	4.0	4.4	0.0	42.8
333	28-09-2018 13:10:51	13 h 10	15.5	4.1	3.8	0.0	45.6
334	28-09-2018 13:11:51	13 h 11	15.4	4.2	3.1	0.0	47.3
335	28-09-2018 13:12:51	13 h 12	15.3	4.3	3.3	0.0	47.9
336	28-09-2018 13:13:51	13 h 13	15.2	4.3	3.4	0.0	47.5
337	28-09-2018 13:14:51	13 h 14	15.2	4.3	3.4	0.0	47.8
338	28-09-2018 13:15:51	13 h 15	15.3	4.3	3.1	0.0	47.5
339	28-09-2018 13:16:51	13 h 16	15.2	4.4	3.4	0.0	47.7
340	28-09-2018 13:17:51	13 h 17	15.2	4.4	3.1	0.0	47.8
341	28-09-2018 13:18:51	13 h 18	15.2	4.4	3.0	0.0	48.0

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
342	28-09-2018 13:19:51	13 h 19	15.2	4.4	3.1	0.0	48.3
343	28-09-2018 13:20:51	13 h 20	15.3	4.4	3.3	0.0	47.4
344	28-09-2018 13:21:51	13 h 21	15.3	4.3	3.1	0.0	47.7
345	28-09-2018 13:22:51	13 h 22	15.3	4.3	3.4	0.0	46.9
346	28-09-2018 13:23:51	13 h 23	15.7	4.1	3.8	0.0	43.3
347	28-09-2018 13:24:51	13 h 24	15.3	4.3	3.2	0.0	47.2
348	28-09-2018 13:25:51	13 h 25	15.3	4.3	3.2	0.0	47.2
349	28-09-2018 13:26:51	13 h 26	15.3	4.3	3.4	0.0	47.8
350	28-09-2018 13:27:51	13 h 27	15.2	4.3	3.1	0.0	48.1
351	28-09-2018 13:28:51	13 h 28	15.3	4.3	3.3	0.0	48.1
352	28-09-2018 13:29:51	13 h 29	15.3	4.3	3.1	0.0	47.8
353	28-09-2018 13:30:51	13 h 30	15.4	4.3	3.3	0.0	46.8
354	28-09-2018 13:31:51	13 h 31	15.3	4.3	3.4	0.0	48.0
355	28-09-2018 13:32:51	13 h 32	15.5	4.2	3.5	0.0	45.8
356	28-09-2018 13:33:51	13 h 33	15.7	4.0	3.6	0.0	43.6
357	28-09-2018 13:34:51	13 h 34	15.7	4.0	3.4	0.0	43.2
358	28-09-2018 13:35:51	13 h 35	15.7	4.0	3.7	0.0	43.3
359	28-09-2018 13:36:51	13 h 36	15.7	4.0	3.7	0.0	43.5
360	28-09-2018 13:37:51	13 h 37	15.7	4.0	3.7	0.0	43.2
361	28-09-2018 13:38:51	13 h 38	15.7	4.0	3.5	0.0	43.2
362	28-09-2018 13:39:51	13 h 39	15.7	4.0	3.6	0.0	43.4
363	28-09-2018 13:40:51	13 h 40	15.7	4.0	3.7	0.0	43.7
364	28-09-2018 13:41:51	13 h 41	15.7	4.0	3.7	0.0	43.1
365	28-09-2018 13:42:51	13 h 42	15.7	4.0	3.6	0.0	42.8
366	28-09-2018 13:43:51	13 h 43	15.7	4.0	3.6	0.0	43.2
367	28-09-2018 13:44:51	13 h 44	15.7	4.0	3.6	0.0	43.3
368	28-09-2018 13:45:51	13 h 45	15.7	4.0	3.6	0.0	42.9
369	28-09-2018 13:46:51	13 h 46	15.7	4.0	3.7	0.0	42.8
370	28-09-2018 13:47:51	13 h 47	15.7	4.0	3.6	0.0	42.8
371	28-09-2018 13:48:51	13 h 48	15.7	4.0	3.6	0.0	42.8
372	28-09-2018 13:49:51	13 h 49	15.7	4.0	3.7	0.0	42.6
373	28-09-2018 13:50:51	13 h 50	15.7	4.0	4.1	0.0	42.2
374	28-09-2018 13:51:51	13 h 51	15.7	4.0	4.1	0.0	42.2
375	28-09-2018 13:52:51	13 h 52	15.8	4.0	3.9	0.0	41.9
376	28-09-2018 13:53:51	13 h 53	15.8	4.0	4.0	0.0	41.8
377	28-09-2018 13:54:51	13 h 54	15.7	4.0	3.9	0.0	42.3
378	28-09-2018 13:55:51	13 h 55	15.7	4.0	3.9	0.0	43.2
379	28-09-2018 13:56:51	13 h 56	15.7	4.0	3.9	0.0	43.0
380	28-09-2018 13:57:51	13 h 57	15.7	4.0	3.9	0.0	42.4
381	28-09-2018 13:58:51	13 h 58	15.7	4.0	3.8	0.0	42.7
382	28-09-2018 13:59:51	13 h 59	15.7	4.0	3.6	0.0	42.7
383	28-09-2018 14:00:51	14 h 00					
384	28-09-2018 14:01:51	14 h 01					
385	28-09-2018 14:02:51	14 h 02					
386	28-09-2018 14:03:51	14 h 03					
387	28-09-2018 14:04:51	14 h 04					
388	28-09-2018 14:05:51	14 h 05					
389	28-09-2018 14:06:51	14 h 06					
390	28-09-2018 14:07:51	14 h 07					
391	28-09-2018 14:08:51	14 h 08					
392	28-09-2018 14:09:51	14 h 09					
393	28-09-2018 14:10:51	14 h 10					
394	28-09-2018 14:11:51	14 h 11					
395	28-09-2018 14:12:51	14 h 12					
396	28-09-2018 14:13:51	14 h 13					
397	28-09-2018 14:14:51	14 h 14	15.3	4.3	2.9	0.0	43.9
398	28-09-2018 14:15:51	14 h 15	15.2	4.4	2.6	0.0	45.1
399	28-09-2018 14:16:51	14 h 16	15.2	4.4	3.0	0.0	45.1
400	28-09-2018 14:17:51	14 h 17	15.2	4.4	3.3	0.0	45.5
401	28-09-2018 14:18:51	14 h 18	15.1	4.4	2.9	0.0	46.1
402	28-09-2018 14:19:51	14 h 19	15.1	4.4	2.8	0.0	45.9
403	28-09-2018 14:20:51	14 h 20	15.2	4.4	3.3	0.0	45.0
404	28-09-2018 14:21:51	14 h 21	15.5	4.3	3.7	0.0	43.6
405	28-09-2018 14:22:51	14 h 22	15.3	4.3	3.4	0.0	44.6
406	28-09-2018 14:23:51	14 h 23	15.2	4.4	3.2	0.0	45.5
407	28-09-2018 14:24:51	14 h 24	15.1	4.4	2.9	0.0	46.1
408	28-09-2018 14:25:51	14 h 25	15.2	4.4	3.0	0.0	45.1

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
409	29-09-2018 16:15:41	16 h 15	12.9	6.1	3.1	-2.7	70.9
410	29-09-2018 16:16:41	16 h 16	12.9	6.1	2.8	-2.9	71.0
411	29-09-2018 16:17:41	16 h 17	12.8	6.2	2.9	-2.8	71.1
412	29-09-2018 16:18:41	16 h 18	12.9	6.1	3.2	-2.8	70.3
413	29-09-2018 16:19:41	16 h 19	12.8	6.1	3.1	-2.8	70.9
414	29-09-2018 16:20:41	16 h 20	12.9	6.1	3.0	-2.8	69.6
415	29-09-2018 16:21:41	16 h 21	13.4	5.7	3.5	-2.6	66.3
416	29-09-2018 16:22:41	16 h 22	13.5	5.6	3.1	-2.4	66.4
417	29-09-2018 16:23:41	16 h 23	13.4	5.7	3.1	-2.4	69.6
418	29-09-2018 16:24:41	16 h 24	13.0	5.9	2.6	-2.5	75.1
419	29-09-2018 16:25:41	16 h 25	12.8	6.1	2.6	-2.3	75.4
420	29-09-2018 16:26:41	16 h 26	12.8	6.1	2.7	-2.1	73.8
421	29-09-2018 16:27:41	16 h 27	12.9	6.1	2.7	-2.1	73.2
422	29-09-2018 16:28:41	16 h 28	12.9	6.0	2.6	-2.1	71.6
423	29-09-2018 16:29:41	16 h 29	13.0	6.0	2.8	-1.8	70.2
424	29-09-2018 16:30:41	16 h 30	12.9	6.1	2.8	-1.8	71.3
425	29-09-2018 16:31:41	16 h 31	13.0	6.0	2.9	-1.5	70.1
426	29-09-2018 16:32:41	16 h 32	13.0	6.0	2.9	-1.6	69.8
427	29-09-2018 16:33:41	16 h 33	12.9	6.1	3.0	-1.4	70.8
428	29-09-2018 16:34:41	16 h 34	13.0	6.0	2.7	-1.3	69.3
429	29-09-2018 16:35:41	16 h 35	13.0	6.0	2.6	-1.3	69.9
430	29-09-2018 16:36:41	16 h 36	13.0	6.0	2.7	-1.3	69.6
431	29-09-2018 16:37:41	16 h 37	13.0	6.0	2.6	-1.1	70.3
432	29-09-2018 16:38:41	16 h 38	13.0	6.0	2.7	-1.1	69.4
433	29-09-2018 16:39:41	16 h 39	13.1	5.9	2.8	-1.1	68.7
434	29-09-2018 16:40:41	16 h 40	13.7	5.6	3.0	-1.0	62.4
435	29-09-2018 16:41:41	16 h 41	13.8	5.5	3.3	-1.0	61.1
436	29-09-2018 16:42:41	16 h 42	13.7	5.5	3.2	-1.0	62.0
437	29-09-2018 16:43:41	16 h 43	13.7	5.5	3.3	-1.1	62.0
438	29-09-2018 16:44:41	16 h 44	13.8	5.4	3.4	-0.9	61.3
439	29-09-2018 16:45:41	16 h 45	13.6	5.6	2.9	-0.8	63.1
440	29-09-2018 16:46:41	16 h 46	13.7	5.5	2.9	-0.6	63.0
441	29-09-2018 16:47:41	16 h 47	13.8	5.5	3.2	-0.7	62.3
442	29-09-2018 16:48:41	16 h 48	13.7	5.5	2.8	-0.6	62.7
443	29-09-2018 16:49:41	16 h 49	13.7	5.5	2.8	-0.5	62.5
444	29-09-2018 16:50:41	16 h 50	13.7	5.5	2.9	-0.3	62.9
445	29-09-2018 16:51:41	16 h 51	13.7	5.5	2.9	-0.2	63.4
446	29-09-2018 16:52:41	16 h 52	13.7	5.5	2.8	-0.2	63.6
447	29-09-2018 16:53:41	16 h 53	13.7	5.5	3.1	0.0	63.7
448	29-09-2018 16:54:41	16 h 54	13.7	5.5	3.1	0.2	63.5
449	29-09-2018 16:55:41	16 h 55	13.7	5.5	3.1	0.3	63.5
450	29-09-2018 16:56:41	16 h 56	13.7	5.5	3.0	0.5	63.7
451	29-09-2018 16:57:41	16 h 57	13.7	5.5	3.1	0.5	64.3
452	29-09-2018 16:58:41	16 h 58	13.7	5.5	2.9	0.7	63.7
453	29-09-2018 16:59:41	16 h 59	13.7	5.5	2.6	0.8	63.9
454	29-09-2018 17:00:41	17 h 00	13.7	5.5	3.1	0.8	64.2
455	29-09-2018 17:01:41	17 h 01	13.7	5.5	2.8	0.9	64.4
456	29-09-2018 17:02:41	17 h 02	13.7	5.5	2.8	1.1	64.4
457	29-09-2018 17:03:41	17 h 03	13.7	5.5	2.8	1.2	64.4
458	29-09-2018 17:04:41	17 h 04	13.7	5.5	2.8	1.3	64.0
459	29-09-2018 17:05:41	17 h 05	13.7	5.5	3.0	1.4	64.3
460	29-09-2018 17:06:41	17 h 06	13.7	5.5	2.8	1.6	64.5
461	29-09-2018 17:07:41	17 h 07	13.7	5.5	3.0	1.4	64.6
462	29-09-2018 17:08:41	17 h 08	13.7	5.5	3.0	1.5	64.5
463	29-09-2018 17:09:41	17 h 09	13.7	5.5	3.0	1.5	64.4
464	29-09-2018 17:10:41	17 h 10	13.7	5.5	3.0	1.4	63.8
465	29-09-2018 17:11:41	17 h 11	13.7	5.5	2.8	1.6	63.8
466	29-09-2018 17:12:41	17 h 12	13.9	5.4	3.2	1.7	60.9
467	29-09-2018 17:13:41	17 h 13	14.1	5.2	3.3	1.6	59.2
468	29-09-2018 17:14:41	17 h 14	14.2	5.2	3.3	1.6	58.3
469	29-09-2018 17:15:41	17 h 15	14.2	5.2	3.1	1.7	58.3
470	29-09-2018 17:16:41	17 h 16	14.2	5.2	3.4	1.9	57.6
471	29-09-2018 17:17:41	17 h 17	14.2	5.2	3.4	2.0	57.8
472	29-09-2018 17:18:41	17 h 18	14.2	5.1	3.3	2.1	57.6
473	29-09-2018 17:19:41	17 h 19	14.2	5.2	3.4	2.3	58.4
474	29-09-2018 17:20:41	17 h 20	14.2	5.2	3.3	2.2	58.3
475	29-09-2018 17:21:41	17 h 21	14.1	5.2	3.3	2.2	58.7

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
476	29-09-2018 17:22:41	17 h 22	14.1	5.2	3.4	2.6	58.3
477	29-09-2018 17:23:41	17 h 23	14.4	5.0	3.5	2.6	55.8
478	29-09-2018 17:24:41	17 h 24	14.6	4.9	3.5	2.8	57.3
479	29-09-2018 17:25:41	17 h 25	14.4	5.0	2.9	3.0	59.1
480	29-09-2018 17:26:41	17 h 26	14.3	5.1	2.8	3.1	58.9
481	29-09-2018 17:27:41	17 h 27	14.2	5.1	3.0	3.4	59.0
482	29-09-2018 17:28:41	17 h 28	14.2	5.1	2.8	3.6	58.1
483	29-09-2018 17:29:41	17 h 29	14.2	5.1	3.0	3.4	58.8
484	29-09-2018 17:30:41	17 h 30	14.2	5.2	2.9	3.4	59.0
485	29-09-2018 17:31:41	17 h 31	14.1	5.1	2.9	3.3	59.3
486	29-09-2018 17:32:41	17 h 32	14.1	5.2	2.8	3.3	60.0
487	29-09-2018 17:33:41	17 h 33	14.2	5.1	2.9	3.1	58.7
488	29-09-2018 17:34:41	17 h 34	14.1	5.1	2.9	2.8	58.7
489	29-09-2018 17:35:41	17 h 35	14.1	5.2	2.9	2.4	59.1
490	29-09-2018 17:36:41	17 h 36	14.1	5.2	2.9	2.1	59.0
491	29-09-2018 17:37:41	17 h 37	14.1	5.2	3.0	1.9	58.4
492	29-09-2018 17:38:41	17 h 38	14.1	5.2	3.0	1.7	58.5
493	29-09-2018 17:39:41	17 h 39	14.1	5.2	3.0	1.4	58.4
494	29-09-2018 17:40:41	17 h 40	14.1	5.2	3.0	1.1	58.3
495	29-09-2018 17:41:41	17 h 41	14.1	5.2	3.3	1.1	58.8
496	29-09-2018 17:42:41	17 h 42	14.1	5.2	3.1	0.7	58.7
497	29-09-2018 17:43:41	17 h 43	14.1	5.2	3.2	0.4	58.4
498	29-09-2018 17:44:41	17 h 44	14.1	5.2	2.9	0.3	58.7
499	29-09-2018 17:45:41	17 h 45	14.1	5.2	3.2	0.1	59.5
500	29-09-2018 17:46:41	17 h 46	14.1	5.2	2.9	-0.1	59.8
501	29-09-2018 17:47:41	17 h 47	14.1	5.2	2.9	-0.3	60.0
502	29-09-2018 17:48:41	17 h 48	14.1	5.2	2.8	-0.3	60.0
503	29-09-2018 17:49:41	17 h 49	14.1	5.2	3.1	-0.4	59.5
504	29-09-2018 17:50:41	17 h 50	14.1	5.2	3.2	-0.5	58.2
505	29-09-2018 17:51:41	17 h 51	14.1	5.2	2.9	-0.5	58.2
506	29-09-2018 17:52:41	17 h 52	14.1	5.2	3.1	-0.6	58.1
507	29-09-2018 17:53:41	17 h 53	14.1	5.2	3.2	-0.7	58.1
508	29-09-2018 17:54:41	17 h 54	14.1	5.2	2.9	-0.7	58.0
509	29-09-2018 17:55:41	17 h 55	14.1	5.2	2.8	-0.6	57.9
510	29-09-2018 17:56:41	17 h 56	14.0	5.3	3.0	-0.7	58.8
511	29-09-2018 17:57:41	17 h 57	14.0	5.3	3.0	-0.8	58.3
512	29-09-2018 17:58:41	17 h 58	14.0	5.2	2.8	-0.8	58.4
513	29-09-2018 17:59:41	17 h 59	14.1	5.2	3.0	-0.7	58.0
514	29-09-2018 18:00:41	18 h 00	14.1	5.2	2.7	-0.8	57.7
515	29-09-2018 18:01:41	18 h 01	14.0	5.3	3.1	-0.7	58.8
516	29-09-2018 18:02:41	18 h 02	14.1	5.2	2.8	-0.7	57.9
517	29-09-2018 18:03:41	18 h 03	14.1	5.2	2.9	-0.8	58.1
518	29-09-2018 18:04:41	18 h 04	14.1	5.2	3.0	-0.6	57.7
519	29-09-2018 18:05:41	18 h 05	14.0	5.3	3.0	-0.6	58.4
520	29-09-2018 18:06:41	18 h 06	14.1	5.2	2.9	-0.6	58.4
521	29-09-2018 18:07:41	18 h 07	14.1	5.3	2.6	-0.7	58.0
522	29-09-2018 18:08:41	18 h 08	14.0	5.3	2.6	-0.8	58.5
523	29-09-2018 18:09:41	18 h 09	14.1	5.2	3.0	-0.8	57.6
524	29-09-2018 18:10:41	18 h 10	14.1	5.2	2.9	-0.6	57.5
525	29-09-2018 18:11:41	18 h 11	14.1	5.2	3.0	-0.5	56.8
526	29-09-2018 18:12:41	18 h 12	13.0	5.9	1.8	-0.4	69.4
527	29-09-2018 18:13:41	18 h 13	12.8	6.2	1.7	-0.3	71.8
528	29-09-2018 18:14:41	18 h 14	12.8	6.2	1.5	-0.3	71.8
529	29-09-2018 18:15:41	18 h 15	12.9	6.1	1.7	-0.3	70.5
530	29-09-2018 18:16:41	18 h 16	12.9	6.2	1.7	-0.1	72.2
531	29-09-2018 18:17:41	18 h 17	12.9	6.1	1.7	0.2	71.7
532	29-09-2018 18:18:41	18 h 18	12.9	6.1	1.5	0.1	72.6
533	29-09-2018 18:19:41	18 h 19	12.9	6.1	1.6	0.2	72.6
534	29-09-2018 18:20:41	18 h 20	12.9	6.1	1.8	0.4	71.7
535	29-09-2018 18:21:41	18 h 21	13.0	6.1	1.9	0.5	70.3
536	29-09-2018 18:22:41	18 h 22	13.0	6.1	1.6	0.7	70.9
537	29-09-2018 18:23:41	18 h 23	13.0	6.1	1.7	0.7	71.0
538	29-09-2018 18:24:41	18 h 24	13.0	6.1	1.7	0.6	71.6
539	29-09-2018 18:25:41	18 h 25	13.0	6.1	1.7	0.7	70.9
540	29-09-2018 18:26:41	18 h 26	12.9	6.1	1.7	0.9	72.6
541	29-09-2018 18:27:41	18 h 27	13.0	6.1	1.7	0.7	71.8
542	29-09-2018 18:28:41	18 h 28	13.0	6.1	1.8	0.8	72.1

	A	B	C	E	G	L	N
6	Date/Heure	Type	O2 0-25 (%vs)	CO2 0-20 (%vs	CO 0-1000 (ppmvs)	SO2 (ppmvs)	NOX (ppmvs)
543	29-09-2018 18:29:41	18 h 29	13.0	6.1	1.6	0.8	72.6
544	29-09-2018 18:30:41	18 h 30	12.9	6.1	1.7	0.8	72.3
545	29-09-2018 18:31:41	18 h 31	13.0	6.1	1.8	0.7	72.3
546	29-09-2018 18:32:41	18 h 32	13.0	6.1	1.5	0.8	72.2
547	29-09-2018 18:33:41	18 h 33	12.9	6.1	1.4	0.9	72.4
548	29-09-2018 18:34:41	18 h 34	12.9	6.1	1.7	0.8	71.8
549	29-09-2018 18:35:41	18 h 35	12.9	6.1	1.6	0.8	71.8
550	29-09-2018 18:36:41	18 h 36	13.0	6.1	1.5	0.7	71.8
551	29-09-2018 18:37:41	18 h 37	12.9	6.1	1.7	0.7	72.3
552	29-09-2018 18:38:41	18 h 38	13.0	6.1	1.6	0.8	72.3
553	29-09-2018 18:39:41	18 h 39	13.0	6.1	1.6	0.5	71.9
554	29-09-2018 18:40:41	18 h 40	12.9	6.1	1.7	0.5	72.5
555	29-09-2018 18:41:41	18 h 41	13.0	6.1	1.7	0.5	72.1
556	29-09-2018 18:42:41	18 h 42	13.0	6.1	1.4	0.4	72.4
557	29-09-2018 18:43:41	18 h 43	12.7	6.2	1.3	0.3	75.2
558	29-09-2018 18:44:41	18 h 44	12.8	6.2	1.4	0.4	74.6
559	29-09-2018 18:45:41	18 h 45	12.7	6.3	1.4	0.3	75.7
560	29-09-2018 18:46:41	18 h 46	12.6	6.3	1.3	0.2	76.4
561	29-09-2018 18:47:41	18 h 47	13.3	5.9	1.4	0.1	76.8
562	29-09-2018 18:48:41	18 h 48	13.4	5.8	1.8	-0.1	76.9
563	29-09-2018 18:49:41	18 h 49	13.5	5.7	1.8	0.0	76.2
564	29-09-2018 18:50:41	18 h 50	13.5	5.7	1.9	-0.2	76.2
565	29-09-2018 18:51:41	18 h 51	13.6	5.6	1.9	-0.4	74.8
566	29-09-2018 18:52:41	18 h 52	13.7	5.6	1.9	-0.3	74.4
567	29-09-2018 18:53:41	18 h 53	13.7	5.6	2.0	-0.5	73.5
568	29-09-2018 18:54:41	18 h 54	13.7	5.6	2.1	-0.4	73.8
569	29-09-2018 18:55:41	18 h 55	13.7	5.6	2.0	-0.7	73.6
570	29-09-2018 18:56:41	18 h 56	13.7	5.6	2.0	-0.5	72.8
571	29-09-2018 18:57:41	18 h 57	13.7	5.6	2.1	-0.8	73.6
572	29-09-2018 18:58:41	18 h 58	13.7	5.6	1.9	-0.7	73.6
573	29-09-2018 18:59:41	18 h 59	13.7	5.6	1.9	-0.8	73.5
574	29-09-2018 19:00:41	19 h 00	13.7	5.6	1.9	-0.8	73.5
575	29-09-2018 19:01:41	19 h 01	13.7	5.6	2.0	-1.0	73.7
576	29-09-2018 19:02:41	19 h 02	13.6	5.6	1.8	-1.1	74.5
577	29-09-2018 19:03:41	19 h 03	13.6	5.7	2.1	-0.8	74.2
578	29-09-2018 19:04:41	19 h 04	13.5	5.7	1.9	-0.9	75.1
579	29-09-2018 19:05:41	19 h 05	13.6	5.6	1.9	-0.9	74.0

APPENDIX 3
CALIBRATION CERTIFICATES

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

FEUILLE D'ÉTALONNAGE DES MODULES 2018

MODULE	GAMMA (K_c)	ORIFICE (K_o) K_o	ΔH@ moy	DATE ÉTALONNAGE	COMPENSÉ 60 °F
1	1.009	0.999	0.970	13-mars-18	OUI
2	0.999	0.969	1.001	15-mars-18	OUI
3	0.990	0.950	1.188	05-déc-17	NON
4	1.001	0.946	1.040	15-août-18	NON
5	0.996	0.997	0.923	20-mars-18	NON
6	1.004	0.991	1.027	06-sept-18	OUI
7	0.981	0.994	0.928	27-oct-17	NON
8	1.013	1.037	0.958	06-juil-18	OUI
9	0.998	1.012	0.899	14-sept-17	NON
10	1.011	0.993	1.005	20-mars-18	OUI
11	0.989	0.974	1.054	06-sept-18	OUI
12	0.999	0.911	1.208	24-mai-18	NON
13	1.019	0.974	0.921	19-mars-18	NON
14	1.000	1.004	0.975	21-mars-18	OUI
15	1.000	0.982	1.021	13-nov-17	NON
16	1.017	1.027	0.872	15-sept-17	NON
17	0.987	1.050	0.833	15-sept-17	NON
18	1.002	1.013	0.896	07-sept-18	NON
19	0.997	1.000	1.005	06-sept-18	OUI
20	1.005	0.970	1.072	07-sept-18	OUI
21	0.989	1.011	0.984	13-nov-17	OUI
22	0.993	0.996	0.995	04-déc-17	NON
23	1.013	1.029	0.875	15-sept-17	NON
24	1.007	0.995	1.160	04-déc-17	NON
25	0.999	0.733	2.529	24-mai-18	NON

MODULE	GAMMA (K_C)	DATE ÉTALONNAGE
F-1	0.973	27-oct-17
F-2	0.977	05-juil-18
F-3	1.006	13-nov-17
F-4	1.009	17-juil-17
F-5	1.001	26-oct-17
F-6	1.013	22-mars-18

Version: 4
Date: 07-09-2018

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

FEUILLE D'ÉTALONNAGE DES MODULES 2018

MODULE	GAMMA (K_c)	ORIFICE (K_o) K_o	ΔH@ moy	DATE ÉTALONNAGE	COMPENSÉ 60 °F
1	1.009	0.999	0.970	13-mars-18	OUI
2	0.999	0.969	1.001	15-mars-18	OUI
3	0.990	0.950	1.188	05-déc-17	NON
4	1.001	0.946	1.040	15-août-18	NON
5	0.996	0.997	0.923	20-mars-18	NON
6	1.004	0.991	1.027	06-sept-18	OUI
7	0.981	0.994	0.928	27-oct-17	NON
8	1.013	1.037	0.958	06-juil-18	OUI
9	0.998	1.012	0.899	14-sept-17	NON
10	1.011	0.993	1.005	20-mars-18	OUI
11	0.989	0.974	1.054	06-sept-18	OUI
12	0.999	0.911	1.208	24-mai-18	NON
13	1.019	0.974	0.921	19-mars-18	NON
14	1.000	1.004	0.975	21-mars-18	OUI
15	1.000	0.982	1.021	13-nov-17	NON
16	1.017	1.027	0.872	15-sept-17	NON
17	0.987	1.050	0.833	15-sept-17	NON
18	1.002	1.013	0.896	07-sept-18	NON
19	0.997	1.000	1.005	06-sept-18	OUI
20	1.005	0.970	1.072	07-sept-18	OUI
21	0.989	1.011	0.984	13-nov-17	OUI
22	0.993	0.996	0.995	04-déc-17	NON
23	1.013	1.029	0.875	15-sept-17	NON
24	1.007	0.995	1.160	04-déc-17	NON
25	0.999	0.733	2.529	24-mai-18	NON

MODULE	GAMMA (K_C)	DATE ÉTALONNAGE
F-1	0.973	27-oct-17
F-2	0.977	05-juil-18
F-3	1.006	13-nov-17
F-4	1.009	17-juil-17
F-5	1.001	26-oct-17
F-6	1.013	22-mars-18

Version: 4
Date: 07-09-2018

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

RÉSUMÉ D'ÉTALONNAGE DES SONDES - S-03 V

Version 1 (02-03-2018)

#	Année	MDF	LV	#	1	2	3	4	5	6	7	8	9	10	11	12	Moy. V	Thermocouple (Validation)	P-T-B	Endroit
				Buse	A-312-1												---			
03-05	2018	O	O	Ct	0.797												0.797	OK	OK	LE-02-W
				E. Rel	0.6												0.6			
				Buse	3Q-371	3Q-431	3Q-503	3Q-682									---			
03-06	2018	N	Q	Ct	0.778	0.779	0.781	0.773									0.778	OK	OK	Atelier
				E. Rel	0.6	0.4	0.6	0.7									0.6			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-07	2018	O	O	Ct	0.779	0.777	0.792	0.790	0.777	0.778	0.782	0.770	0.782	0.781	0.777	0.771	0.780	OK	OK	LE-02-W
				E. Rel	1.0	0.9	0.8	0.8	1.1	1.1	1.0	1.4	1.3	1.1	1.3	1.4	1.1			
				Buse	A-312-3												---			
03-09	2018	O	O	Ct	0.827												0.827	OK	OK	LE-14-B
				E. Rel	0.4												0.4			
				Buse	A-312-3												---			
03-10	2018	O	O	Ct	0.778												0.778	OK	OK	LE-11-V
				E. Rel	1.3												1.3			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-2	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-11	2018	O	O	Ct	0.792	0.795	0.794	0.793	0.796	0.796	0.795	0.798	0.796	0.793	0.793	0.789	0.794	OK	OK	LE-05-O
				E. Rel	1.1	0.8	1.0	1.1	1.1	1.0	1.0	0.6	1.0	1.2	0.9	1.1	1.0			
				Buse	A-312-3												---			
03-12	2018	O	O	Ct	0.791												0.791	OK	OK	LE-14-B
				E. Rel	1.1												1.1			
				Buse	A-312-3												---			
03-13	2018	O	O	Ct	0.772												0.772	OK	OK	LE-11-V
				E. Rel	0.9												0.9			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-14	2018	O	O	Ct	0.801	0.799	0.813	0.811	0.810	0.806	0.808	0.796	0.805	0.802	0.792	0.799	0.804	OK	OK	LE-02-W
				E. Rel	1.2	0.8	1.0	0.7	0.8	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-2	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-15	2018	O	O	Ct	0.808	0.805	0.816	0.811	0.808	0.804	0.800	0.798	0.802	0.800	0.792	0.784	0.802	OK	OK	LE-02-W
				E. Rel	1.2	1.2	1.2	1.0	1.2	1.2	1.3	1.2	1.1	1.3	1.3	1.0	1.2			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-16	2018	O	O	Ct	0.790	0.790	0.794	0.796	0.797	0.794	0.794	0.791	0.800	0.802	0.796	0.793	0.795	OK	OK	LE-02-W
				E. Rel	0.7	1.1	1.3	1.1	1.2	1.3	1.1	1.2	1.4	1.5	1.1	1.1	1.2			
				Buse	A-312-3												---			
03-18	2018	O	O	Ct	0.822												0.822	OK	OK	LE-08-Br
				E. Rel	1.0												1.0			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-19	2018	O	V	Ct	0.765	0.779	0.780	0.772	0.787	0.767	0.774	0.781	0.779	0.781	0.770	0.761	0.775	OK	OK	Atelier Qc
				E. Rel	1.0	0.4	1.0	0.7	0.6	0.0	0.0	0.0	0.0	0.9	1.0	1.0	0.6			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-437-1	A-406-3	A-437-1	A-500-1	A-562-1	---			
03-20	2018	O	V	Ct	0.769	0.779	0.787	0.791	0.795	0.776	0.782	0.788	0.791	0.796	0.785	0.788	0.786	OK	OK	Atelier Qc
				E. Rel	1.3	0.8	1.0	1.1	1.3	1.0	1.1	1.1	1.0	1.1	1.0	1.0	1.1			
				Buse	A-312-3												---			
03-21	2018	O	O	Ct	0.805												0.805	OK	OK	LE-08-Br
				E. Rel	0.4												0.4			
				Buse	A-312-3												---			
03-22	2018	O	N	Ct	0.785												0.785	OK	OK	LE-09-G
				E. Rel	1.1												1.1			
				Buse	A-312-3												---			
03-23	2018	O	O	Ct	0.785												0.785	OK	OK	LE-09-G
				E. Rel	0.0												0.0			

Effectué par: JM / DR / JFG / SA Date: Février 2018

Endroit de la calibration: Université Laval

Vérifié par: Eric Trépanier

Signature: Date: 2 mars 2018

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

RÉSUMÉ D'ÉTALONNAGE DES SONDES - S-05 V

Version 1 (02-03-2018)

#	Année	MDF	LV	#	1	2	3	4	5	6	7	8	9	10	11	12	Moy. V	Thermocouple (Validation)	P-T-B	Endroit
				Buse	A-312-3												---			
05-03	2018	K	N	Ct	0.769												0.769	NO	NO	LE-09-f
				E. Rel	1.5												1.5			
				Buse	A-312-3												---			
05-05	2018	N	N	Ct	0.800												0.800	NO	NO	LE-14-B
				E. Rel	1.0												1.0			
				Buse	5Q-374	5Q-434	5Q-501	5Q-681									---			
05-07	2018	K	Q	Ct	0.783	0.786	0.774	0.792									0.784	NO	NO	Atelier
				E. Rel	1.3	1.3	1.2	1.5									1.3			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-08	2018	N	N	Ct	0.786	0.786	0.783	0.780	0.783	0.779	0.779	0.781	0.809	0.804	0.798	0.802	0.789	NO	NO	LE-05-N
				E. Rel	0.4	0.8	0.8	1.3	0.9	1.2	1.3	0.8	1.4	1.2	1.3	1.2	1.1			
				Buse	A-312-3												---			
05-09	2018	N	N	Ct	0.796												0.796	NO	NO	LE-14-B
				E. Rel	1.1												1.1			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-10	2018	N	N	Ct	0.792	0.792	0.795	0.794	0.796	0.791	0.793	0.792	0.795	0.798	0.790	0.794	0.794	NO	NO	LE-05-N
				E. Rel	0.7	0.7	0.8	0.4	0.9	0.6	0.7	0.6	0.8	0.0	0.6	0.4	0.6			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-1	A-437-1	A-500-1	A-562-1	---			
05-11	2018	N	N	Ct	0.803	0.798	0.805	0.805	0.802	0.800	0.806	0.801	0.807	0.805	0.803	0.802	0.803	NO	NO	LE-02-W
				E. Rel	0.6	0.9	1.0	1.0	1.0	1.0	0.8	1.2	1.0	1.0	1.0	1.0	1.0			
				Buse	A-312-3												---			
05-12	2018	N	N	Ct	0.783												0.783	NO	NO	LE-15-B
				E. Rel	1.0												1.0			
				Buse	A-312-3												---			
05-13	2018	N	N	Ct	0.808												0.808	NO	NO	LE-11-V
				E. Rel	0.9												0.9			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-14	2018	N	N	Ct	0.828	0.824	0.830	0.830	0.830	0.825	0.813	0.816	0.839	0.836	0.832	0.826	0.827	NO	NO	LE-02-W
				E. Rel	0.7	0.0	0.4	0.0	0.4	0.9	1.0	1.5	1.4	0.8	0.8	0.8	0.7			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-15	2018	N	N	Ct	0.774	0.778	0.785	0.787	0.783	0.783	0.782	0.783	0.787	0.791	0.777	0.775	0.782	NO	NO	LE-02-W
				E. Rel	1.5	1.3	1.0	1.0	1.1	0.7	0.7	0.7	0.9	0.7	0.4	0.7	0.9			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-16	2018	N	N	Ct	0.823	0.819	0.823	0.824	0.818	0.820	0.823	0.820	0.823	0.821	0.816	0.817	0.821	NO	NO	LE-02-W
				E. Rel	0.8	0.9	0.7	0.7	0.0	0.4	0.7	0.9	0.7	0.0	0.0	0.0	0.5			
				Buse	A-312-3												---			
05-18	2018	N	N	Ct	0.767												0.767	NO	NO	LE-08-Br
				E. Rel	0.7												0.7			
				Buse	A-312-3												---			
05-19	2018	N	N	Ct	0.830												0.830	NO	NO	LE-08-Br
				E. Rel	0.7												0.7			
				Buse	A-312-3												---			
05-20	2018	N	N	Ct	0.777												0.777	NO	NO	LE-08-Br
				E. Rel	1.0												1.0			
				Buse	A-125-1	A-180-1	A-218-5	A-250-7	A-280-5	A-312-3	A-343-2	A-375-2	A-406-3	A-437-1	A-500-1	A-562-1	---			
05-21	2018	N	V	Ct	0.812	0.815	0.812	0.808	0.820	0.811	0.820	0.813	0.815	0.817	0.815	0.809	0.814	NO	NO	Atelier Qc
				E. Rel	0.4	0.4	1.0	1.0	0.4	0.0	0.7	0.9	1.0	1.0	1.0	1.0	0.7			
				Buse	A-312-3												---			
05-22	2018	N	N	Ct	0.786												0.786	NO	NO	LE-09-f
				E. Rel	0.7												0.7			

E::ectué par J / M GDR G/ Ff GSA — Date J Fé Urier 2018

Endroit de la caligration J b ni Uersité La Ual

Véri:ié par J Eric Trépanier

Sivnature J — Date J 2 mars 2018

APPENDIX 4
LABORATORY ANALYSIS REPORT

AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
ST. LAURENT, QUEBEC
CANADA H4S 1V9
TEL (514)337-1000
FAX (514)333-3046
http://www.agatlabs.com

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC
2022 LAVOISIER LOCAL 125
QUEBEC, QC G1N4L5
(418) 650-5960

À L'ATTENTION DE: Eric Trépanier

N° DE PROJET: Agnico Eagle/5528

N° BON DE TRAVAIL: 18M395832

HAUTE RÉSOLUTION VÉRIFIÉ PAR: Anastasia Kazakova, chimiste

DATE DU RAPPORT: 2018-11-01

VERSION*: 1

NOMBRE DE PAGES: 7

Si vous désirez de l'information concernant cette analyse, S.V.P. contacter votre chargé de projets au (514) 337-1000.

*NOTES

Nous disposerons des échantillons dans les 30 jours suivants les analyses. S.V.P. Contactez le laboratoire si vous désirez avoir un délai d'entreposage.

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Certificat d'analyse

N° BON DE TRAVAIL: 18M395832

N° DE PROJET: Agnico Eagle/5528

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC

À L'ATTENTION DE: Eric Trépanier

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Dioxines et furanes - Air (train d'échantillonnage - OMS 1998)

DATE DE RÉCEPTION: 2018-10-11

DATE DU RAPPORT: 2018-11-01

				501 à 506 - Inc.		507 à 512-Inc.-2		513 à 518-Inc.-3		519 à 524-Inc.
IDENTIFICATION DE L'ÉCHANTILLON:				-1						-BL
MATRICE:				Air		Air		Air		Air
DATE D'ÉCHANTILLONNAGE:				2018-09-22		2018-09-22		2018-09-22		2018-09-22
Paramètre	Unités	C / N	LDR	9616643	LDR	9616650	LDR	9616651	LDR	9616652
2,3,7,8-TCDD (pg total)	pg		1	<1	2	5	7	<7	0.8	<0.8
1,2,3,7,8 PeCDD (pg total)	pg		3	<3	9	47	10	23	2	<2
1,2,3,4,7,8 HxCDD (pg total)	pg		3	<3	7	53	10	28	2	<2
1,2,3,6,7,8 HxCDD (pg total)	pg		3	3	6	71	10	63	2	<2
1,2,3,7,8,9 HxCDD (pg total)	pg		3	<3	7	81	10	65	2	<2
1,2,3,4,6,7,8 HpCDD (pg total)	pg		6	17	10	316	10	307	5	<5
OCDD (pg total)	pg		20	33	10	160	20	300	20	<20
2,3,7,8 TCDF (pg total)	pg		4	15	6	48	9	216	2	<2
1,2,3,7,8 PeCDF (pg total)	pg		8	<8	9	21	20	62	2	<2
2,3,4,7,8-PeCDF (pg total)	pg		6	9	7	43	10	165	2	<2
1,2,3,4,7,8 HxCDF (pg total)	pg		4	13	10	62	10	326	2	<2
1,2,3,6,7,8 HxCDF (pg total)	pg		4	9	10	25	10	120	2	<2
2,3,4,6,7,8-HxCDF (pg total)	pg		4	8	10	50	10	273	2	<2
1,2,3,7,8,9 HxCDF (pg total)	pg		6	<6	20	<20	20	30	3	<3
1,2,3,4,6,7,8 HpCDF (pg total)	pg		3	16	5	64	20	474	2	<2
1,2,3,4,7,8,9 HpCDF (pg total)	pg		6	<6	8	8	20	100	3	<3
OCDF (pg total)	pg		9	20	7	17	30	227	7	<7
Sommation des Tétrachlorodibenzodioxines	pg		1	9	2	159	7	214	0.8	3.3
Sommation des Pentachlorodibenzodioxines	pg		3	11	9	446	10	406	2	8
Sommation des Hexachlorodibenzodioxines	pg		3	25	7	900	10	718	2	5
Sommation des Heptachlorodibenzodioxines	pg		6	20	10	334	10	315	5	<5
Sommation des PCDDs	pg		20	99	10	2000	20	1950	20	<20
Sommation des Tétrachlorodibenzofuranes	pg		4	100	6	282	9	1140	2	20

Certifié par:

La procédure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accréditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDELCC. Toutes les signatures sur les certificats d'AGAT sont protégées par des mots de passe et les signataires rencontrent les exigences des domaines d'accréditation ainsi que les exigences régionales approuvées par CALA, CCN et MDDELCC.

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Certificat d'analyse

N° BON DE TRAVAIL: 18M395832

N° DE PROJET: Agnico Eagle/5528

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC

À L'ATTENTION DE: Eric Trépanier

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Dioxines et furanes - Air (train d'échantillonnage - OMS 1998)

DATE DE RÉCEPTION: 2018-10-11

DATE DU RAPPORT: 2018-11-01

IDENTIFICATION DE L'ÉCHANTILLON:				501 à 506 - Inc. -1		507 à 512-Inc.-2		513 à 518-Inc.-3		519 à 524-Inc. -BL
MATRICE:				Air		Air		Air		Air
DATE D'ÉCHANTILLONNAGE:				2018-09-22		2018-09-22		2018-09-22		2018-09-22
Paramètre	Unités	C / N	LDR	9616643	LDR	9616650	LDR	9616651	LDR	9616652
Sommation des Pentachlorodibenzofuranes	pg		8	72	9	406	20	1540	2	15
Sommation des Hexachlorodibenzofuranes	pg		6	32	20	172	20	963	3	3
Sommation des Heptachlorodibenzofuranes	pg		6	28	8	123	20	880	3	5
Sommation des PCDFs	pg		9	253	20	1000	30	4750	7	43
2,3,7,8-Tetra CDD (TEF 1.0)	TEQ			0		5.30		0		0
1,2,3,7,8-Penta CDD (TEF 1.0)	TEQ			0		47.2		23.4		0
1,2,3,4,7,8-Hexa CDD (TEF 0.1)	TEQ			0		5.31		2.83		0
1,2,3,6,7,8-Hexa CDD (TEF 0.1)	TEQ			0.296		7.05		6.32		0
1,2,3,7,8,9-Hexa CDD (TEF 0.1)	TEQ			0		8.11		6.46		0
1,2,3,4,6,7,8-Hepta CDD (TEF 0.01)	TEQ			0.171		3.16		3.07		0
Octa CDD (TEF 0.0001)	TEQ			0.00335		0.0160		0.0300		0
2,3,7,8-Tetra CDF (TEF 0.1)	TEQ			1.48		4.84		21.6		0
1,2,3,7,8-Penta CDF (TEF 0.05)	TEQ			0		1.03		3.12		0
2,3,4,7,8-Penta CDF (TEF 0.5)	TEQ			4.36		21.6		82.5		0
1,2,3,4,7,8-Hexa CDF (TEF 0.1)	TEQ			1.30		6.24		32.6		0
1,2,3,6,7,8-Hexa CDF (TEF 0.1)	TEQ			0.926		2.48		12.0		0
2,3,4,6,7,8-Hexa CDF (TEF 0.1)	TEQ			0.818		4.96		27.3		0
1,2,3,7,8,9-Hexa CDF (TEF 0.1)	TEQ			0		0		3.04		0
1,2,3,4,6,7,8-Hepta CDF (TEF 0.01)	TEQ			0.162		0.636		4.74		0
1,2,3,4,7,8,9-Hepta CDF (TEF 0.01)	TEQ			0		0.0830		0.998		0
Octa CDF (TEF 0.0001)	TEQ			0.00201		0.00173		0.0227		0
Sommation des PCDDs et PCDFs (TEQ)				9.51		118		230		0

Certifié par:

La procédure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accréditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDELCC. Toutes les signatures sur les certificats d'AGAT sont protégées par des mots de passe et les signataires rencontrent les exigences des domaines d'accréditation ainsi que les exigences régionales approuvées par CALA, CCN et MDDELCC.

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Certificat d'analyse

N° BON DE TRAVAIL: 18M395832

N° DE PROJET: Agnico Eagle/5528

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC

À L'ATTENTION DE: Eric Trépanier

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Dioxines et furanes - Air (train d'échantillonnage - OMS 1998)

DATE DE RÉCEPTION: 2018-10-11

DATE DU RAPPORT: 2018-11-01

			501 à 506 - Inc.			519 à 524-Inc.
	IDENTIFICATION DE L'ÉCHANTILLON:		-1	507 à 512-Inc.-2	513 à 518-Inc.-3	-BL
	MATRICE:		Air	Air	Air	Air
	DATE D'ÉCHANTILLONNAGE:		2018-09-22	2018-09-22	2018-09-22	2018-09-22
Étalon de recouvrement	Unités	Limites	9616643	9616650	9616651	9616652
13C-2378-TCDF	%	30-140	56	60	45	54
13C-12378-PeCDF	%	30-140	48	48	38	52
13C-23478-PeCDF	%	30-140	71	60	56	55
13C-123478-HxCDF	%	30-140	84	89	72	73
13C-123678-HxCDF	%	30-140	94	95	68	88
13C-234678-HxCDF	%	30-140	104	109	68	86
13C-123789-HxCDF	%	30-140	94	101	60	72
13C-1234678-HpCDF	%	30-140	70	72	49	64
13C-1234789-HpCDF	%	30-140	57	61	51	55
13C-2378-TCDD	%	30-140	75	73	54	74
13C-12378-PeCDD	%	30-140	65	61	50	60
13C-123478-HxCDD	%	30-140	99	103	72	77
13C-123678-HxCDD	%	30-140	103	117	67	98
13C-1234678-HxCDD	%	30-140	58	62	50	57
13C-OCDD	%	30-140	31	37	33	30

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes

9616643-9616652 Le résultat en pg total correspond au composite de chacune des parties du train d'échantillonnage.

Certifié par:

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Contrôle de qualité

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC
N° BON DE TRAVAIL: 18M395832
N° DE PROJET: Agnico Eagle/5528
À L'ATTENTION DE: Eric Trépanier
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

Analyse haute résolution

Date du rapport: 2018-11-01			DUPLICATA			MATÉRIAU DE RÉFÉRENCE				BLANC FORTIFIÉ			ÉCH. FORTIFIÉ		
PARAMÈTRE	Lot	N° éch.	Dup #1	Dup #2	% d'écart	Blanc de méthode	% Récup.	Limites		% Récup.	Limites		% Récup.	Limites	
								Inf.	Sup.		Inf.	Sup.		Inf.	Sup.
Dioxines et furanes - Air (train d'échantillonnage - OMS 1998)															
2,3,7,8-TCDD (pg total)	1	MR	32	30	0.0	< 0.7	80%	70%	130%	NA	70%	130%	74%	70%	130%
1,2,3,7,8 PeCDD (pg total)	1	MR	165	178	0.0	< 2	82%	70%	130%	NA	70%	130%	89%	70%	130%
1,2,3,4,7,8 HxCDD (pg total)	1	MR	179	180	0.0	< 2	89%	70%	130%	NA	70%	130%	90%	70%	130%
1,2,3,6,7,8 HxCDD (pg total)	1	MR	197	183	0.0	< 2	99%	70%	130%	NA	70%	130%	92%	70%	130%
1,2,3,7,8,9 HxCDD (pg total)	1	MR	201	183	0.0	< 2	100%	70%	130%	NA	70%	130%	91%	70%	130%
1,2,3,4,6,7,8 HpCDD (pg total)	1	MR	184	179	0.0	< 2	92%	70%	130%	NA	70%	130%	89%	70%	130%
OCDD (pg total)	1	MR	376	341	0.0	< 4	94%	70%	130%	NA	70%	130%	85%	70%	130%
2,3,7,8 TCDF (pg total)	1	MR	37	39	0.0	< 2	92%	70%	130%	NA	70%	130%	97%	70%	130%
1,2,3,7,8 PeCDF (pg total)	1	MR	208	214	0.0	< 2	104%	70%	130%	NA	70%	130%	107%	70%	130%
2,3,4,7,8-PeCDF (pg total)	1	MR	204	215	0.0	< 1	102%	70%	130%	NA	70%	130%	107%	70%	130%
1,2,3,4,7,8 HxCDF (pg total)	1	MR	197	194	0.0	< 2	98%	70%	130%	NA	70%	130%	97%	70%	130%
1,2,3,6,7,8 HxCDF (pg total)	1	MR	209	209	0.0	< 2	105%	70%	130%	NA	70%	130%	105%	70%	130%
2,3,4,6,7,8-HxCDF (pg total)	1	MR	209	203	0.0	< 2	105%	70%	130%	NA	70%	130%	102%	70%	130%
1,2,3,7,8,9 HxCDF (pg total)	1	MR	196	197	0.0	< 3	98%	70%	130%	NA	70%	130%	98%	70%	130%
1,2,3,4,6,7,8 HpCDF (pg total)	1	MR	195	187	0.0	< 2	97%	70%	130%	NA	70%	130%	94%	70%	130%
1,2,3,4,7,8,9 HpCDF (pg total)	1	MR	197	190	0.0	< 3	99%	70%	130%	NA	70%	130%	95%	70%	130%
OCDF (pg total)	1	MR	427	401	0.0	< 3	107%	70%	130%	NA	70%	130%	100%	70%	130%

Certifié par:

La procédure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accréditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDELCC. Toutes les signatures sur les certificats d'AGAT sont protégées par des mots de passe et les signataires rencontrent les exigences des domaines d'accréditation ainsi que les exigences régionales approuvées par CALA, CCN et MDDELCC.

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AGAT Laboratoires

9770 ROUTE TRANSCANADIENNE
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Sommaire de méthode

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC

N° BON DE TRAVAIL: 18M395832

N° DE PROJET: Agnico Eagle/5528

À L'ATTENTION DE: Eric Trépanier

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

PARAMÈTRE	PRÉPARÉ LE	ANALYSÉ LE	AGAT P.O.N.	RÉFÉRENCE DE LITTÉRATURE	TECHNIQUE ANALYTIQUE
Analyse haute résolution					
2,3,7,8-TCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8 PeCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8 HxCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,6,7,8 HxCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8,9 HxCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,6,7,8 HpCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
OCDD (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,7,8 TCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8 PeCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,4,7,8-PeCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8 HxCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,6,7,8 HxCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,4,6,7,8-HxCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8,9 HxCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,6,7,8 HpCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8,9 HpCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
OCDF (pg total)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Tétrachlorodibenzodioxines	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Pentachlorodibenzodioxines	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Hexachlorodibenzodioxines	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Heptachlorodibenzodioxines	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des PCDDs	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Tétrachlorodibenzofuranes	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Pentachlorodibenzofuranes	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Hexachlorodibenzofuranes	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des Heptachlorodibenzofuranes	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des PCDFs	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,7,8-Tetra CDD (TEF 1.0)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8-Penta CDD (TEF 1.0)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8-Hexa CDD (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,6,7,8-Hexa CDD (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8,9-Hexa CDD (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,6,7,8-Hepta CDD (TEF 0.01)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Octa CDD (TEF 0.0001)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,7,8-Tetra CDF (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8-Penta CDF (TEF 0.05)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,4,7,8-Penta CDF (TEF 0.5)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8-Hexa CDF (TEF 0.1)	2018-10-25	2018-10-31	HR_151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,6,7,8-Hexa CDF (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
2,3,4,6,7,8-Hexa CDF (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,7,8,9-Hexa CDF (TEF 0.1)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,6,7,8-Hepta CDF (TEF 0.01)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
1,2,3,4,7,8,9-Hepta CDF (TEF 0.01)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS

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Sommaire de méthode

NOM DU CLIENT: CONSULAIR GASTON BOULANGER INC

N° BON DE TRAVAIL: 18M395832

N° DE PROJET: Agnico Eagle/5528

À L'ATTENTION DE: Eric Trépanier

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

PARAMÈTRE	PRÉPARÉ LE	ANALYSÉ LE	AGAT P.O.N.	RÉFÉRENCE DE LITTÉRATURE	TECHNIQUE ANALYTIQUE
Octa CDF (TEF 0.0001)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
Sommation des PCDDs et PCDFs (TEQ)	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-2378-TCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-12378-PeCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-23478-PeCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-123478-HxCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-123678-HxCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-234678-HxCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-123789-HxCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-1234678-HpCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-1234789-HpCDF	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-2378-TCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-12378-PeCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-123478-HxCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-123678-HxCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-1234678-HxCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS
13C-OCDD	2018-10-25	2018-10-31	HR-151-5400	EPA 1613/EPA Method 23	HRMS

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CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT
LABORATOIRE 483

RAPPORT D'ESSAI

Date : 21 novembre 2018

Réf : P2334-1

Client

 # Client : C8

Nom : Trépanier Éric

Téléphone : (418) 650-5960 # 2208

Courriel : eric.trepanier@consul-air.com

Adresse :
CONSULAIR Québec
125-2022,rue Lavoisier
Québec QC
G1N 4L5 Canada

Résumé du projet

Nb. d'objets : 4

 # Projet lab. : P2334

Votre # projet : 18-5528

Chantier : Agnico-Eagle

Résumé des essais

Paramètre(s) non accrédités

ST	Paramètre	Q.	Principe (Méthode)	Matrice
	Chlorures (Cl)	4	Spectrophotométrie	Eau

ST : Paramètre Sous-Traité

Résultats d'essai(s)

ST	Param.	Échantillon (s)		Dates			Résultat(s)		LDR
		# Lab	*# Client*	*Échantillon.*	*Récep.*	*Essai*	*Valeur*	*Unité*	
	Cl	171018-8	**304 - Inc - B1 - 1**	22-09-18	17-10-18	30-10-18	**86.87**	mg	1.76
		171018-9	**312 - Inc - B1 - 2**	28-09-18	17-10-18	30-10-18	**33.16**	mg	0.73
		171018-10	**320 - Inc - B1 - 3**	29-09-18	17-10-18	30-10-18	**119.33**	mg	1.87
		171018-11	**328 - Bl - Eau - Bl**	23-09-18	17-10-18	30-10-18	**< LDR**	mg	0.04

ST : Essai Sous-Traité
LDR : Limite de Détection Rapportée

Commentaire(s)

1.

Contrôle de qualité

ST	Param.	Date	# Réf	Type	Résultat(s)		LDR
					Valeur	***Unité***	
	Cl	30-10-18	BL3010	BL	< LDR	mg/l	0.39
			MR3010	MR	103.4	% Récup.	-
			AD171018-9	AD	103.1	% Récup.	-
			AD171018-11	AD	101.8	% Récup.	-

ST : Contrôle qualité Sous-Traité
 # Réf : Référence du contrôle qualité dans le système de suivi du laboratoire
BL : Blanc
MR : Matériau de Référence
DP : Duplicata
RP : Réplicata
AD : Ajout Dosé
EA : Étalon Analogue
TM: Témoin de l'extraction
LDR : Limite de Détection Rapportée

Signature

Les résultats ne se rapportent qu'aux objets soumis à l'essai
Tout ou partie de ce document ne peut être reproduit sans l'autorisation du laboratoire de CONSULAIR.
Ce rapport d'essai est certifié par la (les) personne(s) mentionnée(s) ci-après.
Pour toute question concernant ce certificat d'analyse, veuillez vous adresser directement à :

Malha Kirèche

Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE
Votre # Bordereau: N/A

Attention: Éric Trépanier

CONSULAIR INC.
2022 Lavoisier
Local 125
Québec, QC
Canada G1N 4L5

Date du rapport: 2018/11/21
Rapport: R2413187
Version: 1 - Finale

CERTIFICAT D'ANALYSES

 # DE DOSSIER MAXXAM: B847715
Reçu: 2018/10/19, 12:30

Matrice: FILTRE
Nombre d'échantillons reçus: 4

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Métaux extractibles totaux par ICP-MS	4	2018/11/06	2018/11/06	STL SOP-00075	MA.200–Mét. 1.2 R5 m

Matrice: Solution barboteur
Nombre d'échantillons reçus: 16

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Mercure par AAVF	2	2018/10/30	2018/10/31	STL SOP-00042	MA.200–Hg 1.1 R1 m
Mercure par AAVF	2	2018/11/01	2018/11/05	STL SOP-00042	MA.200–Hg 1.1 R1 m
Métaux extractibles	5	2018/11/01	2018/11/05	STL SOP-00075	MA.200–Mét. 1.2 R5 m
Métaux extractibles	3	2018/11/06	2018/11/07	STL SOP-00075	MA.200–Mét. 1.2 R5 m
Métaux extractibles	4	2018/11/14	2018/11/17	STL SOP-00075	MA.200–Mét. 1.2 R5 m
Volume d'échantillon	3	2018/11/02	2018/11/02		

Matrice: SOLVANT
Nombre d'échantillons reçus: 4

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Métaux extractibles	4	2018/11/06	2018/11/07	STL SOP-00075	MA.200–Mét. 1.2 R5 m

Matrice: TRAIN
Nombre d'échantillons reçus: 4

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Métaux extractibles	4	2018/11/01	2018/11/08	STL SOP-00075	MA.200–Mét. 1.2 R5 m

Remarques:

Les laboratoires Maxxam sont certifiés ISO/IEC 17025:2005 pour certains paramètres précis des portées d'accréditation. Sauf indication contraire, les méthodes d'analyses utilisées par Maxxam s'inspirent des méthodes de référence d'organismes provinciaux, fédéraux et américains, tels que le CCME, le MDDELCC, l'EPA et l'APHA.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE
Votre # Bordereau: N/A

Attention: Éric Trépanier

CONSULAIR INC.
2022 Lavoisier
Local 125
Québec, QC
Canada G1N 4L5

Date du rapport: 2018/11/21
Rapport: R2413187
Version: 1 - Finale

CERTIFICAT D'ANALYSES

 # DE DOSSIER MAXXAM: B847715

Reçu: 2018/10/19, 12:30

Toutes les analyses présentées ont été réalisées conformément aux procédures et aux pratiques relatives à la méthodologie, à l'assurance qualité et au contrôle de la qualité généralement appliqués par les employés de Maxxam (sauf s'il en a été convenu autrement par écrit entre le client et Maxxam). Toutes les données de laboratoire rencontrent les contrôles statistiques et respectent tous les critères de CQ et les critères de performance des méthodes, sauf s'il en a été signalé autrement. Tous les blancs de méthode sont rapportés, toutefois, les données des échantillons correspondants ne sont pas corrigées pour la valeur du blanc, sauf indication contraire. Le cas échéant, sauf indication contraire, l'incertitude de mesure n'a pas été prise en considération lors de la déclaration de la conformité à la norme de référence.

Les responsabilités de Maxxam sont restreintes au coût réel de l'analyse, sauf s'il en a été convenu autrement par écrit. Il n'existe aucune autre garantie, explicite ou implicite. Le client a fait appel à Maxxam pour l'analyse de ses échantillons conformément aux méthodes de référence mentionnées dans ce rapport. L'interprétation et l'utilisation des résultats sont sous l'entière responsabilité du client et ne font pas partie des services offerts par Maxxam, sauf si convenu autrement par écrit. Maxxam ne peut pas garantir l'exactitude des résultats qui dépendent des renseignements fournis par le client ou son représentant.

Les résultats des échantillons solides, sauf les biotes, sont rapportés en fonction de la masse sèche, sauf indication contraire. Les analyses organiques ne sont pas corrigées en fonction de la récupération, sauf pour les méthodes de dilution isotopique.
Les résultats s'appliquent seulement aux échantillons analysés. Si l'échantillonnage n'est pas effectué par Maxxam, les résultats se rapportent aux échantillons fournis pour analyse.
Le présent rapport ne doit pas être reproduit, sinon dans son intégralité, sans le consentement écrit du laboratoire.

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.

Notez: Les données brutes sont utilisées pour le calcul du RPD (% d'écart relatif). L'arrondissement des résultats finaux peut expliquer la variation apparente.

Note : Les paramètres inclus dans le présent certificat sont accrédités par le MDDELCC, à moins d'indication contraire.

clé de cryptage

Veuillez adresser toute question concernant ce certificat d'analyse à votre chargé(e) de projets
Argyro Frangoulis, Chargée de projets
Courriel: afrangoulis@maxxam.ca
Téléphone (514)448-9001 Ext:7066229

==========

Maxxam a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à la section 5.10.2 de la norme ISO/CEI 17025:2005(E). Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FX5271	FX5271			FX5389		
Date d'échantillonnage		2018/09/22	2018/09/22			2018/09/22		
# Bordereau		N/A	N/A			N/A		
	Unités	**305-INC-B2345-1 VT:334ML**	**305-INC-B2345-1 VT:334ML Dup. de Lab.**	**LDR**	**Lot CQ**	**307+308-INC-B67-1 VT:615ML**	**LDR**	**Lot CQ**
MÉTAUX								
Aluminium (Al) †	ug	9	8	3	1949070			
Antimoine (Sb) †	ug	<0.3	<0.3	0.3	1949070			
Argent (Ag) †	ug	<2	<2	2	1949070			
Arsenic (As) †	ug	<0.3	<0.3	0.3	1949070			
Baryum (Ba) †	ug	0.2	0.2	0.2	1949070			
Béryllium (Be) †	ug	<0.2	<0.2	0.2	1949070			
Bismuth (Bi) †	ug	<0.2	<0.2	0.2	1949070			
Bore (B) †	ug	2.6	3.6	0.7	1949070			
Cadmium (Cd) †	ug	1.4	1.4	0.2	1949070			
Calcium (Ca) †	ug	126	123	20	1949070			
Chrome (Cr) †	ug	<0.3	<0.3	0.3	1949070			
Cobalt (Co) †	ug	<0.3	<0.3	0.3	1949070			
Cuivre (Cu) †	ug	2.1	1.9	0.3	1949070			
Etain (Sn) †	ug	24	23	2	1949070			
Fer (Fe) †	ug	21	20	20	1949070			
Lithium (Li) †	ug	<3	<3	3	1949070			
Magnésium (Mg) †	ug	96	93	7	1949070			
Manganèse (Mn) †	ug	49.3	49.4	0.3	1949070			
Mercure (Hg)	ug					0.85	0.31	1949380
Mercure (Hg) †	ug	0.4	<0.2	0.2	1949070			
Molybdène (Mo) †	ug	<2	<2	2	1949070			
Nickel (Ni) †	ug	0.4	0.4	0.3	1949070			
Plomb (Pb) †	ug	<2	<2	2	1949070			
Potassium (K) †	ug	34	41	30	1949070			
Sélénium (Se) †	ug	<0.3	<0.3	0.3	1949070			
Silicium (Si) †	ug	46	49	20	1949070			
Sodium (Na) †	ug	<20	<20	20	1949070			
Strontium (Sr) †	ug	<0.3	<0.3	0.3	1949070			
Thallium (Tl) †	ug	<0.3	<0.3	0.3	1949070			
Titane (Ti) †	ug	<3	<3	3	1949070			
Vanadium (V) †	ug	<0.7	<0.7	0.7	1949070			
Zinc (Zn) †	ug	7.5	7.1	0.3	1949070			

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
Duplicata de laboratoire
† Accréditation non existante pour ce paramètre

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FX5496			FX5497		
Date d'échantillonnage		2018/09/28			2018/09/28		
# Bordereau		N/A			N/A		
	Unités	**313-INC-B2345-2 VT:323ML**	**LDR**	**Lot CQ**	**315+316-INC-B67-2 VT:625ML**	**LDR**	**Lot CQ**
MÉTAUX							
Aluminium (Al) †	ug	7	3	1949070			
Antimoine (Sb) †	ug	<0.3	0.3	1949070			
Argent (Ag) †	ug	<2	2	1949070			
Arsenic (As) †	ug	<0.3	0.3	1949070			
Baryum (Ba) †	ug	0.4	0.2	1949070			
Béryllium (Be) †	ug	<0.2	0.2	1949070			
Bismuth (Bi) †	ug	<0.2	0.2	1949070			
Bore (B) †	ug	0.9	0.6	1949070			
Cadmium (Cd) †	ug	0.5	0.2	1949070			
Calcium (Ca) †	ug	60	20	1949070			
Chrome (Cr) †	ug	<0.3	0.3	1949070			
Cobalt (Co) †	ug	<0.3	0.3	1949070			
Cuivre (Cu) †	ug	0.4	0.3	1949070			
Etain (Sn) †	ug	22	2	1949070			
Fer (Fe) †	ug	<20	20	1949070			
Lithium (Li) †	ug	<3	3	1949070			
Magnésium (Mg) †	ug	13	6	1949070			
Manganèse (Mn) †	ug	3.1	0.3	1949070			
Mercure (Hg)	ug				0.60	0.31	1949380
Mercure (Hg) †	ug	<0.2	0.2	1949070			
Molybdène (Mo) †	ug	<2	2	1949070			
Nickel (Ni) †	ug	<0.3	0.3	1949070			
Plomb (Pb) †	ug	<2	2	1949070			
Potassium (K) †	ug	<30	30	1949070			
Sélénium (Se) †	ug	<0.3	0.3	1949070			
Silicium (Si) †	ug	21	20	1949070			
Sodium (Na) †	ug	<20	20	1949070			
Strontium (Sr) †	ug	<0.3	0.3	1949070			
Thallium (Tl) †	ug	<0.3	0.3	1949070			
Titane (Ti) †	ug	<3	3	1949070			
Vanadium (V) †	ug	<0.6	0.6	1949070			
Zinc (Zn) †	ug	1.3	0.3	1949070			

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FX5498			FX5499		
Date d'échantillonnage		2018/09/29			2018/09/29		
# Bordereau		N/A			N/A		
	Unités	**321-INC-B2345-3 VT:330ML**	**LDR**	**Lot CQ**	**323+324-INC-B67-3 VT:625ML**	**LDR**	**Lot CQ**
MÉTAUX							
Aluminium (Al) †	ug	9	3	1949070			
Antimoine (Sb) †	ug	<0.3	0.3	1949070			
Argent (Ag) †	ug	<2	2	1949070			
Arsenic (As) †	ug	<0.3	0.3	1949070			
Baryum (Ba) †	ug	<0.2	0.2	1949070			
Béryllium (Be) †	ug	<0.2	0.2	1949070			
Bismuth (Bi) †	ug	<0.2	0.2	1949070			
Bore (B) †	ug	6.7	0.7	1949070			
Cadmium (Cd) †	ug	0.3	0.2	1949070			
Calcium (Ca) †	ug	137	20	1949070			
Chrome (Cr) †	ug	<0.3	0.3	1949070			
Cobalt (Co) †	ug	<0.3	0.3	1949070			
Cuivre (Cu) †	ug	2.3	0.3	1949070			
Etain (Sn) †	ug	23	2	1949070			
Fer (Fe) †	ug	54	20	1949070			
Lithium (Li) †	ug	<3	3	1949070			
Magnésium (Mg) †	ug	39	7	1949070			
Manganèse (Mn) †	ug	1.2	0.3	1949070			
Mercure (Hg)	ug				<0.31	0.31	1948181
Mercure (Hg) †	ug	<0.2	0.2	1949070			
Molybdène (Mo) †	ug	<2	2	1949070			
Nickel (Ni) †	ug	0.3	0.3	1949070			
Plomb (Pb) †	ug	<2	2	1949070			
Potassium (K) †	ug	<30	30	1949070			
Sélénium (Se) †	ug	<0.3	0.3	1949070			
Silicium (Si) †	ug	48	20	1949070			
Sodium (Na) †	ug	<20	20	1949070			
Strontium (Sr) †	ug	<0.3	0.3	1949070			
Thallium (Tl) †	ug	<0.3	0.3	1949070			
Titane (Ti) †	ug	<3	3	1949070			
Vanadium (V) †	ug	<0.7	0.7	1949070			
Zinc (Zn) †	ug	4.4	0.3	1949070			

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Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FX5500			FX5502		
Date d'échantillonnage		2018/09/23			2018/09/23		
# Bordereau		N/A			N/A		
	Unités	**329-BL-B123-BL VT:200ML**	**LDR**	**Lot CQ**	**330+331-BL-B56-BL VT:325ML**	**LDR**	**Lot CQ**
MÉTAUX							
Aluminium (Al) †	ug	4	2	1949070			
Antimoine (Sb) †	ug	<0.2	0.2	1949070			
Argent (Ag) †	ug	<1	1	1949070			
Arsenic (As) †	ug	<0.2	0.2	1949070			
Baryum (Ba) †	ug	<0.1	0.1	1949070			
Béryllium (Be) †	ug	<0.1	0.1	1949070			
Bismuth (Bi) †	ug	<0.1	0.1	1949070			
Bore (B) †	ug	0.9	0.4	1949070			
Cadmium (Cd) †	ug	0.8	0.1	1949070			
Calcium (Ca) †	ug	43	10	1949070			
Chrome (Cr) †	ug	0.2	0.2	1949070			
Cobalt (Co) †	ug	<0.2	0.2	1949070			
Cuivre (Cu) †	ug	<0.2	0.2	1949070			
Etain (Sn) †	ug	22	1	1949070			
Fer (Fe) †	ug	19	10	1949070			
Lithium (Li) †	ug	<2	2	1949070			
Magnésium (Mg) †	ug	10	4	1949070			
Manganèse (Mn) †	ug	0.5	0.2	1949070			
Mercure (Hg)	ug				<0.16	0.16	1948181
Mercure (Hg) †	ug	<0.1	0.1	1949070			
Molybdène (Mo) †	ug	<1	1	1949070			
Nickel (Ni) †	ug	<0.2	0.2	1949070			
Plomb (Pb) †	ug	<1	1	1949070			
Potassium (K) †	ug	<20	20	1949070			
Sélénium (Se) †	ug	<0.2	0.2	1949070			
Silicium (Si) †	ug	23	10	1949070			
Sodium (Na) †	ug	<10	10	1949070			
Strontium (Sr) †	ug	<0.2	0.2	1949070			
Thallium (Tl) †	ug	<0.2	0.2	1949070			
Titane (Ti) †	ug	<2	2	1949070			
Vanadium (V) †	ug	<0.4	0.4	1949070			
Zinc (Zn) †	ug	0.5	0.2	1949070			

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† Accréditation non existante pour ce paramètre

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Dossier Maxxam: B847715
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CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FZ0589	FZ0590		FZ0591		
Date d'échantillonnage		2018/09/22	2018/09/28		2018/09/29		
# Bordereau		N/A	N/A		N/A		
	Unités	**304-INC-B1-1 VT:180ML**	**312-INC-B1-2 VT:188ML**	**LDR**	**320-INC-B1-3 VT:240ML**	**LDR**	**Lot CQ**
MÉTAUX							
Aluminium (Al) †	ug	3	3	2	5	2	1952598
Antimoine (Sb) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Argent (Ag) †	ug	<0.9	<0.9	0.9	<1	1	1952598
Arsenic (As) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Baryum (Ba) †	ug	0.25	0.15	0.09	0.2	0.1	1952598
Béryllium (Be) †	ug	<0.09	<0.09	0.09	<0.1	0.1	1952598
Bismuth (Bi) †	ug	<0.09	<0.09	0.09	<0.1	0.1	1952598
Bore (B) †	ug	19.9	9.5	0.4	92.6	0.5	1952598
Cadmium (Cd) †	ug	<0.09	<0.09	0.09	<0.1	0.1	1952598
Calcium (Ca) †	ug	18	32	9	17	10	1952598
Chrome (Cr) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Cobalt (Co) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Cuivre (Cu) †	ug	0.5	0.7	0.2	<0.2	0.2	1952598
Etain (Sn) †	ug	<0.9	<0.9	0.9	<1	1	1952598
Fer (Fe) †	ug	<9	521	9	<10	10	1952598
Lithium (Li) †	ug	<2	<2	2	<2	2	1952598
Magnésium (Mg) †	ug	5	<4	4	<5	5	1952598
Manganèse (Mn) †	ug	1.9	4.4	0.2	0.3	0.2	1952598
Mercure (Hg) †	ug	<0.09	0.12	0.09	0.1	0.1	1952598
Molybdène (Mo) †	ug	<0.9	<0.9	0.9	<1	1	1952598
Nickel (Ni) †	ug	0.2	0.4	0.2	<0.2	0.2	1952598
Plomb (Pb) †	ug	<0.9	<0.9	0.9	<1	1	1952598
Potassium (K) †	ug	<20	<20	20	<20	20	1952598
Sélénium (Se) †	ug	0.9	0.3	0.2	0.5	0.2	1952598
Silicium (Si) †	ug	12	11	9	148	10	1952598
Sodium (Na) †	ug	<9	<9	9	<10	10	1952598
Strontium (Sr) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Thallium (Tl) †	ug	<0.2	<0.2	0.2	<0.2	0.2	1952598
Titane (Ti) †	ug	<2	<2	2	<2	2	1952598
Vanadium (V) †	ug	<0.4	<0.4	0.4	<0.5	0.5	1952598
Zinc (Zn) †	ug	2.2	1.3	0.2	0.7	0.2	1952598

LDR = Limite de détection rapportée
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† Accréditation non existante pour ce paramètre

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CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (SOLUTION BARBOTEUR)

ID Maxxam		FZ0592		
Date d'échantillonnage		2018/09/23		
# Bordereau		N/A		
	Unités	**328-BL-EAU-BL VT:100ML**	**LDR**	**Lot CQ**
MÉTAUX				
Aluminium (Al) †	ug	<1	1	1952598
Antimoine (Sb) †	ug	<0.1	0.1	1952598
Argent (Ag) †	ug	<0.5	0.5	1952598
Arsenic (As) †	ug	<0.1	0.1	1952598
Baryum (Ba) †	ug	0.07	0.05	1952598
Béryllium (Be) †	ug	<0.05	0.05	1952598
Bismuth (Bi) †	ug	<0.05	0.05	1952598
Bore (B) †	ug	0.6	0.2	1952598
Cadmium (Cd) †	ug	<0.05	0.05	1952598
Calcium (Ca) †	ug	<5	5	1952598
Chrome (Cr) †	ug	<0.1	0.1	1952598
Cobalt (Co) †	ug	<0.1	0.1	1952598
Cuivre (Cu) †	ug	<0.1	0.1	1952598
Etain (Sn) †	ug	<0.5	0.5	1952598
Fer (Fe) †	ug	<5	5	1952598
Lithium (Li) †	ug	<1	1	1952598
Magnésium (Mg) †	ug	<2	2	1952598
Manganèse (Mn) †	ug	0.2	0.1	1952598
Mercure (Hg) †	ug	<0.05	0.05	1952598
Molybdène (Mo) †	ug	<0.5	0.5	1952598
Nickel (Ni) †	ug	<0.1	0.1	1952598
Plomb (Pb) †	ug	<0.5	0.5	1952598
Potassium (K) †	ug	<10	10	1952598
Sélénium (Se) †	ug	<0.1	0.1	1952598
Silicium (Si) †	ug	<5	5	1952598
Sodium (Na) †	ug	<5	5	1952598
Strontium (Sr) †	ug	<0.1	0.1	1952598
Thallium (Tl) †	ug	<0.1	0.1	1952598
Titane (Ti) †	ug	<1	1	1952598
Vanadium (V) †	ug	<0.2	0.2	1952598
Zinc (Zn) †	ug	0.3	0.1	1952598

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

PARAMÈTRES CONVENTIONNELS (SOLUTION BARBOTEUR)

ID Maxxam		FY0848	FY0856	FY0857	
Date d'échantillonnage		2018/09/22	2018/09/28	2018/09/29	
# Bordereau		N/A	N/A	N/A	
	Unités	**302-INC-BS-HNO3-1**	**310-INC-BS-HNO3-2**	**318-INC-BS-HNO3-3**	**Lot CQ**
CONVENTIONNELS					
Volume final †	ml	88	110	66	1949618

Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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CONSULAIR INC.
Votre # du projet: 18-5528
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MÉTAUX (TRAIN)

ID Maxxam		FY0848		FY0856		FY0857		
Date d'échantillonnage		2018/09/22		2018/09/28		2018/09/29		
# Bordereau		N/A		N/A		N/A		
	Unités	**301+302+303-INC-1**	**LDR**	**309+310+311-INC-2**	**LDR**	**317+318+319-INC-3**	**LDR**	**Lot CQ**
MÉTAUX								
Aluminium (Al) †	ug	570	2	30	2	46	2	1949322
Antimoine (Sb) †	ug	245	0.1	3.6	0.1	219	0.1	1949322
Argent (Ag) †	ug	0.9	0.5	<0.6	0.6	1.3	0.5	1949322
Arsenic (As) †	ug	17.2	0.1	1.3	0.1	30.9	0.1	1949322
Baryum (Ba) †	ug	7.28	0.05	0.65	0.06	1.06	0.05	1949322
Béryllium (Be) †	ug	<0.05	0.05	<0.06	0.06	<0.05	0.05	1949322
Bismuth (Bi) †	ug	0.84	0.05	0.12	0.06	4.83	0.05	1949322
Bore (B) †	ug	4.1	0.5	4.0	0.5	3.7	0.5	1949322
Cadmium (Cd) †	ug	2.47	0.05	0.45	0.06	9.52	0.05	1949322
Calcium (Ca) †	ug	1930	50	309	50	243	50	1949322
Chrome (Cr) †	ug	18.2	0.1	5.1	0.1	73.4	0.1	1949322
Cobalt (Co) †	ug	0.5	0.1	<0.1	0.1	0.2	0.1	1949322
Cuivre (Cu) †	ug	89.1	0.1	24.7	0.1	131	0.1	1949322
Etain (Sn) †	ug	77.4	0.5	4.0	0.6	166	0.5	1949322
Fer (Fe) †	ug	1070	5	33	6	82	5	1949322
Lithium (Li) †	ug	8	1	33	1	32	1	1949322
Magnésium (Mg) †	ug	216	2	34	2	36	2	1949322
Manganèse (Mn) †	ug	16.5	0.1	15.7	0.1	4.3	0.1	1949322
Mercure (Hg)	ug	<0.1	0.1	<0.1	0.1	<0.1	0.1	1949322
Molybdène (Mo) †	ug	4.8	0.5	<0.6	0.6	8.9	0.5	1949322
Nickel (Ni) †	ug	8.1	0.3	0.4	0.3	2.0	0.3	1949322
Plomb (Pb) †	ug	127	0.5	36.0	0.6	444	0.5	1949322
Potassium (K) †	ug	10100	10	1170	10	10200	10	1949322
Sélénium (Se) †	ug	<0.5	0.5	<0.5	0.5	0.5	0.5	1949322
Silicium (Si) †	ug	717	5	148	6	397	5	1949322
Sodium (Na) †	ug	7900	10	851	10	6890	10	1949322
Strontium (Sr) †	ug	5.0	0.1	0.4	0.1	0.4	0.1	1949322
Thallium (Tl) †	ug	<0.1	0.1	<0.1	0.1	<0.1	0.1	1949322
Titane (Ti) †	ug	52	1	4	1	6	1	1949322
Vanadium (V) †	ug	0.8	0.2	<0.2	0.2	0.4	0.2	1949322
Zinc (Zn) †	ug	509	1	54	1	1070	1	1949322

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

MÉTAUX (TRAIN)

ID Maxxam		FY0858		
Date d'échantillonnage		2018/09/23		
# Bordereau		N/A		
	Unités	**325+326+327-BL-BL**	**LDR**	**Lot CQ**
MÉTAUX				
Aluminium (Al) †	ug	4	3	1949322
Antimoine (Sb) †	ug	<0.3	0.3	1949322
Argent (Ag) †	ug	<2	2	1949322
Arsenic (As) †	ug	<0.3	0.3	1949322
Baryum (Ba) †	ug	0.2	0.2	1949322
Béryllium (Be) †	ug	<0.2	0.2	1949322
Bismuth (Bi) †	ug	<0.2	0.2	1949322
Bore (B) †	ug	4.4	0.6	1949322
Cadmium (Cd) †	ug	<0.2	0.2	1949322
Calcium (Ca) †	ug	<50	50	1949322
Chrome (Cr) †	ug	11.0	0.3	1949322
Cobalt (Co) †	ug	<0.3	0.3	1949322
Cuivre (Cu) †	ug	0.3	0.3	1949322
Etain (Sn) †	ug	<2	2	1949322
Fer (Fe) †	ug	<20	20	1949322
Lithium (Li) †	ug	<3	3	1949322
Magnésium (Mg) †	ug	8	6	1949322
Manganèse (Mn) †	ug	<0.3	0.3	1949322
Mercure (Hg)	ug	<0.2	0.2	1949322
Molybdène (Mo) †	ug	<2	2	1949322
Nickel (Ni) †	ug	<0.3	0.3	1949322
Plomb (Pb) †	ug	<2	2	1949322
Potassium (K) †	ug	<30	30	1949322
Sélénium (Se) †	ug	<0.5	0.5	1949322
Silicium (Si) †	ug	63	20	1949322
Sodium (Na) †	ug	143	20	1949322
Strontium (Sr) †	ug	<0.3	0.3	1949322
Thallium (Tl) †	ug	<0.3	0.3	1949322
Titane (Ti) †	ug	<3	3	1949322
Vanadium (V) †	ug	<0.6	0.6	1949322
Zinc (Zn) †	ug	<1	1	1949322

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
† Accréditation non existante pour ce paramètre

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

REMARQUES GÉNÉRALES

MÉTAUX (SOLUTION BARBOTEUR)

Les limites de détection indiquées sont modifiées en fonction du volume d'échantillon reçu.

MÉTAUX (TRAIN)

Les limites de détections indiquées sont multipliées par les facteurs de dilution utilisés pour l'analyse des échantillons.
Les limites de détection indiquées sont modifiées en fonction du volume d'échantillon reçu.

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1948181	EHA	Blanc fortifié	Mercure (Hg)	2018/10/31		160 (1)	%
1948181	EHA	Blanc de méthode	Mercure (Hg)	2018/10/31	<0.050		ug
1949070	EHA	Blanc fortifié	Aluminium (Al)	2018/11/05		105	%
			Antimoine (Sb)	2018/11/05		110	%
			Argent (Ag)	2018/11/05		102	%
			Arsenic (As)	2018/11/05		110	%
			Baryum (Ba)	2018/11/05		106	%
			Béryllium (Be)	2018/11/05		104	%
			Bismuth (Bi)	2018/11/05		108	%
			Bore (B)	2018/11/05		112	%
			Cadmium (Cd)	2018/11/05		105	%
			Calcium (Ca)	2018/11/05		107	%
			Chrome (Cr)	2018/11/05		105	%
			Cobalt (Co)	2018/11/05		105	%
			Cuivre (Cu)	2018/11/05		106	%
			Etain (Sn)	2018/11/05		112	%
			Fer (Fe)	2018/11/05		107	%
			Lithium (Li)	2018/11/05		106	%
			Magnésium (Mg)	2018/11/05		105	%
			Manganèse (Mn)	2018/11/05		107	%
			Mercure (Hg)	2018/11/05		119	%
			Molybdène (Mo)	2018/11/05		110	%
			Nickel (Ni)	2018/11/05		104	%
			Plomb (Pb)	2018/11/05		109	%
			Potassium (K)	2018/11/05		101	%
			Sélénium (Se)	2018/11/05		109	%
			Silicium (Si)	2018/11/05		99	%
			Sodium (Na)	2018/11/05		107	%
			Strontium (Sr)	2018/11/05		118	%
			Thallium (Tl)	2018/11/05		107	%
			Titane (Ti)	2018/11/05		102	%
			Vanadium (V)	2018/11/05		107	%
			Zinc (Zn)	2018/11/05		103	%
1949070	EHA	Blanc de méthode	Aluminium (Al)	2018/11/05	<1		ug
			Antimoine (Sb)	2018/11/05	<0.1		ug
			Argent (Ag)	2018/11/05	<0.5		ug
			Arsenic (As)	2018/11/05	<0.1		ug
			Baryum (Ba)	2018/11/05	<0.05		ug
			Béryllium (Be)	2018/11/05	<0.05		ug
			Bismuth (Bi)	2018/11/05	<0.05		ug
			Bore (B)	2018/11/05	<0.2		ug
			Cadmium (Cd)	2018/11/05	<0.05		ug
			Calcium (Ca)	2018/11/05	<5		ug
			Chrome (Cr)	2018/11/05	<0.1		ug
			Cobalt (Co)	2018/11/05	<0.1		ug
			Cuivre (Cu)	2018/11/05	<0.1		ug
			Etain (Sn)	2018/11/05	<0.5		ug
			Fer (Fe)	2018/11/05	<5		ug
			Lithium (Li)	2018/11/05	<1		ug
			Magnésium (Mg)	2018/11/05	<2		ug
			Manganèse (Mn)	2018/11/05	<0.1		ug
			Mercure (Hg)	2018/11/05	<0.05		ug

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Molybdène (Mo)	2018/11/05	<0.5		ug
			Nickel (Ni)	2018/11/05	<0.1		ug
			Plomb (Pb)	2018/11/05	<0.5		ug
			Potassium (K)	2018/11/05	<10		ug
			Sélénium (Se)	2018/11/05	<0.1		ug
			Silicium (Si)	2018/11/05	<5		ug
			Sodium (Na)	2018/11/05	<5		ug
			Strontium (Sr)	2018/11/05	<0.1		ug
			Thallium (Tl)	2018/11/05	<0.1		ug
			Titane (Ti)	2018/11/05	<1		ug
			Vanadium (V)	2018/11/05	<0.2		ug
			Zinc (Zn)	2018/11/05	<0.1		ug
1949380	SD2	MRC	Mercure (Hg)	2018/11/05		110	%
1949380	SD2	Blanc fortifié	Mercure (Hg)	2018/11/05		125 (1)	%
1949380	SD2	Blanc de méthode	Mercure (Hg)	2018/11/05	<0.050		ug
1952598	EHA	Blanc fortifié	Aluminium (Al)	2018/11/17		102	%
			Antimoine (Sb)	2018/11/17		100	%
			Argent (Ag)	2018/11/17		115	%
			Arsenic (As)	2018/11/17		104	%
			Baryum (Ba)	2018/11/17		113	%
			Béryllium (Be)	2018/11/17		101	%
			Bismuth (Bi)	2018/11/17		98	%
			Bore (B)	2018/11/17		105	%
			Cadmium (Cd)	2018/11/17		96	%
			Calcium (Ca)	2018/11/17		98	%
			Chrome (Cr)	2018/11/17		102	%
			Cobalt (Co)	2018/11/17		98	%
			Cuivre (Cu)	2018/11/17		100	%
			Etain (Sn)	2018/11/17		106	%
			Fer (Fe)	2018/11/17		98	%
			Lithium (Li)	2018/11/17		100	%
			Magnésium (Mg)	2018/11/17		98	%
			Manganèse (Mn)	2018/11/17		105	%
			Mercure (Hg)	2018/11/17		108	%
			Molybdène (Mo)	2018/11/17		102	%
			Nickel (Ni)	2018/11/17		98	%
			Plomb (Pb)	2018/11/17		101	%
			Potassium (K)	2018/11/17		98	%
			Sélénium (Se)	2018/11/17		103	%
			Silicium (Si)	2018/11/17		98	%
			Sodium (Na)	2018/11/17		104	%
			Strontium (Sr)	2018/11/17		109	%
			Thallium (Tl)	2018/11/17		97	%
			Titane (Ti)	2018/11/17		105	%
			Vanadium (V)	2018/11/17		102	%
			Zinc (Zn)	2018/11/17		111	%
1952598	EHA	Blanc de méthode	Aluminium (Al)	2018/11/17	<1		ug
			Antimoine (Sb)	2018/11/17	<0.1		ug
			Argent (Ag)	2018/11/17	<0.5		ug
			Arsenic (As)	2018/11/17	<0.1		ug
			Baryum (Ba)	2018/11/17	<0.05		ug
			Béryllium (Be)	2018/11/17	<0.05		ug

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Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Bismuth (Bi)	2018/11/17	<0.05		ug
			Bore (B)	2018/11/17	0.2, LDR=0.2		ug
			Cadmium (Cd)	2018/11/17	<0.05		ug
			Calcium (Ca)	2018/11/17	<5		ug
			Chrome (Cr)	2018/11/17	<0.1		ug
			Cobalt (Co)	2018/11/17	<0.1		ug
			Cuivre (Cu)	2018/11/17	<0.1		ug
			Etain (Sn)	2018/11/17	<0.5		ug
			Fer (Fe)	2018/11/17	<5		ug
			Lithium (Li)	2018/11/17	<1		ug
			Magnésium (Mg)	2018/11/17	<2		ug
			Manganèse (Mn)	2018/11/17	<0.1		ug
			Mercure (Hg)	2018/11/17	<0.05		ug
			Molybdène (Mo)	2018/11/17	<0.5		ug
			Nickel (Ni)	2018/11/17	<0.1		ug
			Plomb (Pb)	2018/11/17	<0.5		ug
			Potassium (K)	2018/11/17	<10		ug
			Sélénium (Se)	2018/11/17	<0.1		ug
			Silicium (Si)	2018/11/17	<5		ug
			Sodium (Na)	2018/11/17	<5		ug
			Strontium (Sr)	2018/11/17	<0.1		ug
			Thallium (Tl)	2018/11/17	<0.1		ug
			Titane (Ti)	2018/11/17	<1		ug
			Vanadium (V)	2018/11/17	<0.2		ug
			Zinc (Zn)	2018/11/17	<0.1		ug

LDR = Limite de détection rapportée

MRC: Un échantillon de concentration connue préparé dans des conditions rigoureuses par un organisme externe. Utilisé pour vérifier la justesse de la méthode.

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Réc = Récupération

(1) La récupération ou l'écart relatif (RPD) pour ce composé est en dehors des limites de contrôle, mais l'ensemble du contrôle qualité rencontre les critères d'acceptabilité pour cette analyse

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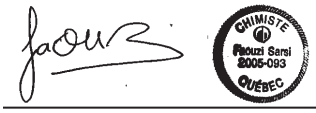
Dossier Maxxam: B847715
Date du rapport: 2018/11/21

CONSULAIR INC.
Votre # du projet: 18-5528
Adresse du site: AGNICO EAGLE MELIADINE

PAGE DES SIGNATURES DE VALIDATION

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:



Faouzi Sarsi, B. Sc. Chimiste

Miryam Assayag, B.Sc. Chimiste

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CHAÎNE DE RESPONSABILITÉ

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

2022-125, rue Lavoiser
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Tél..: (418) 650-5960
Fax : (418) 704-2221
www.consul-air.com

Travaux effectués à : Agnico Eagle Meliadine

Projet #: 18-5528

Chargé de Projet : Eric Trépanier

LABORATOIRE RESPONSABLE DES ANALYSES :
Maxxam
889 Montée de Liesse
Ville St-Laurent (Qc) H4T 1P5
Téléphone : (514) 448-9001
Télécopieur : (514) 448-5922

ÉCHANTILLON	Matrice	Fraction	Qte	Date	Paramètres	Unité	Remarque
301 - Inc - BS-Acétone - 1	Acétone	BS-Acétone	1	2018-09-22	Métaux, Hg	mg	Combiner les échantillons 301 à 303 pour les métaux particulaires de la source Inc - Essai #1
302 - Inc - BS-HNO3 - 1	HNO3	BS-HNO3	1	2018-09-22	Métaux, Hg	mg	Combiner avec les échantillons 301 et 303 pour les métaux particulaires de la source Inc - Essai #1
303 - Inc - Filtre - 1	Filtre	Poids avant : 0.5266 gr	1	2018-09-22	Métaux, Hg	mg	Combiner les échantillons 301 à 303 pour les métaux particulaires de la source Inc - Essai #1
304 - Inc - B1 - 1	Eau	B1 - Vt: 180 mL	1	2018-09-22	Métaux, Hg	mg	
305 - Inc - B2345 - 1	H2O2 10% / HNO3 5%	B2345 - Vt: 334 mL	1	2018-09-22	Métaux, Hg	mg	
307 - Inc - B67 - 1	KMNO4 4%/H2SO4 10%	B67 - Vt: 390 mL	1	2018-09-22	Hg	mg	Combiner les échantillons 307 et 308 pour le Hg de la source Inc - Essai #1

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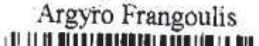
19-Oct-18 12:30
Argyro Frangoulis



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AM1

REMIS PAR:		DATE:	HEURE:
REÇU PAR:	Vivek Sawlani	DATE: 2018/10/19	HEURE: 12:30

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ICE : YES
SEAL : NO

DRIVER 7,7,6

CHAÎNE DE RESPONSABILITÉ

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

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Travaux effectués à : Agnico Eagle Meliadine

Projet #:

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LABORATOIRE RESPONSABLE DES ANALYSES :
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ÉCHANTILLON	Matrice	Fraction	Qte	Date	Paramètres	Unité	Remarque
308 - Inc - B67-HCl - 1	HCl	B67-HCl - Vt: 225 mL	1	2018-09-22	Hg	mg	Combiner les échantillons 307 et 308 pour le Hg de la source Inc - Essai #1
309 - Inc - BS-Acétone - 2	Acétone	BS-Acétone	1	2018-09-28	Métaux, Hg	mg	Combiner les échantillons 309 à 311 pour les métaux particulaires de la source Inc - Essai #2
310 - Inc - BS-HNO3 - 2	HNO3	BS-HNO3	1	2018-09-28	Métaux, Hg	mg	Combiner avec les échantillons 309 et 311 pour les métaux particulaires de la source Inc - Essai #2
311 - Inc - Filtre - 2	Filtre	Poids avant : 0.5248 gr	1	2018-09-28	Métaux, Hg	mg	Combiner les échantillons 309 à 311 pour les métaux particulaires de la source Inc - Essai #2
312 - Inc - B1 - 2	Eau	B1 - Vt: 188 mL	1	2018-09-28	Métaux, Hg	mg	
313 - Inc - B2345 - 2	H2O2 10% / HNO3 5%	B2345 - Vt: 323 mL	1	2018-09-28	Métaux, Hg	mg	

REMIS PAR:		**DATE:** 10/10/19	**HEURE:** 12:30
REÇU PAR: Vivien Dawson		**DATE:**	**HEURE:**

WT: 533.

DRIED

ICE: Y-S
SEAL: N

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

CHAÎNE DE RESPONSABILITÉ

2022-125, rue Lavoisier
Québec (Qc) G1N 4L5
Tél.: (418) 650-5960
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Travaux effectués à : Agnico Eagle Meliadine

Projet #: _____

Chargé de Projet : _____

LABORATOIRE RESPONSABLE DES ANALYSES :
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889 Montée de Liesse
Ville St-Laurent (Qc) H4T 1P5
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ÉCHANTILLON	Matrice	Fraction	Qte	Date	Paramètres	Unité	Remarque
315 - Inc - B67 - 2	KMNO4 4%/H2SO4 10%	B67 - Vt: 400 mL	1	2018-09-28	Hg	mg	Combiner les échantillons 315 et 316 pour le Hg de la source Inc - Essai #2
316 - Inc - B67-HCl - 2	HCl	B67-HCl - Vt: 225 mL	1	2018-09-28	Hg	mg	Combiner les échantillons 315 et 316 pour le Hg de la source Inc - Essai #2
317 - Inc - BS-Acétone - 3	Acétone	BS-Acétone	1	2018-09-29	Métaux, Hg	mg	Combiner les échantillons 317 à 319 pour les métaux particulaires de la source Inc - Essai #3
318 - Inc - BS-HNO3 - 3	HNO3	BS-HNO3	1	2018-09-29	Métaux, Hg	mg	Combiner avec les échantillons 317 et 319 pour les métaux particulaires de la source Inc - Essai #3
319 - Inc - Filtre - 3	Filtre	Poids avant : 0.5182 gr	1	2018-09-29	Métaux, Hg	mg	Combiner les échantillons 317 à 319 pour les métaux particulaires de la source Inc - Essai #3
320 - Inc - B1 - 3	Eau	B1 - Vt: 240 mL	1	2018-09-29	Métaux, Hg	mg	

ICE: YES
SEAL: NO

REMIS PAR:		DATE: 2018/09/29	HEURE: 12:30
REÇU PAR:	Vlad Davis	DATE:	HEURE:

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DAVIS 7,7,6

CHAÎNE DE RESPONSABILITÉ

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GESTION GLOBALE AIR ET ENVIRONNEMENT

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Travaux effectués à : Agnico Eagle Meliadine

Projet #: _____

Chargé de Projet : _____

LABORATOIRE RESPONSABLE DES ANALYSES :
Maxxam
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Télécopieur : (514) 448-5922

ÉCHANTILLON	Matrice	Fraction	Qte	Date	Paramètres	Unité	Remarque
321 - Inc - B2345 - 3	H2O2 10% / HNO3 5%	B2345 - Vt: 330 mL	1	2018-09-29	Métaux, Hg	mg	
323 - Inc - B67 - 3	KMNO4 4%/H2SO4 10%	B67 - Vt: 400 mL	1	2018-09-29	Hg	mg	Combiner les échantillons 323 et 324 pour le Hg de la source Inc - Essai #3
324 - Inc - B67-HCl - 3	HCl	B67-HCl - Vt: 225 mL	1	2018-09-29	Hg	mg	Combiner les échantillons 323 et 324 pour le Hg de la source Inc - Essai #3
325 - Bl - BS-Acétone - Bl	Acétone	BS-Acétone - Vt: 100 mL	1	2018-09-23	Métaux, Hg	mg	Combiner les échantillons 325 à 327 pour les métaux particulaires de la source Blanc - Essai #Bl
326 - Bl - BS-HNO3 - Bl	HNO3	BS-HNO3 - Vt: 300 mL	1	2018-09-23	Métaux, Hg	mg	Combiner avec les échantillons 325 et 327 pour les métaux particulaires de la source Blanc - Essai #Bl
327 - Bl - Filtre - Bl	Filtre	Poids avant : 0.5176 gr	1	2018-09-23	Métaux, Hg	mg	Combiner les échantillons 325 à 327 pour les métaux particulaires de la source Blanc - Essai #Bl

REMIS PAR:		DATE: 2018/10/19	HEURE: 12:30
REÇU PAR: Jules DAVIDS		DATE:	HEURE:

ICE : Yes
SEAL : no.

DAVA 7,7,6

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

CHAÎNE DE RESPONSABILITÉ

2022-125, rue Lavoisier
Québec (Qc) G1N 4L5
Tél.: (418) 650-5960
Fax : (418) 704-2221
www.consul-air.com

Travaux effectués à : Agnico Eagle - Meliadine

Projet #: _____

Chargé de Projet : _____

LABORATOIRE RESPONSABLE DES ANALYSES :
Maxxam
889 Montée de Liesse
Ville St-Laurent (Qc) H4T 1P5
Téléphone : (514) 448-9001
Télécopieur : (514) 448-5922

ÉCHANTILLON	Matrice	Fraction	Qte	Date	Paramètres	Unité	Remarque
328 - BI - Eau - BI	Eau	Eau - Vt: 100 mL	1	2018-09-23	Métaux, Hg	mg	
329 - BI - B123 - BI	H2O2 10% / HNO3 5%	B123 - Vt: 200 mL	1	2018-09-23	Métaux, Hg	mg	
330 - BI - B56 - BI	KMNO4 4%/H2SO4 10%	B56 - Vt: 100 mL	1	2018-09-23	Hg	mg	Combiner les échantillons 330 et 331 pour le Hg de la source Blanc - Essai #BI
331 - BI - B56-HCl - BI	HCl	B56-HCl - Vt: 225 mL	1	2018-09-23	Hg	mg	Combiner les échantillons 330 et 331 pour le Hg de la source Blanc - Essai #BI

REMIS PAR:		DATE: 2018/10/19	HEURE: 12:30
REÇU PAR:	STACEY DAVIDS	DATE:	HEURE:

DRIVER

4,7,6

ICE: YES
SEAL: NO

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

Québec, le lundi 15 octobre 2018
Argyro Frangoulis
Maxxam
Ligne Directe: 514.448.9001 #6229
Courriel: AFrangoulis@maxxam.ca

Objet : **Explications de la demande d'analyses pour le projet de Agnico Eagle (Meliadine).**
Notre no de projet : #18-5528

Bonjour Argyro,

Voici la demande d'analyse concernant le dossier mentionné précédemment. Les mesures ont été effectuées du 22 au 29 septembre 2018. Les échantillons se retrouvent dans une glacière. À cela suivra plus tard les échantillons des métaux particulaires et les échantillons d'eau (# 304, 312, 320 et 328).

DEMANDE D'ANALYSES / MÉTAUX

Les fractions filtres et buse-sonde acétone vous seront envoyées un peu plus tard afin de faire l'analyse pour les métaux particulaires. Pour chacun des essais, nous voulons un résultat combiné des 2 fractions Buse-Sonde (Acétone et HNO_3) et le Filtre (donc 3 échantillons à combiner ex. éch.# 301, 302 et 303 – 309, 310 et 311 etc. Aussi, pour le Mercure d'un même essai, les fractions de $KmnO_4$ (BB56) et de HCl 8N (BB56-HCL) doivent être combinées (ex. éch.# 307 et 308). Il est important de respecter ces combinaisons exigées.

Il y a aussi les échantillons d'eau, # 304, 312, 320 et 328 qui vont arriver plus tard. L'analyse des métaux et du Hg sera également à faire.

Les métaux à analyser sont les suivants : Al, Sb, Ag, As, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Sn, Fe, Li, Mg, Mn, Mo, Ni, Pb, K, Se, Na, Ti, V, Zn, Sr, Tl, Si (Silicium soluble), Hg

Il est important de ne pas jeter les échantillons et de nous les retourner après l'analyse.

Pour des renseignements supplémentaires n'hésitez pas à communiquer avec nous.

Envoyer les résultats à eric.trepanier@consul-air.com.

Salutations.

Eric Trépanier

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT
LABORATOIRE 483

Envoi pour analyse à Maxxam
Date: 24/10/2018
Chantier: Agnico Eagle(Meliadine)
Projet: 18-5528
Projet Lab: P2333

# du Labo	# de l'échantillon	# Bécher	Date d'envoi	Retour
171018-1	301 - Inc - BS-Acétone - 1	368	24-10-2018	
171018-2	309 - Inc - BS-Acétone - 2	716	24-10-2018	
171018-3	317 - Inc - BS-Acétone - 3	735	24-10-2018	
171018-4	325 - Bl - BS-Acétone - Bl	#453	24-10-2018	

Note:Nous retourner SVP les béchers aprés analyse dans leurs boîtes à:

Consulair
Bureau de Repentigny
101-800 Rue Leclerc
Repentigny (Qc), J6A 2E5
Tél: (450) 654-8000 poste 2304
Fax: (450) 654-6730
Courriel: laboratoire@consul-air.com

à Laurie Dowiey
2018/10/24
13:00.
ice-mg
pour le
driver.

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT
LABORATOIRE 483

RAPPORT D'ESSAI

Date : 25 octobre 2018

Réf : P2338-1

Client

 # Client : C8

Nom : Trépanier Éric

Téléphone : (418) 650-5960 # 2208

Courriel : eric.trepanier@consul-air.com

Adresse :
CONSULAIR Québec
125-2022,rue Lavoisier
Québec QC
G1N 4L5 Canada

Résumé du projet

Nb. d'objets : 7

 # Projet lab. : P2338

Votre # projet : 18-5517

Chantier : Agnico-Eagle

Résumé des essais

Paramètre(s) accrédités

ST	Paramètre	Q.	Principe (Méthode)	Matrice
	Matières particulaires (MP-A)	4	Gravimétrie (LPT1)	Acétone
	Matières particulaires (MP-F)	3	Gravimétrie (LPT2)	Filtre

ST : paramètre Sous-Traité

Résultats d'essai(s)

ST	Param.	Échantillon (s)		Dates			Résultat(s)		LDR
		# Lab	# Client	Échantillon.	Récep.	Essai	Valeur	Unité	
	MP-A	191018-1	**301 - Inc - BS-Acétone - 1**	05-10-18	19-10-18	19-10-18	**37.0**	mg	1.0
		191018-2	**309 - Inc - BS-Acétone - 2**	06-10-18	19-10-18	19-10-18	**53.1**	mg	1.0
		191018-3	**317 - Inc - BS-Acétone - 3**	07-10-18	19-10-18	19-10-18	**5.3**	mg	1.0
		191018-4	**325 - Bl - BS-Acétone - Bl**	06-10-18	19-10-18	19-10-18	**< LDR**	mg	1.0
	MP-F	191018-5	**303 - Inc - Filtre - 1**	05-10-18	19-10-18	24-10-18	**48.2**	mg	0.1
		191018-6	**311 - Inc - Filtre - 2**	06-10-18	19-10-18	24-10-18	**48.4**	mg	0.1
		191018-7	**319 - Inc - Filtre - 3**	07-10-18	19-10-18	24-10-18	**46.0**	mg	0.1

ST : Essai Sous-Traité
LDR : Limite de Détection Rapportée

Commentaire(s)

1. LPT1 & LPT2: Méthode MA.100-Part 1.0 (Domaine 400 de Chimie de l'air)
2. Le volume de l'échantillon 191018-4 ; V= 110 ml.

Contrôle de qualité

ST	Param.	Date	# Réf	Type	Résultat(s)		LDR
					Valeur	***Unité***	
	MP-A	19-10-18	BL1910	BL	< LDR	mg	1.0
			MR1910	MR	100.7	% Récup.	-
	MP-F	24-10-18	AP- 02 Conforme	-	-	mg	0.1

ST : Contrôle qualité Sous-Traité
 # Réf : Référence du contrôle qualité dans le système de suivi du laboratoire
BL : Blanc
MR : Matériau de Référence
DP : Duplicata
RP : Réplicata
AD : Ajout Dosé
EA : Étalon Analogue
TM: Témoin de l'extraction
LDR : Limite de Détection Rapportée

Signature

Les résultats ne se rapportent qu'aux objets soumis à l'essai
Tout ou partie de ce document ne peut être reproduit sans l'autorisation du laboratoire de CONSULAIR.
Ce rapport d'essai est certifié par la (les) personne(s) mentionnée(s) ci-après.
Pour toute question concernant ce certificat d'analyse, veuillez vous adresser directement à :

Malha Kirèche

APPENDIX 5
RAW FIELD DATA

CONSULAIR

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : ME. E1

February/2017

Usine : AE. Meljadine	Date : 22.05.2018	P. Bar (po Hg) :	# Cold box : ME-1		
Ville: Tanger / Nord		P. Stat. (po H_2O) :			
ID point d'émission : Incinerateur	Sonde N° : 05.07	Module N° : #25 NC	K' : 30.14		
Diamètre : 32.5	Cp : 0.774	Kc : 0.999			
Distance avant : 5 D	Buse N° : 50 - 502	Ko : 0.733	Niveau du manomètre: ✓		
Distance après : 2 D	Coef : 0.4684	Distance P-T°-B : ✓	Zéro du manomètre: ✓		

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F)				Volume Prélevé (pi^3)	Masse molaire			Vaccum po. Hg	Température			
						Cheminée	Compteur Entrée	Compteur Sortie	Orifice		O_2 (%v)	CO_2 (%v)	CO (ppmv)		Sonde (°F)	Filtre (°F)	Sortie (°F)	Trappe/Filtre (°F)
										534.62								
1445	1	1	5	0.15	1.75	1300	79	79		538.31	13.4	5.7	2	-2.0	—	270		
		1		0.15	1.75	1300	82	82		541.93								
		2		0.15	1.75	1300	83	83		545.49						270		
		2		0.19	2.65	1348	84	84		549.01	14.0	5.4	2					
		3		0.18	2.00	1348	84	84		553.11								
		3		0.18	2.00	1349	85	85		557.22	14.0	5.4	2	-2.0		270		
		4		0.18	2.00	1354	86	86		561.31	14.0	5.3	2					
		4		0.18	2.00	1346	88	88		565.42								
		5		0.18	2.00	1348	88	88		569.51	13.9	5.4						
		5		0.18	2.00	1350	89	89		573.61								
		6		0.18	2.00	1361	89	89		577.68								
		6		0.18	2.00	1362	89	89		581.77								
		1		0.19	2.78	1354	92	92		586.08								
		1		0.19	2.78	1356	92	92		590.50	14.3	5.1				270		
		2		0.19	2.20	1356	94	94		595.00								
		2		0.19	2.20	1348	95	94		599.50	14.2	5.1						
		4		0.19	2.20	1352	95	95		604.03								
		4		0.19	2.20	1352	96	96		608.50								
		3		0.18	2.11	1355	97	97		613.00								
		3		0.18	2.11	1355	97	97		617.49	14.3	5.1						
		2		0.15	1.78	1377	98	98		621.69								
		2		0.15	1.80	1295	98	98		625.82								
		1		0.13	1.54	1337	99	99		629.70								
		1	D	0.13	1.54	1341	99	99		633.54				-2.0				

TDF Initial Débit (pi^3/min): < 0.01	Pression (inhg) : -15" Hg	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) : ✓
TDF Final Débit (pi^3/min): < 0.01	Pression (inhg) : -12" Hg	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES | O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

ΔP → 0.17 1340
ΔPx → 0.19
ΔPN → 0.13

TECHNICIEN :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT | F_12_V9 (1/2) | CODE D'ESSAI : MRE, E1 | August/2018

Décontamination avant essai et détermination de l'humidité recueillie - USEPA 29

Compagnie:	AE - MRGIADINE	Projet:	5528
Source:	incinérateur	Essai: MRE1	# Cold Box: MR-1
Échantillonnée le:	22.09.2018	Date de l'assemblage : 21.09.2018	Heure:

DÉCONTAMINATION AVANT ESSAI DE LA BUSE ET DE LA SONDE

Item	Remarques	Brosser acétone	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
Buse et liner de verre		✓	✓	✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :				OUI	(NON)

DÉCONTAMINATION AVANT ESSAI DU TRAIN

Item	Remarques	Brosser acétone (si nécessaire)	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
du by-pass au barboteur 6			✓	✓	✓
Vérification du train d'échantillonnage à conserver :				OUI	(NON)

Remarques :

VOLUME D'EAU RECUEILLI (g)

ITEM #	PIÈCES	CONTENU	POIDS		
			APRÈS	AVANT	TOTAL
1	Barboteur 1 - GS mod	~~VIDE (optionnel)~~ OU CMM H_2O déminéralisée (100 ml)	682.1	599.7	
2	Barboteur 2 - GS mod	HNO_3 5% / H_2O_2 10% (100 ml)	722.2	693.0	
3	Barboteur 3 - GS	HNO_3 5% / H_2O_2 10% (100 ml)	567.3	562.3	
4	Barboteur 4 - GS mod	VIDE ✓	517.1	517.7	
5	Barboteur 5 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	613.0	613.4	
6	Barboteur 6 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	791.5	792.2	
7	Contenant de dessicant	GEL DE SILICE	1766.2	1747.8	(33.3)
TOTAL			5659.4	5526.1	

PARTICULES TOTALES (g)

# FILTRE QUARTZ	POIDS (g)	REMARQUES
QZF-4823		

LOTS DES PRODUITS UTILISÉS

Produits	# LOT
Acétone ~~ACS~~ Optima	153394
Solution d'acide nitrique (HNO_3) 10%	A.148
Solution d'acide nitrique (HNO_3) 0.1 N	A.148
Solution d'acide sulfurique (H_2SO_4) 10%	A.136
Solution d'acide chlorhydrique (HCl) 8N	A.095
Permanganate de potassium ($KMnO_4$)	A.1017
Solution H_2O_2 10% / HNO_3 5%	A.148 / R-387

Remarques:

Technicien :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT — F_12_V9 (2/2) — August/2018

Récupération finale du dispositif de prélèvement MÉTAUX USEPA 29

Date de récupération :	23.09.2018	Heure de récupération:	8L200
Pesée des barboteurs pour l'humidité:	✓	Nettoyage de l'extérieur des différentes pièces :	✓
Conditionnement des contenants de récupération :	✓		

Contenant 1 - Récupération du filtre (Séparateur principal)

Mettre le filtre dans un pétri propre et scellé (pince en polyéthylène ou teflon)	✓

Contenants 2 et 3 - Récupération de la buse et de la sonde

Items	Remarques	Brosser 100 ml Acétone	Rincer 100 ml HNO_3 0,1N	Niveau
de la buse à la partie avant du porte-filtre		✓	✓	✓

Contenant 4 - Récupération de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)

Items	Remarques	Rincer 100 mL HNO_3 0.1N	Niveau	Volume (mL)
de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)	BB 1234	✓	✓	334

Contenant 5 - Récupération barboteurs 4 seul

Items	Remarques	Rincer 100 ml HNO_3 0.1N	Niveau	Volume (mL)
barboteur 4	Avec 123	✓	✓	✓

Contenant 6 - Récupération barboteurs 5 et 6 ($KMnO_4$)

Items	Remarques	Rincer 100 ml $KMnO_4/H_2SO_4$	Rincer 100 ml eau	Niveau	Volume (mL)
du barboteur 5 au barboteur 6 (pot de verre ambré)		✓	✓	✓	390

Contenant 7 - Récupération barboteurs 5 et 6 ($KMnO_4$) avec HCl 8N

Items	Remarques	200 mL H_2O dans bouteille récup. Rincer 25 mL HCl 8N	Niveau	Volume (mL)
du barboteur 5 au barboteur 6		✓	✓	225

Remarques:

BB1 → HCl 180 cc

BB4 → Rincé avec BB 123 parce qu'il était vide après les tests

Blancs :

100 mL Acétone		Pour la demande d'analyse, voici les échantillons:
300 mL 0.1 N HNO_3		1a- Métaux sur contenants 1 + 2 + 3
100 mL H_2O		1b- Hg sur contenants 1 + 2 + 3
200 mL Solution H_2O_2 10% / HNO_3 5%		2a- Métaux sur contenant 4
100 mL KMnO4 4% / H2SO4 10%		2b- Hg sur contenant 4
200 mL H_2O + 25 mL HCL 8N		3a- Hg sur contenant 5
Filtre Quartz (x3)		3b- Hg sur contenant 6
		3c- Hg sur contenant 7

Technicien :

Consulair — Échantillonnage de l'air — Conformité environnementale

Formulaire: F_11_V4 janvier-2014

Laboratoire - Décontamination initiale des ensembles de verrerie - MÉTAUX USEPA 29

Compagnie:	Projet:	# du Cold box : ME-1
Source:	Essai:	# du filtre :
Échantillonnée le:	Date décontamination:	Heure:

Décontamination			Rinçage Eau	Eau + Savon	Eau	Rincer H_2O démin.	Tremper HNO_3 10%	Rincer H_2O démin.	Rincer Acétone
Item (dans l'ordre)		Remarques	1 x	1 x	3 x	3 x	4 hres	3 x	3 x
By pass			✓	✓	✓	✓	✓		
Cyclone (si applicable)									
Erlenmeyer (si applicable)									
Cloche femelle									
Support à filtre en téflon									
Cloche mâle									
Coude (bas cloche - barb.)									
Barboteur 1 x 1			✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓
Barboteur 2			✓	✓	✓	✓	✓	✓	✓
Barboteur 3			✓	✓	✓	✓	✓	✓	✓
Barboteur 4 (si applicable)			✓	✓	✓	✓	✓	✓	✓
Barboteur 5 (si Hg)			✓	✓	✓	✓	✓	✓	✓
Barboteur 6 (si Hg)			✓	✓	✓	✓	✓	✓	✓
Coudes (5 ou ....)			✓	✓	✓	✓	✓	✓	✓
Liner de verre							Rincer		+ Brosser
Vérification initiale de la verrerie et du liner du train d'échantillonnage et conserver le dernier rinçage à l'acétone si nécessaire.									
Buse de verre									+ Brosser
Vérification initiale de la buse, conserver le dernier rinçage à l'acétone si nécessaire.									
N.B. Joint d'étanchéité en téflon									

Commentaires:

Décontaminé par: ID Date: 04/09/2018 Endroit: QC

Consulair
Échantillonnage de l'air
Conformité environnementale

Formulaire: F_11_V4 **janvier-2014**

Laboratoire - Décontamination initiale des ensembles de verrerie - MÉTAUX USEPA 29

Compagnie:	Projet:	# du Cold box :
Source:	Essai:	# du filtre :
Échantillonnée le:	Date décontamination:	Heure:

Décontamination			Rinçage Eau	Eau + Savon	Eau	Rincer H_2O démin.	Tremper HNO_3 10%	Rincer H_2O démin.	Rincer Acétone
Item (dans l'ordre)		**Remarques**	**1 x**	**1 x**	**3 x**	**3 x**	**4 hres**	**3 x**	**3 x**
By pass			✓	✓	✓	✓	✓	✓	✓
Cyclone (si applicable)									
Erlenmeyer (si applicable)									
Cloche femelle			✓	✓	✓	✓	✓	✓	✓
Support à filtre en téflon			✓	✓	✓	✓	✓	✓	✓
Cloche mâle			✓	✓	✓	✓	✓	✓	✓
Coude (bas cloche - barb.)									
Barboteur 1									
Barboteur 2									
Barboteur 3									
Barboteur 4 (si applicable)									
Barboteur 5 (si Hg)									
Barboteur 6 (si Hg)									
Coudes (5 ou ....)									
Liner de verre							**Rincer**		**+ Brosser**
Vérification initiale de la verrerie et du liner du train d'échantillonnage et conserver le dernier rinçage à l'acétone si nécessaire.									
Buse de verre									**+ Brosser**
Vérification initiale de la buse, conserver le dernier rinçage à l'acétone si nécessaire.									
N.B. Joint d'étanchéité en téflon									

Commentaires:

Décontaminé par: Date: 04/09/2015 Endroit: QC

P1

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : ME-EZ

February/2017

Usine : AE Meliadine	Date : 23-09-2018	P. Bar (po Hg) :	# Cold box : ME-1
Ville: Rankin Inlet		P. Stat. (po H_2O) : — 0.01	
ID point d'émission : Incinérateur	Sonde N° : 05-07 (SQ-501)	Module N° : 25 NC	K' : 28.82
Diamètre : 33 1/2"	Cp : 0.724	Kc : 0.599	
Distance avant : 5D	Buse N° : SQ-434	Ko : 0.733	Niveau du manomètre: —
Distance après : 2D	Coef : 0.4366	Distance P-T°-B : —	Zéro du manomètre: —

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F)				Volume Prélevé (pi^3)	Masse molaire			Vaccum po. Hg	Température			
						Cheminée	Compteur Entrée	Compteur Sortie	Orifice		O_2 (%v)	CO_2 (%v)	CO (ppmv)		Sonde (°F)	Filtre (°F)	Sortie (°F)	Trappe/Filtre (°F)
										636.84								
11434	1	1	5	0.15	1.31	1290	72	71	←	670.06	14.4	4.9	3	-2.0	/	260	/	40
		1		0.15	1.28	1341	73	72		643.21								
		1		0.15	1.23	1349	73	73		646.52								
		2		0.14	1.19	1352	74	74		649.71								
		2		0.14	1.19	1354	76	76		652.87	14.6	4.7						
		2		0.14	1.19	1354	78	78		656.06					—	272	—	
		3		0.13	1.13	1344	80	80		659.14	14.7	4.7						
		3		0.13	1.13	1340	82	82		662.29								
		3		0.13	1.12	1348	83	83		665.39	14.5	4.9	3					
		4		0.13	1.12	1347	85	85		668.50								
		4		0.13	1.12	1345	86	86		671.62	14.5	4.9						
		4		0.13	1.14	1348	83	83		674.77								
		5		0.13	1.15	1334	89	89		677.84	15.2	4.4						
		5		0.13	1.11	1336	91	91		680.96								
		5		0.13	1.15	1337	92	92		684.09	15.1	4.4	4					
		6		0.12	1.06	1334	93	93		687.13								
		6		0.12	1.06	1335	94	94		690.18	15.3	4.3	4	-3.0	/	270		40
		6	▷	0.12	1.06	1340	95	95	↓	693.21								

TDF Initial Débit (pi^3/min): 0.01	Pression (inhg) : 1"Hg	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):

Fuite Pitot (ΔP) :

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

P2

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

Code d'essai : ME-2

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

February/2017

Usine :	Date :	P. Bar (po Hg) :	# Cold box :
Ville:		P. Stat. (po H_2O) :	
ID point d'émission :	Sonde N° :	Module N° :	K' :
Diamètre :	Cp :	Kc :	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F)				Volume Prélevé (pi^3)	Masse molaire			Vaccum po. Hg	Température			
						Cheminée	Compteur Entrée	Compteur Sortie	Orifice		O_2 (%v)	CO_2 (%v)	CO (ppmv)		Sonde (°F)	Filtre (°F)	Sortie (°F)	Trappe/Filtre (°F)
										693.21								
	2	6	5	0.12	1.07	1358	96	96		696.26	15.3	4.3	4	-30	✓	273	40	✓
		6		0.12	1.07	1338	97	97		699.31								
		6		0.12	1.08	1328	97	97		702.37	15.3	4.3	4					
		5		0.12	1.08	1344	98	98		705.44								
		5		0.12	1.08	1344	98	98		708.51					✓	271	40	✓
		5		0.12	1.08	1341	99	99		711.60	15.3	4.3	4					
		4		0.12	1.08	1342	99	99		714.66								
		4		0.10	0.90	1329	100	100		717.50								
		4		0.10	0.90	1326	100	100		720.31								
		3		0.10	0.90	1326	100	101		723.10								
		3		0.10	0.90	1330	102	102		725.88	15.3	4.0						
		3		0.10	0.90	1330	102	102		728.68								
		3		0.10	0.90	1326	103	103		731.49								
		2		0.10	0.90	1316	104	104		734.29	15.3	4.4						
		2		0.10	0.90	1317	104	104		737.13								
		1		0.10	0.90	1311	105	105		740.0								
		1	⇩						⇩									

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) :
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

Arrêt procédé (180 mins - 15 mins)

TECHNICIEN :

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

F_12_V9 (1/2) CODE D'ESSAI: ME-2 August/2018

Décontamination avant essai et détermination de l'humidité recueillie - USEPA 29

Compagnie: AEM - Mtl		Projet: 18-5528	
Source: incinérateur		Essai: 2	# Cold Box: ME-1
Échantillonnée le: 28-05-2018	Date de l'assemblage : 18-09-26		Heure: 10h30

DÉCONTAMINATION AVANT ESSAI DE LA BUSE ET DE LA SONDE

Item	Remarques	Brosser acétone	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
Buse et liner de verre		✓	✓	✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :				OUI	NON

DÉCONTAMINATION AVANT ESSAI DU TRAIN

Item	Remarques	Brosser acétone (si nécessaire)	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
du by-pass au barboteur 6		✓	✓	✓	✓
Vérification du train d'échantillonnage à conserver :				OUI	NON

Remarques :

VOLUME D'EAU RECUEILLI (g)

ITEM #	PIÈCES	CONTENU	POIDS		
			APRÈS	AVANT	TOTAL
1	Barboteur 1 - GS mod	~~VIDE (optionnel) OU~~ CMM H_2O déminéralisée (100 ml)	682.6	609.7	
2	Barboteur 2 - GS mod	HNO_3 5% / H_2O_2 10% (100 ml)	707.5	684.9	
3	Barboteur 3 - GS	HNO_3 5% / H_2O_2 10% (100 ml)	573.5	565.5	
4	Barboteur 4 - GS mod	VIDE	520.4	520.8	
5	Barboteur 5 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	611.7	610.2	
6	Barboteur 6 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	781.4	783.3	
7	Contenant de dessicant	GEL DE SILICE	1782.6	1761.7	121.6
TOTAL					

PARTICULES TOTALES (g)

# FILTRE QUARTZ	POIDS (g)	REMARQUES

LOTS DES PRODUITS UTILISÉS

Produits	# LOT
Acétone ACS	
Solution d'acide nitrique (HNO_3) 10%	
Solution d'acide nitrique (HNO_3) 0.1 N	
Solution d'acide sulfurique (H_2SO_4) 10%	
Solution d'acide chlorhydrique (HCl) 8N	
Permanganate de potassium ($KMnO_4$)	
Solution H_2O_2 10% / HNO_3 5%	

Remarques:

Technicien :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT

F_12_V9 (2/2)

August/2018

Récupération finale du dispositif de prélèvement MÉTAUX USEPA 29

Date de récupération :	29-09-2018	Heure de récupération:	8h00
Pesée des barboteurs pour l'humidité:	✓	Nettoyage de l'extérieur des différentes pièces :	✓
Conditionnement des contenants de récupération :	✓		

Contenant 1 - Récupération du filtre (Séparateur principal)

Mettre le filtre dans un pétri propre et scellé (pince en polyéthylène ou teflon)	✓

Contenants 2 et 3 - Récupération de la buse et de la sonde

Items	Remarques	Brosser 100 ml Acétone	Rincer 100 ml HNO_3 0,1N	Niveau
de la buse à la partie avant du porte-filtre		✓	✓	✓

Contenant 4 - Récupération de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)

Items	Remarques	Rincer 100 mL HNO_3 0.1N	Niveau	Volume (mL)
de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3) +4		✓	✓	323

Contenant 5 - Récupération barboteurs 4 seul

Items	Remarques	Rincer 100 ml HNO_3 0.1N	Niveau	Volume (mL)
barboteur 4	Avec BB123			

Contenant 6 - Récupération barboteurs 5 et 6 ($KMnO_4$)

Items	Remarques	Rincer 100 ml $KMnO_4/H_2SO_4$	Rincer 100 ml eau	Niveau	Volume (mL)
du barboteur 5 au barboteur 6 (pot de verre ambré)		✓	✓	✓	400

Contenant 7 - Récupération barboteurs 5 et 6 ($KMnO_4$) avec HCl 8N

Items	Remarques	200 mL H_2O dans bouteille récup. Rincer 25 mL HCl 8N	Niveau	Volume (mL)
du barboteur 5 au barboteur 6		✓	✓	225

Remarques:

BB1 → HCl → 188cc

BB4 → N/Pble Rincer Avec BB123

Blancs :

100 mL Acétone	
300 mL 0.1 N HNO_3	
100 mL H_2O	
200 mL Solution H_2O_2 10% / HNO_3 5%	
100 mL KMnO4 4% / H2SO4 10%	
200 mL H_2O + 25 mL HCL 8N	
Filtre Quartz (x3)	

Pour la demande d'analyse, voici les échantillons:
1a- Métaux sur contenants 1 + 2 + 3
1b- Hg sur contenants 1 + 2 + 3
2a- Métaux sur contenant 4
2b- Hg sur contenant 4
3a- Hg sur contenant 5
3b- Hg sur contenant 6
3c- Hg sur contenant 7

Technicien :

P1

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : ME - E3

février-2017

Usine : NE Meladine	Date : 25-09-2018	P. Bar (po Hg) :	# Cold box : ME.1
Ville: Rawdon Let		P. Stat. (po H_2O) :	
ID point d'émission : Incinérateur	Sonde N° : 05-07 Q 501	Module N° : 25 NC	K' : 28,82
Diamètre : 30.5"	Cp : 0774	Kc : 0.999	
Distance avant : 5D	Buse N° : SQ. 434	Ko : 0,733	Niveau du manomètre: ✓
Distance après : 2D	Coef : 0.4366	Distance P-T°-B : ✓	Zéro du manomètre: ✓

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi^3)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										747.13								
16h14	1	1	5	0.20	1.68	1327	78	78	✓	750.81	12.9	6.0	3	-3.0	✓	200	50	✓
		1		0.20	1.72	1347	79	79		754.60								
		1		0.20	1.77	1350	80	80		758.43	13.0	6.0	3					
		2		0.20	1.71	1360	81	81		762.18								
		2		0.20	1.70	1374	81	81		765.96	12.8	6.1						
		2		0.20	1.70	1378	82	82		769.75								
		3		0.22	1.87	1380	83	83		773.68								
		3		0.23	1.91	1393	84	84		777.76	13.7	5.5				268		
		3		0.23	1.94	1401	85	85		781.76								
		4		0.23	1.94	1410	85	85		785.75								
		4		0.23	1.92	1420	86	86		789.72	13.7	5.5	3					
		4		0.23	1.93	1423	87	87		793.77								
		5		0.23	1.92	1431	88	88		797.79								
		5		0.20	1.68	1418	89	89		801.59								
		5		0.20	1.68	1430	90	90		805.38	14.5	5.2						
		6		0.20	1.69	1418	90	90		809.19	14.2	5.1						
		6		0.20	1.67	1440	90	90		813.00				-4.0		270		
		6	H5	0.20	1.67	1441	91	91		816.78								

TDF Initial Débit (pi^3/min): < 0.01	Pression (inhg) :- 15" Hg	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) : ✓
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

P2

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

Code d'essai : ME-E3

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

février-2017

Usine :	Date :	P. Bar (po Hg) :	# Cold box :
Ville:		P. Stat. (po H_2O) :	
ID point d'émission :	Sonde N° :	Module N° :	K' :
Diamètre :	Cp :	Kc :	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F)				Volume Prélevé (pi^3)	Masse molaire			Vaccum po. Hg	Température			
						Cheminée	Compteur Entrée	Compteur Sortie	Orifice		O_2 (%v)	CO_2 (%v)	CO (ppmv)		Sonde (°F)	Filtre (°F)	Sortie (°F)	Trappe/Filtre (°F)
										816.78								
	2	6	5	0.20	1.66	145	91	91		820.57	14.1	5.2	3	-3.0		250	90	
		6		0.20	1.66	1460	92	92		824.36								
		6		0.20	1.65	1467	93	93		828.17								
		5		0.19	1.57	1476	94	94		831.88	14.0	5.3	3					
		5		0.19	1.57	1479	95	95		835.60								
	—	5		0.19	1.57	1481	96	96		839.27								
		4		0.19	1.55	1502	97	97		842.94	12.9	6.2						
		4		0.21	1.72	1518	99	99		846.82								
		4		0.21	1.71	1518	99	99		850.30								
		3		0.21	1.71	1520	100	100		854.57								
		3		0.21	1.72	1518	101	101		858.43								
	—	3		0.21	1.71	1525	101	102		862.07								
		2		0.21	1.71	1522	103	103		866.14								
		2		0.17	1.39	1522	104	104		869.62								
		2		0.17	1.44	1460	105	105		873.16								
		1		0.17	1.46	1436	106	106		876.67								
		1		0.17	1.47	1429	106	106		880.21								
		1	↓	0.17	1.48	1421	107	107		883.85								

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):

Fuite Pitot (ΔP) :

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT | F_12_V9 (1/2) | CODE D'ESSAI: AE ME-3 | August/2018

Décontamination avant essai et détermination de l'humidité recueillie - USEPA 29

Compagnie: AE Meliadine		Projet: 5528	
Source: Cheminée		Essai: # 3	# Cold Box: ME-1
Échantillonnée le:	Date de l'assemblage : 28-09-2018		Heure: 7h00

DÉCONTAMINATION AVANT ESSAI DE LA BUSE ET DE LA SONDE

Item	Remarques	Brosser acétone	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
Buse et liner de verre		✓	✓	✓	✓

Vérification de la buse et sondes d'échantillonnage à conserver : OUI / NON (NON)

DÉCONTAMINATION AVANT ESSAI DU TRAIN

Item	Remarques	Brosser acétone (si nécessaire)	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
du by-pass au barboteur 6			✓	✓	✓

Vérification du train d'échantillonnage à conserver : OUI / NON (NON)

Remarques :

VOLUME D'EAU RECUEILLI (g)

ITEM #	PIÈCES	CONTENU	POIDS APRÈS	POIDS AVANT	POIDS TOTAL
1	Barboteur 1 - GS mod	VIDE (optionnel) OU CMM H_2O déminéralisée (100 ml)	740.1	604.4	
2	Barboteur 2 - GS mod	HNO_3 5% / H_2O_2 10% (100 ml)	711.9	684.0	
3	Barboteur 3 - GS	HNO_3 5% / H_2O_2 10% (100 ml)	575.8	570.9	
4	Barboteur 4 - GS mod	VIDE	519.6	518.9	
5	Barboteur 5 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	623.3	624.0	
6	Barboteur 6 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium	773.1	774.0	
7	Contenant de dessicant	GEL DE SILICE	1801.7	1783.6	18.1
TOTAL					

PARTICULES TOTALES (g)

# FILTRE QUARTZ	POIDS (g)	REMARQUES

LOTS DES PRODUITS UTILISÉS

Produits	# LOT
Acétone ACS	
Solution d'acide nitrique (HNO_3) 10%	
Solution d'acide nitrique (HNO_3) 0.1 N	
Solution d'acide sulfurique (H_2SO_4) 10%	
Solution d'acide chlorhydrique (HCl) 8N	
Permanganate de potassium ($KMnO_4$)	
Solution H_2O_2 10% / HNO_3 5%	

Remarques:

Technicien :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT F_12_V9 (2/2) August/2018

Récupération finale du dispositif de prélèvement MÉTAUX USEPA 29

Date de récupération :	30 Q 2018	Heure de récupération:	9h15
Pesée des barboteurs pour l'humidité:	✓	Nettoyage de l'extérieur des différentes pièces :	✓
Conditionnement des contenants de récupération :	✓		

Contenant 1 - Récupération du filtre (Séparateur principal)

Mettre le filtre dans un pétri propre et scellé (pince en polyéthylène ou teflon)	✓

Contenants 2 et 3 - Récupération de la buse et de la sonde

Items	Remarques	Brosser 100 ml Acétone	Rincer 100 ml HNO_3 0,1N	Niveau
de la buse à la partie avant du porte-filtre		✓	✓	✓

Contenant 4 - Récupération de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)

Items	Remarques	Rincer 100 mL HNO_3 0.1N	Niveau	Volume (mL)
de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)	230+100	✓		330

Contenant 5 - Récupération barboteurs 4 seul

Items	Remarques	Rincer 100 ml HNO_3 0.1N	Niveau	Volume (mL)
barboteur 4	Avec BB 123			

Contenant 6 - Récupération barboteurs 5 et 6 ($KMnO_4$)

Items	Remarques	Rincer 100 ml $KMnO_4/H_2SO_4$	Rincer 100 ml eau	Niveau	Volume (mL)
du barboteur 5 au barboteur 6 (pot de verre ambré)		✓	✓	✓	400

Contenant 7 - Récupération barboteurs 5 et 6 ($KMnO_4$) avec HCl 8N

Items	Remarques	200 mL H_2O dans bouteille récup. Rincer 25 mL HCl 8N	Niveau	Volume (mL)
du barboteur 5 au barboteur 6		✓	✓	225

Remarques:

BB 1 → HCl → 240 mL

BB4 avec BB 123

Blancs :

100 mL Acétone	
300 mL 0.1 N HNO_3	
100 mL H_2O	
200 mL Solution H_2O_2 10% / HNO_3 5%	
100 mL KMnO4 4% / H2SO4 10%	
200 mL H_2O + 25 mL HCL 8N	
Filtre Quartz (x3)	

Pour la demande d'analyse, voici les échantillons:
1a- Métaux sur contenants 1 + 2 + 3
1b- Hg sur contenants 1 + 2 + 3
2a- Métaux sur contenant 4
2b- Hg sur contenant 4
3a- Hg sur contenant 5
3b- Hg sur contenant 6
3c- Hg sur contenant 7

Technicien :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT

F_12_V9 (1/2) CODE D'ESSAI : ME-BL blanc August/2018

Décontamination avant essai et détermination de l'humidité recueillie - USEPA 29

Compagnie: AER - Mel		Projet: 19-5528	
Source: Incinérateur		Essai: BL	# Cold Box: ME-1
Échantillonnée le: 2019-09-23	Date de l'assemblage : 19-09-23		Heure: 9h00

DÉCONTAMINATION AVANT ESSAI DE LA BUSE ET DE LA SONDE

Item	Remarques	Brosser acétone	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
Buse et liner de verre			✓	✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :				OUI	NON

DÉCONTAMINATION AVANT ESSAI DU TRAIN

Item	Remarques	Brosser acétone (si nécessaire)	Rincer 3x HNO_3 10%	Rincer 3x H_2O démin.	Rincer 3x Acétone
du by-pass au barboteur 6			✓	✓	✓
Vérification du train d'échantillonnage à conserver :				OUI	NON

Remarques :

VOLUME D'EAU RECUEILLI (g)

ITEM #	PIÈCES	CONTENU	POIDS		
			APRÈS	AVANT	TOTAL
1	Barboteur 1 - GS mod	VIDE (optionnel) OU CMM H_2O déminéralisée (100 ml)		603.0	
2	Barboteur 2 - GS mod	HNO_3 5% / H_2O_2 10% (100 ml)		705.1	
3	Barboteur 3 - GS	HNO_3 5% / H_2O_2 10% (100 ml)		560.1	
4	Barboteur 4 - GS mod	VIDE		519.2	
5	Barboteur 5 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium		620.4	
6	Barboteur 6 - GS mod	$KMnO_4$ 4% / H_2SO_4 10% (100 ml) recouvert d'aluminium		764.1	
7	Contenant de dessicant	GEL DE SILICE		766.7	
TOTAL					

PARTICULES TOTALES (g)

# FILTRE QUARTZ	POIDS (g)	REMARQUES

LOTS DES PRODUITS UTILISÉS

Produits	# LOT
Acétone ACS Optima	153 794
Solution d'acide nitrique (HNO_3) 10%	A-148
Solution d'acide nitrique (HNO_3) 0.1 N	A-148
Solution d'acide sulfurique (H_2SO_4) 10%	A-136
Solution d'acide chlorhydrique (HCl) 8N	A-095
Permanganate de potassium ($KMnO_4$)	AZ087
Solution H_2O_2 10% / HNO_3 5%	

Remarques:

Technicien :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT — F_12_V9 (2/2) — August/2018

Récupération finale du dispositif de prélèvement MÉTAUX USEPA 29

Date de récupération : 24-09-2018		Heure de récupération: 10h00	
Pesée des barboteurs pour l'humidité:	✓	Nettoyage de l'extérieur des différentes pièces :	✓
Conditionnement des contenants de récupération :	✓		

Contenant 1 - Récupération du filtre (Séparateur principal)

Mettre le filtre dans un pétri propre et scellé (pince en polyéthylène ou teflon)	✓

Contenants 2 et 3 - Récupération de la buse et de la sonde

Items	Remarques	Brosser 100 ml Acétone	Rincer 100 ml HNO_3 0,1N	Niveau
de la buse à la partie avant du porte-filtre		✓	✓	✓

Contenant 4 - Récupération de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)

Items	Remarques	Rincer 100 mL HNO_3 0.1N	Niveau	Volume (mL)
de la partie arrière du porte-filtre aux barboteurs métaux (Barb. 1-2 & 3)		✓	✓	≈ 300

Contenant 5 - Récupération barboteurs 4 seul

Items	Remarques	Rincer 100 ml HNO_3 0.1N	Niveau	Volume (mL)
barboteur 4	Avec 123	✓	✓	✓

Contenant 6 - Récupération barboteurs 5 et 6 ($KMnO_4$)

Items	Remarques	Rincer 100 ml $KMnO_4/H_2SO_4$	Rincer 100 ml eau	Niveau	Volume (mL)
du barboteur 5 au barboteur 6 (pot de verre ambré)		✓	✓	✓	400

Contenant 7 - Récupération barboteurs 5 et 6 ($KMnO_4$) avec HCl 8N

Items	Remarques	200 mL H_2O dans bouteille récup. Rincer 25 mL HCl 8N	Niveau	Volume (mL)
du barboteur 5 au barboteur 6		✓	✓	225

Remarques: BB1 - HCl → 100 cc

BB4 - Rincer avec BB 123

Blancs :

100 mL Acétone	✓
300 mL 0.1 N HNO_3	✓
100 mL H_2O	✓
200 mL Solution H_2O_2 10% / HNO_3 5%	✓
100 mL KMnO4 4% / H2SO4 10%	✓
200 mL H_2O + 25 mL HCL 8N	✓
Filtre Quartz (x3)	

Pour la demande d'analyse, voici les échantillons:
1a- Métaux sur contenants 1 + 2 + 3
1b- Hg sur contenants 1 + 2 + 3
2a- Métaux sur contenant 4
2b- Hg sur contenant 4
3a- Hg sur contenant 5
3b- Hg sur contenant 6
3c- Hg sur contenant 7

Technicien :

P1-

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COSU-E1

February/2017

Usine : AE Methadone	Date : 22.09.2018	P. Bar (po Hg) :	# Cold box : OR-2/U1
Ville: Rankin Inlet		P. Stat. (po H_2O) : −0.06	
ID point d'émission : Incinérateur	Sonde N° : 03.06 (371)	Module N° : 19 COMP	K' : 26.18
Diamètre : 32.5	Cp : 0.788	Kc : 0.997	
Distance avant : 5D	Buse N° : 3~~02~~ ~~3~~71	Ko : 1.000	Niveau du manomètre: ✓
Distance après : 2D	Coef : 0.~~9981~~ (3741)	Distance P-T°-B : ✓	Zéro du manomètre: ✓

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi³)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										483.64								
13h44	I	1	5	0.18	0.45	1330	60	60	76	485.51	13.4	5.3	3	−1.0	✓	200	—	37
		1		0.17	0.43	1345			77	488.0								
		1		0.17	0.43	1345			77	490.46	13.4	5.6	3	−1.0				
		1		0.17	0.43	1341			77	492.92	13.4	5.7	3			200		36
		2		0.17	0.43	1352			78	495.48	13.4	5.7	3					
		2		0.17	0.43	1356			79	497.85	13.5	5.7	2					
		2		0.18	0.41	1354			80	500.35	13.5	5.7	2			200		36
		2		0.18	0.41	1353			80	502.87	13.5	5.7	2	−1.0				
		3		0.18	0.41	1361			82	505.38	13.5	5.7	2			200		36
		3		0.21	0.53	1366			82	508.08	13.5	5.7	2	−1.0				
		3		0.21	0.53	1381			84	510.79	13.4	5.8	2					39
		3		0.21	0.53	1377			83	513.50	13.4	5.7	2	−1.5				
14h44	AE	4		0.21	0.53	1379			84	516.20	13.4	5.7	2					
		4		0.21	0.53	1380			85	518.83	13.5	5.7	2					
		4		0.21	0.53	1373			84	521.61	13.7	5.6		−1.5		200		39
		4		0.21	0.53	1373			85	524.28	13.9	5.4						
		5		0.18	0.41	1351			87	526.78	13.9	5.4						39
		5		0.18	0.41	1348			87	529.27	14.0	5.3		−1.5		200		
		5		0.18	0.41	1350			88	531.86	14.0	5.3						
				0.18	0.41	1354			88	534.26	14.0	5.4						
		6		0.18	0.41	1355			88	536.79	14.0	5.3	2					
		6		0.18	0.41	1359			90	539.34	14.0	5.3	2					
		6		0.18	0.41	1361			90	541.87	14.0	5.3	2					
		6	↻	0.17	0.41	1350	↻	↻	90	544.36	14.0	5.3						

TDF Initial Débit (pi³/min): 0.015	Pression (inhg) : ~15"Hg	Volume ini (pi³):	Volume fin (pi³):	Volume (pi³):	Fuite Pitot (ΔP) : ✓
TDF Final Débit (pi³/min):	Pression (inhg) :	Volume ini (pi³):	Volume fin (pi³):	Volume (pi³):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

$\overline{\Delta P}$ = 0.16 ΔP_{avg} = 0.18

ΔP_{max} = 0.21

TECHNICIEN :

P2

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

Code d'essai : COSU-E1

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

February/2017

Usine :	Date :	P. Bar (po Hg) :	# Cold box :
Ville:		P. Stat. (po H_2O) :	
ID point d'émission :	Sonde N° :	Module N° :	K' :
Diamètre :	Cp :	Kc :	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi^3)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										544.36								
		6	5	0.15	0.38	1357	60	60	93	546.67						250		
		6		0.16	0.41	1350			93	549.00	14.3	5.1						
		6		0.16	0.41	1355			94	551.26								
		6		0.16	0.41	1357			95	553.57	14.3	5.1						
		5		0.16	0.41	1348			97	555.93								
		5		0.16	0.41	1350			97	558.42								
		5		0.16	0.41	1335			97	560.77	14.3	5.1						
		5		0.15	0.37	1340			98	563.08								
		4		0.15	0.39	1332			99	565.37								
		4		0.13	0.35	1280			100	567.67								
		4		0.13	0.35	1300			100	569.98	14.9	4.7						
		4		0.11	0.29	1306			101	572.08								
		3		0.11	0.29	1304			101	574.08	14.8	4.8						38
		3		0.11	0.29	1280			102	576.10								
		3		0.11	0.29	1250			102	578.09								
		3		0.11	0.29	1266			103	580.17	14.9	4.6	3					
		2		0.13	0.31	1318			103	582.40								
		2		0.13	0.35	1320			103	584.62								
		2		0.13	0.35	1324			103	586.87	14.4	5.0						
		2		0.13	0.31	1310			102	589.10								
		1		0.13	0.35	1317			102	591.32	14.5	5.0						
		1		0.13	0.31	1322			102	593.56								
		1		0.13	0.31	1318			102	595.76								
		1		0.13	0.31	1306			102	598.00								

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):

Fuite Pitot (ΔP) :

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT | F_07_V5 (1/2) Avril 2018 | CODE DE L'ESSAI : MEC COSV - E1

Vérification avant essai et montage du dispositif de prélèvement - COSV (SPE 1/RM/2)

Compagnie: AE Heliantus	Projet: 5528	# Ensemble de verrerie : 28
Source: Incinérateur	Essai: #1	# Hot Box : OR.2 / V1
Date : 22-05-2018		Heure : 17400

1 - DÉCONTAMINATION & VÉRIFICATION AVANT ESSAI - BUSE ET SONDE

Item	Remarques	Brosse - DHA	HA
		3x Ch.	3x Ch.
Buse et sonde		✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :		OUI	(NON)

2 - VÉRIFICATION AVANT ESSAI - TRAIN

Item	Remarques	HA	
		3x Ch.	
Train		✓	
Vérification de la verrerie du train d'échantillonnage à conserver :		OUI	(NON)

3 - VOLUME D'EAU RECUEILLIE

ITEM #	PIÈCE	CONTENU	POIDS (g)		
			APRÈS	AVANT	TOTAL
1	Condenseur (réfrigérant)	VIDE			
2	Trappe de résine *	XAD-2 #4781	401.1	382.8	
3	Trappe à condensat	VIDE	502.9	365.3	
4	Barboteur Greenburg-Smith	ÉTHYLÈNE GLYCOL (100-~~150~~ mL)	599.7	586.7	
5	Barboteur modifié	VIDE	446.7	446.20	
6	Contenant de dessicant	GEL DE SILICE	1713.9	1708.0	174.8
			3664.3	3488.0	TOTAL

* : Recouvrir de papier d'aluminium après la pré-pesée, et retirer avant la pesée après essai.

REMARQUES :

4 - LOTS DES SOLVANTS UTILISÉS

SOLVANTS	# LOT
Dichlorométhane (grade optima)	
Hexane (grade optima)	156309
Acétone (grade optima)	153394
Éthylène glycol	142823
Eau HPLC	135150
Résine XAD-2	

Vérifié par:	Date:	Endroit:

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

F_07_V5 (2/2)
Avril 2018

Récupération finale du dispositif de prélèvement - COSV (SPE 1/RM/2)

Date de récupération : 2018-09-23	Heure de récupération:	
Nettoyage de l'extérieur des différentes pièces : ✓	✓	
Conditionnement (HA) des contenants **(verre ambré)** de récupération :	✓ ✓	

Contenant 1 - Buse-Sonde

Item	Remarques	Brosse HA	HA 3x Ch.	Niveau
Buse et Sonde		✓	✓	✓

Contenant 2 - Filtre

Filtre	Pétri scellé avec ruban de teflon - dans le papier d'aluminium	✓

Contenant 3 - Récupération de la partie arrière du Porte-filtre au Condenseur (avant trappe)

Item	Remarques	Tremp. H-A 5 min. Ch	HA 3x Ch.	Niveau
Avant trappe résine		✓	✓	✓

Contenant 4 - Récupération de la Trappe de résine XAD-2

Trappe de résine XAD-2	Sceller avec ruban de teflon - enveloppé papier d'aluminium	✓

Contenant 5 - Récupération de la Trappe à condensat au 1er Barboteur (eau)

Item (dans l'ordre)	Remarques	H_2O HPLC 3x	Niveau
Eau		✓	✓

Contenant 6 - Rinçage final de la partie arrière du Porte-filtre au dernier Barboteur

Item	Remarques	HA 3x Ch.	Niveau
Rinçage final		✓	✓

Les pots doivent être en verre ambré.

Remarques

Blancs:

Blanc de terrain (1x pour chaque 3 essais) - Faire aspirer volume d'air équivalent à tous les tests de fuite	
Résine XAD-2 (environ 40g, 1 tube)	
Eau HPLC	
Éthylène Glycol	
Acétone	
Hexane	

Récupération par :	Date :	Endroit :

CONSULAIR

Train d'échantillonnage - ORGANIQUES

Compagnie: AE Metabolive		Projet: 5528	
Échantillonné le: 22-05-2018		Récupéré par:	
Source: Incinérateur	Essai: #1	Date: 21-05-2018	Heure:

CAISSE # 28

Décontamination			Sol. RBS	Eau + Savon	Eau démin.	DHA	HA
Item (dans l'ordre)	#	Nom de la pièce	Ok				
By pass	OR-28-BP	By pass	✓	✓	✓	✓	✓
Cloche femelle	(N/A)	Cloche femelle	✓	✓	✓	✓	✓
Support à filtre en téflon	(N/A)	Support à filtre en téflon	✓	✓	✓	✓	✓
Cloche mâle	(N/A)	Cloche mâle	✓	✓		✓	✓
Réfrigérant	ORC-28-R	Réfrigérant	✓	✓	✓	✓	✓
Trappe de résine		Trappe de résine					
Trappe à condensat verticale	OR-28TC	Trappe à condensat verticale	✓	✓	✓	✓	✓
Long coude		Tuyau MF pour Réfrigérant	✓	✓	✓	✓	✓
	OR-28-LC	Long coudé	✓	✓	✓	✓	✓
Barbotteur Greenberg Smith	(N/A)	Barbotteur Greenberg Smith	✓	✓	✓	✓	✓
Coude	ORC-28-C	Coude	✓	✓	✓	✓	✓
Barbotteur Std	(N/A)	Barbotteur Std	✓	✓	✓	✓	✓
Bouteille de verre ambrée (1)		Bouteille de verre ambrée	✓	✓	✓		✓
Garnitures (Téflon + Aluminium)							
Nombre total de pièces	10	# Unique	1494				

Décontaminé par:	Date: 30/08/2018	Endroit: Québec
Code de décontamination (pot):	JD-30082018-OR28	
# Lot Des Solvants:	Dichlorométhane: 176773	
	Hexane: 175762	
	Acétone: 161822	

Commentaires

Formulaire mis-à-jour le 2018-05-14

P1

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COSU. E2

February/2017

Usine : AE McIlodise	Date : 28.09.2018	P. Bar (po Hg) :	# Cold box : CR2/U1		
Ville: Rankin Inlet		P. Stat. (po H_2O) : −0.05			
ID point d'émission : Incinerateur	Sonde N° : 03.06 3Q.503	Module N° : 19 COMP	K' : 26.19		
Diamètre : 32 1/2	Cp : 0.781	Kc : 0.997			
Distance avant : 5D	Buse N° : 3Q.503	Ko : 1.000	Niveau du manomètre: —		
Distance après : 2D	Coef : 0.4958	Distance P-T°-B : —	Zéro du manomètre: —		

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi³)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
11:50	1	6	5	0.12	1.08	1375	60	60	72	604.57	14.5	4.6	3	−7.0	—	200		45
		6		0.15	1.26	1353			73	608.84								
		6		0.15	1.15	1360			73	612.97	14.5	4.9	3					
		5		0.15	1.15	1362			74	617.11								
		5		0.15	1.15	1369			75	621.25								
		5		0.11	1.11	1362			77	625.40	14.6	4.7	3	−6.5	—	251		41
		4		0.10	1.23	1369			77	629.66	14.7	4.7	3					
		4		0.15	1.15	1371			79	633.81								
		4		0.15	1.16	1372			80	637.92	14.5	4.9	3					
		3		0.15	1.16	1369			81	642.08								
		3		0.11	1.16	1370			83	646.17	14.5	4.9						
		3		0.15	1.16	1373			84	650.31								
		2		0.13	1.04	1315			86	654.36	15.2	4.4	3					
		2		0.13	1.04	1320			87	658.45								
		2		0.12	0.97	1316			88	661.97	15.1	14.4	4					
		1		0.12	0.97	1314			89	665.75								
		1		0.12	0.97	1318			90	669.50	15.3	4.3	4			200		40
		1	↓	0.12	0.97	1318	↓	↓	91	673.25								

TDF Initial Débit (pi³/min): 20.05	Pression (inhg) : −15"Hg	Volume ini (pi³):	Volume fin (pi³):	Volume (pi³):	Fuite Pitot (ΔP) :
TDF Final Débit (pi³/min):	Pression (inhg) :	Volume ini (pi³):	Volume fin (pi³):	Volume (pi³):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

Changement réfrigérant — Cassé à cause du gel

TECHNICIEN :

P2

CONSULAIR

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COJV-E2

February/2017

Usine :	Date :	P. Bar (po Hg) :	# Cold box :
Ville:		P. Stat. (po H_2O) :	
ID point d'émission :	Sonde N° :	Module N° :	K' :
Diamètre :	Cp :	Kc :	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi^3)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										673.25								
	2	1	5	0.12	0.98	1318	80	60	92	677.00	15.3	4.3	4	-5.5	~	252	~	34
		1		0.12	0.98	1311			94	680.74								
		1		0.12	0.99	1300			94	684.49	15.3	4.3	4					
		2		0.12	0.98	1317			95	688.23								
		2		0.12	0.98	1322			96	691.97					~	252	~	40
		2		0.12	0.98	1318			96	695.73	15.3	4.3						
		3		0.12	0.98	1325			97	699.41								
		3		0.11	0.90	1320			98	703.00								
		3		0.11	0.90	1318			90	706.53								
		4		0.10	0.82	1310			100	709.94								
		4		0.10	0.82	1310			100	713.38	15.3	4.4						
1417		4		0.10	0.83	1314			101	716.79								
		5		0.10	0.83	1300			101									
		5																
		6																
		6																
		6	↓				10	10										

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):

Fuite Pitot (ΔP) :

REMARQUES | O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

Fin bris équipement (réfrigérant) changer de point !

TECHNICIEN :

MEV

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT | F_07_V5 (1/2) Avril 2018 | CODE DE L'ESSAI : COSV - 2

Vérification avant essai et montage du dispositif de prélèvement - COSV (SPE 1/RM/2)

Compagnie: AEM - Mtl	Projet: 18-5578	# Ensemble de verrerie : 10
Source: Incinérateur	Essai: 2	# Hot Box : OR-2
Date : 28 - 09 - 2018		Heure :

1 - DÉCONTAMINATION & VÉRIFICATION AVANT ESSAI - BUSE ET SONDE

Item	Remarques	Brosse - DHA	HA
		3x Ch.	3x Ch.
Buse et sonde		✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :		OUI	NON

2 - VÉRIFICATION AVANT ESSAI - TRAIN

Item	Remarques	HA	
		3x Ch.	
Train		✓	
Vérification de la verrerie du train d'échantillonnage à conserver :		OUI	NON

3 - VOLUME D'EAU RECUEILLIE

ITEM #	PIÈCE	CONTENU	POIDS (g)		
			APRÈS	AVANT	TOTAL
1	Condenseur (réfrigérant)	VIDE			
2	Trappe de résine *	XAD-2	131.7	125.6	
3	Trappe à condensat	VIDE	375.6	269.5	
4	Barboteur Greenburg-Smith	ÉTHYLÈNE GLYCOL (100-150 mL)	713.9	700.8	
5	Barboteur modifié	VIDE	—	—	
6	Contenant de dessicant	GEL DE SILICE	1723.1	1713.6	134.8
				TOTAL	

* : Recouvrir de papier d'aluminium après la pré-pesée, et retirer avant la pesée après essai.

REMARQUES :

trappe XAD: 1172

4 - LOTS DES SOLVANTS UTILISÉS

SOLVANTS	# LOT
Dichlorométhane (grade optima)	
Hexane (grade optima)	
Acétone (grade optima)	
Éthylène glycol	
Eau HPLC	
Résine XAD-2	

Vérifié par:	Date:	Endroit:

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

F_07_V5 (2/2)
Avril 2018

Récupération finale du dispositif de prélèvement - COSV (SPE 1/RM/2)

Date de récupération :	28.06.2018	Heure de récupération:	15h00
Nettoyage de l'extérieur des différentes pièces :			
Conditionnement (HA) des contenants **(verre ambré)** de récupération :			

Contenant 1 - Buse-Sonde

Item	Remarques	Brosse HA	HA 3x Ch.	Niveau
Buse et Sonde				

Contenant 2 - Filtre

Filtre	Pétri scellé avec ruban de teflon - dans le papier d'aluminium	

Contenant 3 - Récupération de la partie arrière du Porte-filtre au Condenseur (avant trappe)

Item	Remarques	Tremp. H-A 5 min. Ch	HA 3x Ch.	Niveau
Avant trappe résine				

Contenant 4 - Récupération de la Trappe de résine XAD-2

Trappe de résine XAD-2	Sceller avec ruban de teflon - enveloppé papier d'aluminium	

Contenant 5 - Récupération de la Trappe à condensat au 1er Barboteur (eau)

Item (dans l'ordre)	Remarques	H_2O HPLC 3x	Niveau
Eau			

Contenant 6 - Rinçage final de la partie arrière du Porte-filtre au dernier Barboteur

Item	Remarques	HA 3x Ch.	Niveau
Rinçage final			

Les pots doivent être en verre ambré.

Remarques

Blancs:

Blanc de terrain (1x pour chaque 3 essais) - Faire aspirer volume d'air équivalent à tous les tests de fuite		
Résine XAD-2 (environ 40g, 1 tube)		
Eau HPLC		
Éthylène Glycol		
Acétone		
Hexane		
Récupération par :	Date :	Endroit :

CONSULAIR

Train d'échantillonnage - ORGANIQUES

Compagnie: AE Medicine		Projet: 5528	
Échantillonné le: 23-09-2018		Récupéré par:	
Source: Incinérateur	Essai: 98 E-2	Date: 23-09-2018	Heure:

CAISSE # 10

Décontamination			Sol. RBS	Eau + Savon	Eau démin.	DHA	HA
Item (dans l'ordre)	#	Nom de la pièce	Ok				
By pass		By pass	✓	✓	✓	✓	✓
Cloche femelle		Cloche femelle	✓	✓	✓	✓	✓
Support à filtre en téflon		Support à filtre en téflon	✓	✓	✓	✓	✓
Cloche mâle		Cloche mâle	✓	✓	✓	✓	✓
Réfrigérant		Long MF	✓	✓	✓	✓	✓
		Réfrigérant	✓	✓	✓	✓	✓
		Court MF	✓	✓	✓	✓	✓
Trappe à condensat		Trappe à condensat	✓	✓	✓	✓	✓
Grand L							
		Grand " L"	✓	✓	✓	✓	✓
Barbotteur Greenberg Smith		Barbotteur Greenberg Smith	✓	✓	✓	✓	✓
Coude		Coude	✓	✓	✓	✓	✓
Barbotteur Std		Barbotteur Std	✓	✓	✓	✓	✓
Pot pour le proofing		Pot pour le proofing	✓	✓	✓		✓
Nombre total de pièces		# Unique	988				

Sur le terrain

Verrerie de laboratoire							
Bouteilles de verre ambrée (5)							
Teflon							
Aluminium							
Trappe de résine		Trappe de résine					

Décontaminé par: JD	Date: 24/08/2018	Endroit: Québec	
Code de décontamination (pot):	JD - 24/08/2018 - ORIO		
# Lot Des Solvants:	Dichlorométhane: 162956		
	Hexane: 162082		
	Acétone: 161622		

Commentaires

P1

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COSV-E3

février-2017

Usine : AE Methadone	Date : 29.09.2021	P. Bar (po Hg) :	# Cold box : ORR-V1
Ville: Rankin Inlet		P. Stat. (po H_2O) :	K' : 26.19
ID point d'émission : Incinérateur	Sonde N° : 03.06 Q503	Module N° : 19 COMP	Niveau du manomètre: ✓
Diamètre : 32.1"	Cp : 0.781	Kc : 0.997	Zéro du manomètre: ✓
Distance avant : 5D	Buse N° : 3Q.503	Ko : 1.000 ✓	
Distance après : 2D	Coef : 0.4958	Distance P-T°-B : ✓	

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi^3)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										729.20								
1643	1	6	5	0.24	1.85	1396	60	60	75	734.29	12.9	6.0	3	-7.5	✓	250	✓	40
		6		0.24	1.85	1377			76	739.45								
		6		0.24	1.82	1386			77	744.61	13.0	6.0	3					
		5		0.24	1.83	1385			78	749.76								
		5		0.24	1.82	1405			79	754.91	12.8	6.2	3					
		5		0.24	1.81	1410			80	760.08								
		4		0.21	1.63	1366			81	764.98								
		4		0.23	1.77	1380			82	770.00	13.7	5.5	3			248		
		4		0.23	1.77	1387			82	775.00								
		3		0.23	1.77	1396			83	780.01								
		3		0.23	1.76	1403			84	785.00	13.7	5.5	3					
		3		0.23	1.75	1409			84	789.95								
		2		0.18	1.35	1393			84	794.45								
		2		0.19	1.48	1391			86	799.04								
		2		0.18	1.39	1387			87	803.50	14.5	5.2						
		1		0.18	1.40	1380			87	807.95	14.2	5.1						
		1		0.18	1.39	1400			88	812.39								
		1	↓	0.18	1.38	1410	↓	↓	89	816.86						↓		↓

TDF Initial Débit (pi^3/min): 20.01	Pression (inhg) : 15" Hg	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) : ✓
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

P2

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COSV - E3

février-2017

Usine :	Date :	P. Bar (po Hg) :	# Cold box :
Ville:		P. Stat. (po H_2O) :	
ID point d'émission :	Sonde N° :	Module N° :	K' :
Diamètre :	Cp :	Kc :	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F) Cheminée	Compteur Entrée	Compteur Sortie	Orifice	Volume Prélevé (pi^3)	Masse molaire O_2 (%v)	Masse molaire CO_2 (%v)	Masse molaire CO (ppmv)	Vaccum po. Hg	Température Sonde (°F)	Température Filtre (°F)	Température Sortie (°F)	Température Trappe/Filtre (°F)
										816.86								
	2	1	5	0.18	1.38	1413	60	60	90	821.26	14.1	5.2	3	-60				
		1	1	0.18	1.38	1417			90	825.67								
		1		0.17	1.30	1423			91	829.97								
		2		0.17	1.30	1440			94	834.34								
		2		0.17	1.29	1438			92	838.54								
		2		0.17	1.30	1443			94	842.77								
		3		0.17	1.29	1450			95	847.00								
		3		0.24	1.83	1529			91	851.90								
		3		0.24	1.85	1535			97	856.84								
		4		0.24	1.76	1533			97	861.77								
		4		0.24	1.76	1533			98	866.72								
		4		0.24	1.76	1542			99	871.64								
		5		0.24	1.76	1541			99	876.54								
		5		0.23	1.68	1548			101	881.29								
		5		0.22	1.65	1500			101	886.00								
		6		0.22	1.68	1463			102	890.71								
		6		0.22	1.69	1457			103	895.49								
		6	↓	0.22	1.69	1460	↓	↓	103	900.26								

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) :
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN :

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

F_07_V5 (1/2) Avril 2018

CODE DE L'ESSAI : MRL - COSV - E3

Vérification avant essai et montage du dispositif de prélèvement - COSV (SPE 1/RM/2)

Compagnie: AE Molécule	Projet: 5508	# Ensemble de verrerie :	/
Source: Incinérateur	Essai: #3	# Hot Box :	OK2-V1
Date : 28-09-2018		Heure :	16h00

1 - DÉCONTAMINATION & VÉRIFICATION AVANT ESSAI - BUSE ET SONDE

Item	Remarques	Brosse - DHA	HA
		3x Ch.	3x Ch.
Buse et sonde		✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :		OUI	NON

2 - VÉRIFICATION AVANT ESSAI - TRAIN

Item	Remarques	HA	
		3x Ch.	
Train		✓	
Vérification de la verrerie du train d'échantillonnage à conserver :		OUI	NON

3 - VOLUME D'EAU RECUEILLIE

ITEM #	PIÈCE	CONTENU	POIDS (g)		
			APRÈS	AVANT	TOTAL
1	Condenseur (réfrigérant)	VIDE			
2	Trappe de résine *	XAD-2 1151	121.0	114.1	
3	Trappe à condensat	VIDE	523.10	304.5	
4	Barboteur Greenburg-Smith	ÉTHYLÈNE GLYCOL (100-150 mL)	751.7	729.0	
5	Barboteur modifié	VIDE		—	
6	Contenant de dessicant	GEL DE SILICE	1734.0	1723.1	259.1
				TOTAL	

*: Recouvrir de papier d'aluminium après la pré-pesée, et retirer avant la pesée après essai.

REMARQUES :

4 - LOTS DES SOLVANTS UTILISÉS

SOLVANTS	# LOT
Dichlorométhane (grade optima)	
Hexane (grade optima)	
Acétone (grade optima)	
Éthylène glycol	
Eau HPLC	
Résine XAD-2	

Vérifié par:	Date:	Endroit:

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

F_07_V5 (2/2)
Avril 2018

Récupération finale du dispositif de prélèvement - COSV (SPE 1/RM/2)

Date de récupération : 30-09-2018	Heure de récupération: 8h20	
Nettoyage de l'extérieur des différentes pièces :	✓	
Conditionnement (HA) des contenants **(verre ambré)** de récupération :	✓	

Contenant 1 - Buse-Sonde

Item	Remarques	Brosse HA	HA 3x Ch.	Niveau
Buse et Sonde		✓	✓	✓

Contenant 2 - Filtre

Filtre	Pétri scellé avec ruban de teflon - dans le papier d'aluminium	✓

Contenant 3 - Récupération de la partie arrière du Porte-filtre au Condenseur (avant trappe)

Item	Remarques	Tremp. H-A 5 min. Ch	HA 3x Ch.	Niveau
Avant trappe résine		✓	✓	✓

Contenant 4 - Récupération de la Trappe de résine XAD-2

Trappe de résine XAD-2	Sceller avec ruban de teflon - enveloppé papier d'aluminium	✓

Contenant 5 - Récupération de la Trappe à condensat au 1er Barboteur (eau)

Item (dans l'ordre)	Remarques	H_2O HPLC 3x	Niveau
Eau		✓	✓

Contenant 6 - Rinçage final de la partie arrière du Porte-filtre au dernier Barboteur

Item	Remarques	HA 3x Ch.	Niveau
Rinçage final		✓	✓

Les pots doivent être en verre ambré.

Remarques

Blancs:

Blanc de terrain (1x pour chaque 3 essais) - Faire aspirer volume d'air équivalent à tous les tests de fuite	
Résine XAD-2 (environ 40g, 1 tube)	
Eau HPLC	
Éthylène Glycol	
Acétone	
Hexane	

Récupération par :	Date :	Endroit :

CONSULAIR

Train d'échantillonnage - ORGANIQUE

Compagnie: AE Medicine		Projet: 5528	
Échantillonné le:		Récupéré par:	
Source: Mainmatem	Essai: ROSU E3	Date:	Heure:

CAISSE # 1

Décontamination			Sol. RBS	Eau + Savon	Eau démin.	DHA	HA
Item (dans l'ordre)	#	Nom de la pièce	Ok				
By pass		By pass	✓	—	—	—	—
Cloche femelle		Cloche femelle	✓	✓	—	—	—
Support à filtre en téflon		Support à filtre en téflon	—	—	—	—	—
Cloche mâle		Cloche mâle	—	—	—	—	—
Réfrigérant							
		Réfrigérant	✓	✓	—	—	—
Trappe de résine		Trappe de résine					
Trappe à condensat		Trappe à condensat	✓	—	—	—	—
Grand L		Tige MM	✓	✓	—	—	—
		Tige MF	—	—	—	—	—
		Coude 4 po.	✓	—	—	—	—
Barbotteur Greenberg Smith		Barbotteur Greenberg Smith	—	—	[redacted]		
Coude		Coude	—	—	—	—	—
Barbotteur Std		Barbotteur Std	—	—	—	—	—
Pot pour le proofing						[redacted]	
Bouteille de verre ambrée (5)		Bouteille de verre ambrée	✓	—	—	[redacted]	—
Garnitures (Téflon + Aluminium)							
Nombre total de pièces		# Unique	495				

Décontaminé par: JD	Date: 28/08/2018	Endroit: Québec
Code de décontamination (pot):	JD-28/08/2018	

Lot des Solvants:
Dichlorométhane: 182960
Hexane: 175762
Acétone: 181822

Commentaires

CONSULAIR — GESTION GLOBALE AIR ET ENVIRONNEMENT

Formulaire: F_09_V5

FEUILLE DE VÉRIFICATIONS ET DE DONNÉES DE PRÉLÈVEMENT MANUEL

Code d'essai : COSV - Blanc

February/2017

Usine : LEM-Mtl	Date :	P. Bar (po Hg) :	# Cold box :
Ville: Montréal		P. Stat. (po H_2O) :	
ID point d'émission : incinérateur	Sonde N° :	Module N° : 25	K' :
Diamètre :	Cp :	Kc : 0.999	
Distance avant :	Buse N° :	Ko :	Niveau du manomètre:
Distance après :	Coef :	Distance P-T°-B :	Zéro du manomètre:

Heure	Trav.	Point	Temps prélèv. (min)	ΔP (po H_2O)	ΔH (po H_2O)	Températures (°F)				Volume Prélevé (pi^3)	Masse molaire			Vaccum po. Hg	Température			
						Cheminée	Compteur Entrée	Compteur Sortie	Orifice		O_2 (%v)	CO_2 (%v)	CO (ppmv)		Sonde (°F)	Filtre (°F)	Sortie (°F)	Trappe/Filtre (°F)
										34.7								
							71	71	71	35.7								

TDF Initial Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	Fuite Pitot (ΔP) :
TDF Final Débit (pi^3/min):	Pression (inhg) :	Volume ini (pi^3):	Volume fin (pi^3):	Volume (pi^3):	

REMARQUES — O_2/CO_2 - Utiliser le formulaire de gaz en continu pour calibration des appareils.

TECHNICIEN : JFC

CONSULAIR GESTION GLOBALE AIR ET ENVIRONNEMENT | F_07_V5 (1/2) Avril 2018 | CODE DE L'ESSAI : MEV COSV-2 blanc

Vérification avant essai et montage du dispositif de prélèvement - COSV (SPE 1/RM/2)

Compagnie: NF Meliadine	Projet: 5728	# Ensemble de verrerie : 22
Source: Incinérateur	Essai: #2	# Hot Box : OR2-V1
Date : 22-09-2018		Heure : 10h00

1 - DÉCONTAMINATION & VÉRIFICATION AVANT ESSAI - BUSE ET SONDE

Item	Remarques	Brosse - DHA	HA
		3x Ch.	3x Ch.
Buse et sonde		✓	✓
Vérification de la buse et sondes d'échantillonnage à conserver :		OUI	(NON)

2 - VÉRIFICATION AVANT ESSAI - TRAIN

Item	Remarques	HA	
		3x Ch.	
Train		✓	
Vérification de la verrerie du train d'échantillonnage à conserver :		OUI	(NON)

3 - VOLUME D'EAU RECUEILLIE

ITEM #	PIÈCE	CONTENU	POIDS (g)		
			APRÈS	AVANT	TOTAL
1	Condenseur (réfrigérant)	VIDE			
2	Trappe de résine *	XAD-2 lisr	123.4	123.3	
3	Trappe à condensat	VIDE	371.8	371.8	
4	Barboteur Greenburg-Smith	ÉTHYLÈNE GLYCOL (100-150 mL)	686.2	687.0	
5	Barboteur modifié	VIDE	—	—	
6	Contenant de dessicant	GEL DE SILICE	1730	1730	
				TOTAL	0

*: Recouvrir de papier d'aluminium après la pré-pesée, et retirer avant la pesée après essai.

REMARQUES :

4 - LOTS DES SOLVANTS UTILISÉS

SOLVANTS	# LOT
Dichlorométhane (grade optima)	
Hexane (grade optima)	156309
Acétone (grade optima)	153394
Éthylène glycol	142823
Eau HPLC	135150
Résine XAD-2	

Vérifié par:	Date:	Endroit:

CONSULAIR
GESTION GLOBALE AIR ET ENVIRONNEMENT

F_07_V5 (2/2)
Avril 2018

Récupération finale du dispositif de prélèvement - COSV (SPE 1/RM/2)

Date de récupération : 24.09.2018	Heure de récupération: 15h00	
Nettoyage de l'extérieur des différentes pièces : ✓	✓	
Conditionnement (HA) des contenants **(verre ambré)** de récupération :	✓	

Contenant 1 - Buse-Sonde

Item	Remarques	Brosse HA	HA 3x Ch.	Niveau
Buse et Sonde		✓	✓	✓

Contenant 2 - Filtre

Filtre	Pétri scellé avec ruban de teflon - dans le papier d'aluminium	✓

Contenant 3 - Récupération de la partie arrière du Porte-filtre au Condenseur (avant trappe)

Item	Remarques	Tremp. H-A 5 min. Ch.	HA 3x Ch.	Niveau
Avant trappe résine		✓	✓	✓

Contenant 4 - Récupération de la Trappe de résine XAD-2

Trappe de résine XAD-2	Sceller avec ruban de teflon - enveloppé papier d'aluminium	✓

Contenant 5 - Récupération de la Trappe à condensat au 1er Barboteur (eau)

Item (dans l'ordre)	Remarques	H_2O HPLC 3x	Niveau
Eau		✓	✓

Contenant 6 - Rinçage final de la partie arrière du Porte-filtre au dernier Barboteur

Item	Remarques	HA 3x Ch.	Niveau
Rinçage final		✓	✓

Les pots doivent être en verre ambré.

Remarques

Blancs:

Blanc de terrain (1x pour chaque 3 essais) - Faire aspirer volume d'air équivalent à tous les tests de fuite	✓
Résine XAD-2 (environ 40g, 1 tube)	✓
Eau HPLC	✓
Éthylène Glycol	
Acétone	✓
Hexane	✓

Récupération par : [illegible]	Date : 15-09-20	Endroit : MEL

CONSULAIR

Train d'échantillonnage - ORGANIQUES

Compagnie: AE Maliadine		Projet: 5128	
Échantillonné le: 23-09-2018		Récupéré par:	
Source: Incinérateur	Essai: [illegible] BL	Date: 23-09-2018	Heure: 10h00

CAISSE # 22

Décontamination			Sol. RBS	Eau + Savon	Eau démin.	DHA	HA
Item (dans l'ordre)	#	Nom de la pièce	Ok				
By pass 125 mm	(N/A)	By pass 125 mm	✓	✓	✓	✓	✓
Cloche femelle	(N/A)	Cloche femelle	✓	✓	✓	✓	✓
Support à filtre en téflon	(N/A)	Support à filtre en téflon	✓	✓	✓	✓	✓
Cloche mâle	B	Cloche mâle	✓	✓	✓	✓	✓
Réfrigérant	OR-13-R1	Réfrigérant	✓	✓	✓	✓	✓
	OR-13-R2	Rallonge de réfrigérant	✓	✓	✓	✓	✓
	(N/A)	~~Coude réfrigérant~~	✓	✓	✓	✓	✓
Trappe de résine	[redacted]	Trappe de résine					
Trappe à condensat verticale	OR-22-TC	Trappe à condensat verticale	✓	✓	✓	✓	✓
Coude	(N/A)	Coude	✓	✓	✓	✓	✓
Barbotteur Greenberg Smith	(N/A)	Barbotteur Greenberg Smith	✓	✓	✓	✓	✓
Coude	(N/A)	Coude	✓	✓	✓	✓	✓
Barbotteur Std	(N/A)	Barbotteur Std	✓	✓	✓	✓	✓
Bouteille de verre ambrée (1)	[redacted]	[illegible]mbrée	✓	✓	✓	[redacted]	✓
Garnitures (Téflon + Aluminium)	[redacted]						
Nombre total de pièces	12	[illegible]e [redacted]	1000				

Bouteille de verre [illegible] 04122018-OR22

Décontaminé par: [illegible]	[illegible]018	Endroit: QC
Code de décontamination (pot): [illegible]: 31		
# Lot Des Solvants:	Dichlorométhane: 170773	
	Hexane: 175762	
	Acétone: 181827	

Commentaires

Formulaire mis-à-jour le 2018-05-14

AGNICO EAGLE

MELIADINE GOLD PROJECT

Quality Assurance/Quality Control Plan

MARCH 2019
VERSION 3
6513-QQY-01

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ᑎᑎᖅᑲᖅ ᐱᔨᔪᑎᖃᖅᑐᖅ ᑕᓯᖏᐊᖏᑦᑕᑦ ᐅᓴᖏᑕᒪᐊᖅ ᖃᓄᐃᓕᓂᕐᒧᓄᑦ ᓇᓗᓇᐃᖅᓯᓂᖅ ᓇᓗᓇᐃᖅᓯᒪᓂᖅ / ᖃᓄᐃᓕᓂᕐᒧᑐᓂᖅ ᐊᐅᓚᑦᑎᓂᖅ (QA/QC) <ᖏᓇᐅᑎᑦᑕ, ᐱᓴᒪᐊᖃᖅᑐᖅ ᑕᓯᖏᐊᖏᓪᓗᑦ Type A ᐃᒪᖏᓪᓗᑦ ᓚᐃᓴᖅᓯ ᓴᓴᐅᑎ 2AM-MEL1631-ᒥᑦ, ᐅᖃᖅᓯᒪᔪᖅ ᐊᐃᓴᑐᖅᓯᒪᔪᖅ I, ᖃᓄᐃᓕᓴᕆᒪᐊᖃᖏᓂᖅ 16-ᒥᑦ:

> *ᓚᐃᓴᖃᖅᑐᖅ ᑲᒪᓂᐊᖅᐸᓕᒐ ᖃᓄᐃᓕᓂᕐᓂᓇᓗᐃᖅᓯᓂᖅ / ᖃᓄᐃᓕᓂᕐᓂᓚᓂᑲ ᐊᐅᓚᑎᓂᖅ (QA/QC) <ᖏᓇᐅᑎᑦᑕ, ᓴᓱᒪᓕᕐᐅᔪᖅ ᑲᑎᒪᓴᓂᕐᓂ ᐃᓚᐅᑐᐃᑎᑲ ᐱᓴᕆᖃᖏᓐᓂᐅᔪᑦ ᐃᖏᕐᕕᓂ ᐊᓯᖏᓐᓂ ᐅᑲᑐᑎᓂᖃᖏᓐᓂᑲ ᐊᓱᒪᓗ ᖃᐅᔨᓴᐃᓂᖃᖏᓐᓂᑲ. QA/QC <ᖏᓇᐅᑎᑦᑕ ᐱᓚᓱᖃᓕᕐᓂᓕᖅᑐᑦ ᐊᓱᒪᓗ ᐅᓪᓗᒥᓚᖅᑕᐅᑐᓂ ᐱᓴᒪᖃᖏᓪᓂᕐᒧᑦ ᓚᓚᑦᓗᑦ ᐊᓱᒪᓗ ᐅᖃᖅᑎᑲᓂᕐᒪᑦ ᐃᓚᒪᓴᐅᓂᖃᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᐃᖅᑲᐃᑦ ᖃᐅᔨᓴᐃᐃᖃᖅᑕᑦ. <ᖏᓇᐅᑎᑦᑕ ᐃᓚᐅᓂᐊᓕᖅᑐᑦ ᑎᑎᖅᑲᖅ ᐃᓚᒪᓴᐅᓂᖃᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᐃᖅᑲᐃᑦ ᓇᓗᓇᐃᖅᓯᓗᒃᑐᓂ ᐃᓚᒪᓴᐅᓂᖃᖅᑕᑦ ᖃᐅᔨᓴᐃᖅᑲᐃᑦᑐᓗᒃ ᖃᐅᔨᓴᐃᐃᖃᖅᑕᑦ ᐊᓱᒪᓗ ᓚᓚᑦᓗᑦ ᓚᐃᓴᖅᓯ. ᑕᐃᓇ <ᖏᓇᐅᑎᑦᑕ ᐱᓚᓱᖃᓕᕐᓂᓕᖅᑐᑦ ᓚᓚᑦᓗᑦ ᓯᐅᑦᓂᐅᔪᓂᖅ ᐊᑐᖃᖏᓐᓂᑲᑦ ᐃᓚᒪᓴᐅᓂᖃᖅᓯᒪᔪᑦ ᐊᓱᒪᓗ ᓚᓚᑦᓗᑦ ᓴᓴᐅᑎ 1996-ᒥᑦ ᖃᓄᐃᓕᓂᕐᓂᓚᓂᑲ ᓇᓗᓇᐃᖅᓯᓂᖅ (QA) ᖃᓄᐃᓕᓂᕐᓂᓚᓂᑲ ᐊᐅᓚᑎᓂᖅ (QC)-ᓂᑦ ᓚᓚᑦᑕᐅᔨᓴᐃᑦ ᐊᑐᖃᖅᑕᐅᓂᐊᓕᖅᓯᓗᒃᑐᓂ ᐃᓂᐅᔨᓴᖅ "A" (INAC).*

AGNICO EAGLE

EXECUTIVE SUMMARY

This document presents the Meliadine Mine Quality Assurance / Quality Control (QA/QC) Plan, a requirement of the Meliadine Type A Water License No. 2AM-MEL1631, specified under Part I, Condition 16:

> *The Licensee shall maintain a Quality Assurance / Quality Control Plan, accepted by the Board that includes requirements for independent third party sampling and analysis. The QA/QC Plan shall be prepared and updated as needed in accordance with and in consultation with the accredited laboratory conducting the analyses. The Plan shall include a cover letter from the accredited laboratory confirming approval of the Plan for analyses to be performed under this Licence. This Plan shall be developed in accordance with current Standard Methods and the 1996 Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" (INAC).*

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TABLES AND FIGURES

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	April 2015			This is the first version of this Plan, developed for the Type A Water Licence Application	Golder Associates Ltd.
2	March 2018	All	All	-Updated revision date	Meliadine Environment Department
		2.1	3	-Changed Hanna multi-meter to Eureka Manta II	
		2.2.4	6	-Laboratory name change: MultiLab to H2Lab	
		Table A-2	Appendix 12	-Updated table of analytical parameters (removed Group listing)	
		Figure A-2		-Removed figure heading for site sampling location – no figure was included with the heading	
		Figure A-1	Appendix 16	-Added General Site Plan figure to existing heading	
3	March 2019			Reviewed internally (added changes that the construction phase brought and review of the grammatical tense)	Meliadine Environment Department
		Executive Summary	Ii	Additional INAC information added to executive summary	
		Table A-1	A-2, A-3	Updated GPS Coordinates	
		Figure A-1	A-5	Updated Site Map	

ACRONYMS

CIRNAC	Crown-Indigenous Relations and Northern Affairs
Agnico Eagle	Agnico Eagle Mines Limited
AEMP	Aquatic Effects Monitoring Program
Mine	Proposed Meliadine Gold Mine
MDMER	Metal and Diamond Mining Effluent Regulations
NWB	Nunavut Water Board
Project	Meliadine Gold Project
QA/QC	Quality Assurance and Quality Control
SNP	Surveillance Network Program
CALA	Canadian Laboratory Accreditation

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) developed the Meliadine Gold mine site approximately 25 kilometres north from Rankin Inlet, and 80 kilometres southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson's Bay, the Meliadine site is located on a peninsula (the Peninsula) between the east, south, and west basins of Meliadine Lake (63°01'23.8"N, 92°13'6.42"W), on Inuit Owned Land.

This report presents the Quality Assurance/Quality Control (QA/QC) Plan for the Project. The Plan was prepared in accordance with the requirements of Type A Water Licence Application and the Supplementary Information Guidelines for Mining and Water Works, issued by Nunavut Water Board (NWB 2010a, b, c). It has been developed in accordance with the Aboriginal Affairs and Northern Development Canada (AANDC) 1996 '*Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan*', which includes the following definitions:

- Quality Assurance: the system of activities designed to better ensure that quality control is done effectively; and
- Quality Control: the use of established procedures to achieve standards of measurement for the three principal components of quality – precision, accuracy and reliability.

The mine will have an open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The mine will produce approximately 14.9 million tonnes (Mt) of ore, 31.4 Mt of waste rock, 7.1 Mt of overburden waste, and 14.9 Mt of tailings. There are four phases to the development of Tiriganiaq: 3.5 years construction (Q4 Year -5 to Q2 Year -1), 8.5 years mine operation (Q2 Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

A general location plan of the Mine is shown in Figure A-1.

This Plan, which is part of the Environmental Management System for the Mine, is divided into the following components:

- Procedures for field sample collection (Section 2);
- External and internal laboratory requirements (Section 3); and
- Data verification procedures and regulatory reporting requirements (Section 4).

The objective of the QA/QC program is to assure that the chemical data collected are representative of the material being sampled, are of known quality, are properly documented, and are scientifically defensible. Data quality is assured throughout the collection and analysis of samples using specified standardized procedures, by the employment of accredited laboratories, and by staffing the program with experienced technicians.

This QA/QC Plan sets out standard procedures for sample and data collection with respect to surface water and groundwater sampling in support of monitoring programs outlined in the Water Management Plan, Groundwater Management Plan, and the Aquatic Effects Monitoring Program (AEMP) Design Plan.

SECTION 2 • FIELD SAMPLING

Water quality monitoring was initiated at the pre-development stage and will continue during construction, operations, and closure. Sampling stations, frequency, and parameters are listed in Appendix A, Table A-1. Table A-2 provides supporting definitions. The stations and their requirements may be adjusted based on the requirements of the Type A Water Licence and/or any updates to the Mine management plans over the life of the Mine. Sampling stations are shown in Appendix A, Figure A-2.

There are three categories of aquatic monitoring at Meliadine:

- **Regulated monitoring** occurs at monitoring points specified in licences or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (i.e., water licence) or regulation (i.e., Metal and Diamond Mining Effluent Regulations). Enforcement action may be taken if discharge limits are exceeded for a parameter.
- **Verification monitoring** is carried out for operational and management purposes by Agnico Eagle. This type of monitoring provides data for decision making and builds confidence in the success of processes being used. There is no obligation to report verification monitoring results, although some monitoring locations and these results can be mentioned in environmental management plans (i.e., sampling to verify soil remediation in the landfarm).
- **General monitoring** is commonly included in a water licence specifying what is to be monitored according to a schedule. It covers all types of monitoring (i.e., geotechnical, lake levels, etc.). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included QA/QC provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the Water Board.

All sampling stations are clearly identified; their GPS coordinates collected and stored. All sampling is conducted by qualified personnel, at the same location, using the same techniques to reduce operational error. The following sections outline the standard procedures for collection and handling of all surface water and groundwater samples.

2.1 Sampling Equipment

New laboratory supplied containers are used for sample collection. The bottles are either polyethylene plastic or glass, dependent on the specific parameter being analyzed.

Equipment, such as the HACH test kit – 2100 Q Portal Turbidimeter (turbidity), Oakton PCS35 Meter (pH and conductivity), and Eureka Manta II (pH, dissolved oxygen and conductivity) are handheld instruments that are used to collect, as required, field parameters. The instruments are calibrated before each sample event to ensure optimal performance and record of the calibration are kept in a

Calibration log, and maintenance procedures will be followed as set out by the supplier's operation manual. Equipment and bottles are selected so that they do not contaminate or alter the concentrations of parameters of interest according to laboratory standards.

To collect water samples at depth from the surrounding lake receiving environments, a pump with tubing is used. Low Density Polyethylene tubing, filter apparatus, manual or electric pump, and ashless filter paper are used to filter water for specific analyses (e.g., dissolved metals, chlorophyll *a*) and/or for depth integrated sampling (e.g., chlorophyll *a*, phytoplankton, or biological oxygen demand).

2.2 Sampling Methods and Handling

2.2.1 Sampling Identification

All samples have a unique sample identification name based on a station identifier, date, and time of collection. For duplicates and field blanks, the sample identification follows the naming convention *year* and *sampling number* by following the Environment QAQC table (e.g. 2018-0001)

All sample bottles are identified with the sample identification and date of collection. This information is marked on a label with a water resistant pen or using a label printer and affixed to the sample bottle. Additional information (time of sampling and parameters to analyze) is included in the analysis request (Chain of Custody) that is sent to the Canadian Laboratory Accredited laboratory (CALA).

2.2.2 Surface Water Sampling

Bottles are pre-labeled with the required sample identification before going to the field. Surface grab samples are collected by submerging the sample bottle to half depth of the stream. For sumps, diversion ditches and piped discharge points, samples are collected below the surface of the water.

Samples bottles are provided by the accredited laboratory. All bottles from the lab are pre-rinsed and pre-preserved or pre-rinsed with vials of preservative to that are added in the field by qualified technicians; in the case that bottles are not pre-preserved; bottles are rinsed three times with sample water before filling. When the sampling bottles contains preservative, the bottles are filled by using another clean bottle to avoid any release of preservative. Sometimes, a preservative is added after filling as directed by the laboratory; see Section 2.2.4 for more details on preservation. The bottles are filled properly to allow mixing, preservative addition, and thermal expansion.

Samples analyzed for dissolved metals and chlorophyll *a* are filtered through ash less filter paper at the time of collection when the delay before analyses is long. However, when the delay before analyses is short, the accredited laboratory filters the sample before analyses. In some cases, when the analysis delay is long, the sample will be frozen to prevent parameter degradation.

2.2.3 Groundwater Sampling

Water samples taken from sumps within the underground mine follow the procedures outlined in Section 2.2.2.

Samples representing non-contact groundwater are collected via Diamond Drill Holes (DDHs) intersecting the fracture network. In order to ensure samples are unaffected by substances and materials used during the drilling process, DDHs are flushed thoroughly prior to collecting. The duration of a flush is based on the length of the DDH and rate of groundwater flow measured at its collar. These values are matched to flush-duration curves provided by Golder Associates.

Groundwater samples are collected in clean 4L and 1L containers. In order to minimize the impact of potential contamination from the atmospheric conditions in the underground mine, the 4L sample is transferred to bottles of smaller volume any additional parameters to be analyzed once brought to surface. This is done in a clean laboratory environment where the risk of sample contamination is greatly decreased. Samples are processed and preserved in an appropriate timeframe after collection.

2.2.4 Preservation

Preservatives, if required, are added to sample bottles by the laboratory or added by the technician after filling, as directed by the analytical laboratory. Table A-3 summarizes the minimum sample volumes, preservation, and holding times for select parameters. This information was provided by the CALA certified laboratory H2Lab (formerly MultiLab) for the Meadowbank Mine; however, they are also applicable to the Project.

Table 0-1: Summary of Sampling Requirements

Parameters	Matrix				Type of Bottle	Preservative	Volume
	Drinking Water	Waste Water	Surface Water	Ground Water (1)			
Microbiology							
Escherichia coli, total coliforms, A.A.H.B	48h	48h	48h	48h	PPS	TS, E	250ml
Enterococcus	48h	48h	48h	48h	PPS	TS, E	250ml
Thermo tolerant coliforms (fecal)	48h	48h	48h	48h	PPS	TS, E	250ml
Inorganic Chemistry							
Absorbance UV, Transmittance UV				24h	P. T. V	N	125ml
Alkalinity, Acidity, Bicarbonates, Carbonates	14d	14d	14d	14d	P, T, V	N	250ml
Ammonia nitrogen (NH_3-NH_4)	28d	28d	28d	28d	P, T, V	AS	125ml
Kjeldahl ammonia (NTK)		28d	28d	28d	P, T, V	AS	125ml
Anions (Cl, F,SO_4)	28d	28d	28d	28d	P, T, V	N	250ml
Color, Free & total Chlorine	48h	48h	48h	48h	P, T, V	N	125ml
Conductivity	28d	28d	28d	28d	P, T, V	N	250ml
Cyanides total/available, Cyanides	14d	14d	14d	14d	P, T, V	NaOH	250ml
BOD_5/Carbonated BOD_5 (2)		48h/4°	48h/4°		P, T, V	N	250ml
COD (chemical oxygen demand)		28d	28d		P, T, V	AS	125ml
Mercury (Hg)	28d	28d	28d	28d	P, T, V	AN	250ml
Total/dissolved metals (filtered on field)	180d	180d	180d	180d	P, T, V	AN	250ml
Dissolved Metals (filtered in the laboratory)	24h	24h	24h	24h	P, T, V	N	250ml
Total suspended solids & Volatile TSS		7d	7d	7d	P. T. V	N	500ml
NH_3 or NH_4		24h	24h	24h	P.T.V	N+AS	2/125ml

Nitrites (NO_2), Nitrates (NO_3), Turbidity	48h	48h	48h	48h	P, T, V	N	250ml
Nitrites-Nitrates (NO_2-NO_3)	28d	28d	28d	28d	P, T, V	AS	250ml
O-Phosphates (O-PO_4)	48h	48h	48h	48h	P, T, V	N	500ml
pH	24h	24h	24h	24h	P, T, V	N	125ml
Total Phosphorus (P-tot)	28d	28d	28d	28d	P, T, V	AS	125ml
Dissolved solids (TDS)		7d	7d	7d	P. T. V	N	250ml
Total solids		7d	7d	7d	P. T. V	N	250ml
Sulphides (H_2S) (3)	28d	28d	28d	28d	P. T. V	AcZn + NaOH	125ml
Thiosulfates	48h	48h	48h	48h	P. T. V	N	125ml
Radioactive & Organic Chemistry							
Fatty resin acids (S-T)	--	28d	28d	--	VA, VT	AS	1L
Congeners PCB (S-T)	28d	28d	28d	28d	VA, VT	N	1L
Chlorobenzene	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml
Total Organic Carbon (TOC)	28d	28d	28d	28d	P, T, V (B)	AC	100ml
Dissolved Organic Carbon (DOC)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Total Inorganic Carbon (CIT)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Phenolic compound (GC-MS)	28d	28d	28d	28d	VA, VT	AS	1L
Glyphosate (S-T)	14d	14d	14d	14d	P.T	N	500ml
PAH	28d	28d	28d	28d	VB	AS	1L
Oil & Greases (total and non-polar)	28d	28d	28d	28d	VA, VT	AS	1L
C10-C50 HP and/or Petroleum Product Identification	28d	28d	28d	28d	VA, VT	AS	1L
Phenol index	28d	28d	28d	28d	VA, VT	AS	500ml
Radium-226	180d	180d	180d	180d	P, T. V	AN	1L
VOC (MAH, CAH, THM, BTEX) (3)	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml

Type of bottle:
P.S.V.T.: plastic bottle, bag or glass bottle with Teflon cap
P, T: Plastic bottle or plastic bottle with Teflon cap
P.T.V.: Plastic bottle or glass bottle with plastic or Teflon cap
PPS: Sterile propyl ethylene bottle
VA: Clear or amber glass with aluminium or Teflon seal
VB: Amber glass (or clear glass covered with aluminium paper) aluminium seal of Teflon
VT: Clear or amber glass bottle with Teflon seal
Preservative:
AC: 0.1ml (100µl) of HCl per 100ml of sample
AcZn: 0.2ml zinc acetate 2N per 100ml of sample and NaOH 10N to pH >9
AN: HNO3 to pH <2
AS: H2SO4 to pH <2
E: 2.5ml EDTA 1.5% (p/v) per 100ml of sample if heavy metals are suspected
ED: 0.1ml diamine ethylene 45 mg/l per 100 ml of sample
EDTA: 1ml EDTA 0.25M per 100ml of sample
N: No preservative
NaOH: NaOH 10N to >12
TS: Sodium thiosulfate final concentration in the sample of 0.1% (p/v)

2.2.5 Field Duplicates and Blanks

One field duplicate and one field blank are collected for approximately every 10 samples as shown in Table 2.2. Field duplicates are collected and handled in the same manner as the other samples in the field. Field blanks are samples of deionized water handled concurrently and in the same manner as the other samples in the field.

Table 0-2: Quality Control Sample Frequency

Sampling Site	QA/QC Sampling Frequency
Compliance Monitoring Program	
Regulated Monitoring	1 field duplicate and 1 field blank per 10 samples
Verification Monitoring	1 field duplicate and 1 field blank per 10 samples
–General Aquatic Monitoring	1 field duplicate and 1 field blank per 10 samples
Event Monitoring Program	
Each event	1 field duplicate and 1 field blank per 10 samples

2.2.6 Sample Transport

All water samples are stored upright in coolers with ice packs and preserved as specified by the laboratory. Samples are to be shipped to the external laboratory as soon as possible via Nolinor Charter flight and dedicated ground transportation to ensure arrival in a safe and timely manner. If the sample (sediments, soil and water) cannot be shipped the same day, they are to be stored in a refrigerator at approximately 4°C until shipping.

A Chain of Custody form with the following information is completed for every shipment of samples:

- Company name and sampler's name;
- Sample identification name;
- Time and date of sampling;
- Presence and type of preservative and whether the sample was filtered or not;
- Requested analytical parameters for each bottle;
- Time and date of shipping; and
- Analytical laboratory address and contact person.

One electronic or PDF copy will be sent by email to the laboratory; an electronic copy will be kept at the Mine site for reference.

SECTION 3 • LABORATORY ANALYSIS

3.1 External Laboratory

All analytical chemistry analyses are performed by a CALA accredited laboratory.

In most cases, these analyses are performed by Maxxam, an accredited facility (see Appendix B) located in Ottawa, Ontario. All data from Maxxam undergoes a rigorous internal QA/QC process, including the use of spiked samples and duplicate samples. Toxicity tests will be performed by Aquatox in Nova Scotia. Testing will be conducted as stipulated by Environment Canada's Biological Test Methods.

Agnico Eagle may also require the services of laboratory, such as Maxxam in Edmonton, AB, SGS in Lakefield, ON and H2Lab in Val d'Or, QC. Agnico Eagle may also use the services of ALS Global for some of the AEMP water quality analysis.

3.2 Internal Laboratory

The assay lab at the Mine site is not an accredited laboratory but will be used periodically for "real-time" results for some parameters like pH, total suspended solids, and Weak Acid Dissociable Cyanide. These results are for observational purposes and do not meet the standards of an accredited laboratory.

SECTION 4 • DATA REQUIREMENTS

4.1 Data Collection

A database of all water sampling data is maintained at the Mine site. The database is designed based on the various discharge limits designated in the Water License and the MDMER. The database functionality includes event scheduling, trend analysis, and flagging out-of-compliance samples, all to enhance the effectiveness of the QA/QC program. The database information is presented to regulators in the annual report.

The following data is collected for each sample in the field and is entered into the database by the sampler for the corresponding sampling station:

- Sample identification name;
- Name of sampler;
- Date and time of sampling or measurement; and
- Physical characteristics (pH, temperature, etc.), if required.

The sample results from the laboratory are input into the database and matched to the sample identification name. The analysis certificate for each sample from the accredited laboratory includes but is not limited to:

- Analytical methods or techniques used;
- Date of analysis;
- Detection limit
- Name of the person(s) / laboratory that approved the certificate; and
- Results of any analysis.

4.2 Data Verification

Upon receipt of analytical results, the field blank and duplicate analyses are verified for potential contamination and accuracy, respectively. Results are interpreted and recommended actions are taken if necessary.

4.3 Exceedance Reporting

Any measured concentration at a sample station exceeding a regulated discharge criterion stipulated in the Water License or the MDMER are reported to the Nunavut Water Board, Environment Canada and Climate Change, and AANDC water inspector within 30 days of the receipt of the analysis. In addition, results of the action plan, where required, is reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

SECTION 5 • REFERENCES

AANDC (Aboriginal Affairs and Northern Development Canada). 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan.

NWB (Nunavut Water Board). 2010a. Guide 4: Completing and Submitting a Water Licence Application for a New Licence. April 2010.

NWB. 2010b. Supplemental Information Guideline (SIG) for General Water Works (M1). Issued February 2010.

NWB. 2010c. Supplemental Information Guideline (SIG) for Mine Development (MM3). Issued February 2010.

APPENDIX A • TABLES AND FIGURES

Table A-1: Proposed Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure A-2

Table A-2: List of Analytical Parameters A-4

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Figure A-2: Maxxam Ottawa Lab Accreditation A-6

Table A-1: Proposed Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	UTM Zone 11		Sampling Depth	Sample Type	Number of Samples per Station
					Easting	Northing			
Regulated	Construction	MEL-D-1 to TBD	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes	Quality of intake water	TBD	TBD	Shoreline	Grab	1
Regulated	Construction, and Operations	MEL-SR-1-TBD	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries	Confirm no adverse effects from leakage/runoff	Sample Dependant	Sample Dependant	Surface water runoff (if present)	Grab	1
Aquatic	Construction, and Operations	MEL-11	Water intake from Meliadine Lake	Test quality of final effluent before release	539439	6990637	From pipe	Grab	1
Verification	Construction (prior to release), Operations, and Closure	MEL-12	Water treatment plant (pre-treatment) coming from CP1, off the pipe and not in the pond	Test quality of water before treatment (required to evaluate treatment efficiency)	539636	6989909	From pipe	Grab	1
Aquatic	Construction (prior to release), Operations, and Closure	MEL-13	Mixing zone in Meliadine Lake, Station 1; and MMER exposure stations for final discharge point	Test mixing of effluent in the receiving environment; sample at varied distances and directions from pipe; MMER exposure for final discharge point	542805.78	689105.05	Depends on presence of a vertical conductivity gradient	Discrete	1 (depth of maximum conductivity, or mid-depth if no conductivity gradient is present)
Regulated	Construction (upon effluent release), Operations, and Closure	MEL-14	Water treatment plant from CP-1 (post-treatment), end of pipe (before offsite release) in the plant before release.	Quality of intake water	539642.3	6989897.9	Depth Integrated or from Intake Pipe	Grab	1
Verification	Construction, and Operations	MEL-15	Local Lake E-3	Confirm no leakage/runoff from Emulsion Plant	537019	6990676	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-16	Local Lake G2	Possible seepage or dust loadings from site infrastructure	538444	6990917	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-17	Local Pond H1		540728	6989568	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-18	Local Lake B5		537306	6988841	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-19	CP-2 Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	539575.88	6989757.49	Surface water runoff (if present)	Grab	1
Verification	Construction, and Operations	MEL-20	CP-3 Collection of drainage from dry stacked tailings	Collection of drainage from dry stacked tailings	538207.30	698723.66	TBD	Grab	1
Verification	Construction, and Operations	MEL-21	CP-4 Collection of drainage from WRSF1	Collection of drainage from WRSF1	538991.12	6988841.31	TBD	Grab	1
Verification	Construction, Operations, and Closure	MEL-22	CP-5 Collection of drainage from WRSF1 and WRSF2	Collection of drainage from WRSF1 and WRSF2	540257	6988627.4	TBD	Grab	1

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	UTM Zone 11		Sampling Depth	Sample Type	Number of Samples per Station
					Easting	Northing			
Verification	Construction, Operations, and Closure	MEL-23	CP-6 Collection of drainage from WRSF3	Collection of drainage from WRSF3	TBD	TBD	TBD	Grab	1
Verification	Construction, Operations, and Closure	MEL-24	Seepage from the Landfill between the landfill and Pond H3	Located between the landfill and Pond H3 to monitor seepage from the landfill	539085.44	6989561.54	Pooling Water (if present)	Grab	1
Regulated	Construction, Operations, and Closure	MEL-25	Secondary containment area at the Itivia Site Fuel Storage and Containment Facility	Located in the secondary containment area of the tankfarm at Itivia to monitor water quality prior to discharge to land	545939.8	6963675.3	Pooling Water (if present)	Grab	1

Notes: as per Metal Mining Effluent Regulations (MMER), samples for effluent characterization and receiving environment must be collected quarterly, or at least one month apart while effluent is being deposited.

Grey shading indicates that verification monitoring parameters and locations are internal for Agnico Eagle. A systematic approach will be used in communicating inspections results, likely on an annual basis. This will allow Agnico Eagle to inform government, Inuit associations, and the public of inspection outcomes.

CP = collection pond; WRSF = waste rock storage facility; TBD = to be determined

Table A-2: List of Analytical Parameters

	Parameters
Total/Dissolved Metals	Aluminum, antimony, arsenic, barium, beryllium, boron cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc and mercury
Nutrients	Ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorus, total organic carbon, dissolved organic carbon
MDMER	Total cyanide, arsenic, copper, lead, nickel, zinc, radium-226, TSS, pH, sulphate, turbidity, and aluminum. Effluent volumes and flow rate of discharge, acute toxicity (Rainbow Trout and *Daphnia magna*) and environmental effects monitoring (EEM).
Conventional Parameters	Bicarbonate alkalinity, carbonate alkalinity, turbidity, conductivity, hardness, pH, total alkalinity, TDS, TSS, turbidity
Cyanide	Free and total cyanide
Major Ions	Calcium, magnesium, potassium, sodium, chloride and sulphate
Petroleum Hydrocarbons	F1, F2-F4 and BTEX
Other	Reactive silica, radium-226, oil & grease
Flow	Flow datalogger/meter
Field measurements	Field pH, specific conductivity, dissolved oxygen, and temperature.

MDMER = Metal and Diamond Mining Effluent Regulations.

Figure A-1: General Site Plan

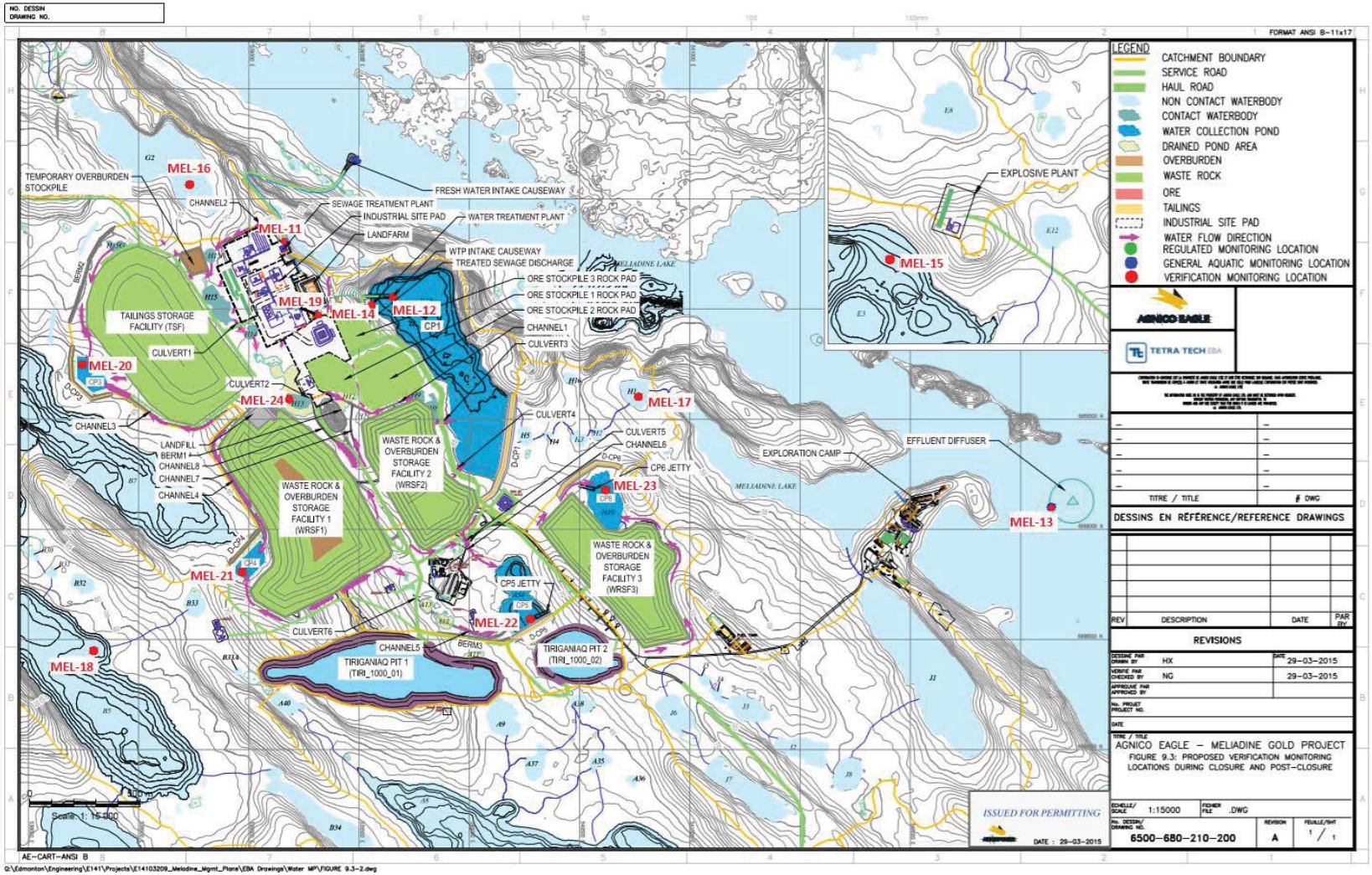

Figure A-2: Maxxam Ottawa Lab Accreditation

CERTIFICATE OF ACCREDITATION

Standards Council of Canada
Conseil canadien des normes

CERTIFICAT D'ACCRÉDITATION

Maxxam Analytics International Corporation
32 Colonnade Road North, Unit 1000, Nepean, ON K2E 7J6

having been assessed by the Standards Council of Canada (SCC) and found to conform with the requirements of ISO/IEC 17025:2005 and the conditions for accreditation established by SCC is hereby recognized as an

ayant fait l'objet d'une évaluation du Conseil canadien des normes (CCN), et ayant été trouvé conforme aux exigences énoncées dans ISO/IEC 17025:2005 et aux conditions d'accréditation établies par le CCN, est de ce fait reconnu comme étant un

ACCREDITED TESTING LABORATORY

LABORATOIRE D'ESSAIS ACCRÉDITÉ

for the specific tests or types of tests listed in the scope of accreditation approved by SCC and found on the SCC website at www.scc.ca.

pour les essais ou types d'essais énumérés dans la portée d'accréditation approuvée par le CCN et figurant dans le site Web du CCN au www.ccn.ca.

Accredited laboratory number: / Numéro de laboratoire accrédité : 814

SCC file number: / Dossier du CCN n° : 151024

Initial accreditation date: / Date de la première accréditation : 2015-10-14

Vice-President – Accreditation Services / Vice-présidente – Services d'accréditation

Issued on: / Délivré le : 2018-01-24

The validity of this certificate, including the date of last re-accreditation and its expiry can be confirmed by the accompanying Scope of Accreditation document in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. The accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF communiqué dated April 2017).

Pour vérifier la validité du présent certificat, y compris la date de la dernière réaccréditation et la date d'expiration du certificat, consulter la portée d'accréditation qui se trouve dans le répertoire des laboratoires accrédités dans le site Web du CCN au www.ccn.ca.

Ce laboratoire est accrédité conformément à la Norme internationale reconnue ISO/IEC 17025:2005. Cette accréditation démontre la compétence technique d'un organisme pour une portée définie et l'exploitation d'un système de management de la qualité de laboratoire (cf. communiqué conjoint ISO-ILAC-IAF date de avril 2017).

This certificate is the property of the Standards Council of Canada (SCC) and must be returned on request; reproduction is prohibited except on written approval of SCC.
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Canada

AGNICO EAGLE

MELIADINE GOLD PROJECT

Environmental Management and Protection Plan (EMPP)

MARCH 2019
VERSION 9
6513-MPS-07

ᓇᐃᓐᓴᕐᓯᒪᔪᖅ

ᐊᓂᐊᓕᕆᓂᖅᑎᑦ ᐊᐅᓪᓚᑎᓂᖓᓪᓗᒍ ᐊᓚᒪᓗ ᒥᐊᓂᕐᓴᕐᓂᖓᓪᓗᒍ ᕿᖏᐅᑎ ᑕᑯᐸᐅᑎᑕᑎᔪᖅ ᖃᓄᐊᖓᓴᖏᓐᓂᐅᔪᓂᖅ ᐊᓂᐊᓕᕆᓂᖓᓪᓗᒍ ᐊᓚᒪᓗ ᐃᓄᐃᑦ-ᐱᑭᐅᕿᓂᖓᓪᓗᒍ ᐊᐅᓪᓚᑎᓂᖅᑎᑦ ᐊᓗᓐᓂᑯᑦ ᑕᓯᔾᔨᖓᑦ ᔪᓐᓇᒪᒍ ᐱᓕᕆᐊᖅᑎᑦ (ᐱᓕᕆᐊᖅ). ᐃᑲᔪᖅᑕᐅᔪᖅ ᑲᑎᒪᔪᓂ ᐱᓕᕆᐊᖅᓯᒪᔪᓂᖅ ᐊᖏᓪᓗᐊᖏᑦᑐᐊᖅᑎᑕᑎᓂᖓᓪᓗᑎᑦ, ᖃᐅᔨᒋᐊᖅᑕᑕᓂᖓᓪᓗᑎᑦ, ᐊᓚᒪᓗ/ᐅᕐᓂᓚᓐᓂᓂ ᐊᐅᓚᑎᓂᖓᓪᓗᑎᑦ ᕿᖏᐅᑎᓄᑦ ᐅᖃᖅᓯᒪᔪᓂ ᐱᓕᕆᐊᖅᓗᒍ ᐊᑐᖅᑕᐅᔪᓂᖅ ᐊᓚᒪᓗ ᐱᓕᕆᐊᖅᑐᖃᖅᑐᓂᖓᓪᓗᒍ ᐊᐅᓚᑎᓂᖓᓪᓗᑎᑦ. ᐊᓗᓐᓂᑯᑦ ᐊᐅᓚᓐᓂᐊᖅᑕᖏᑦ ᖃᓄᐊᖓᓴᓕᕆᖃᖅᓂᐅᔪᓂᖅ ᐱᓕᕆᐊᖅᓗᒍ ᓇᓗᓇᐃᓐᓇᓯᒋᐊᖅᑐᑐᑦ, Type A ᐃᒪᖅᓗᒍ ᓕᐃᔨᓪᓗ (2AM-MEL1631)-ᒥᑦ, ᐊᓯᖏᑦ ᐱᒋᐊᕐᓇᖅᑎᑎᓄᓂᖅ, ᐊᓚᒪᓗ ᐱᓕᕆᐊᖃᖅᑐᑦ ᐱᐟᔨᑎᖃᖅᑐᓂᖓᓪᓗᑎᑦ ᑕᐟᔪᓂᖃᖅᑐᑦ ᐊᓚᒪᓗ ᒪᓕᑎᕋᓐᓂᓂᖅ. ᐊᓗᓐᓂᑯᑦ ᐊᖃᖅᑭᓯᓕᐅᖃᖅᑐᓂᖓᓪᓗᒍ ᐊᐅᓪᓚᑎᓂᖓᓪᓗᑎᑦ ᑕᑯᐸᐅᑎᑕᑎᔪᖅ ᒪᓕᑎᓕᕆᓂᖓᓪᓗᒍ ᐱᓕᕆᐊᖅᑐᖃᖅᑐᓂᖓᓪᓗᒍ ᐊᐅᓚᑎᓂᖓᓪᓗᑎᑦ ᐊᖏᓪᓗᐊᖏᑦᑐᐊᖅᑎᑕᑎᓂᖓᓪᓗᒍ ᐱᓕᕆᐊᖅᑐᖃᖅᑐᓂᖓᓪᓗᒍ ᐱᓕᕆᐊᖅᑐᖃᖅᑐᓂᖓᓪᓗᒍ ᒪᓕᑎᓕᕆᓂᖓᓪᓗᒍ ᐱᓕᕆᐊᖅᑐᖃᖅᑐ

ᖃᓄᐃᖓᓂᐅᔪᑦ ᐃᓕᓴᐅᑎᓂᐊᖏᓚᐅᑎᑦ ᐱᓕᕆᐊᖏᑦ ᖃᐅᔨᒪᓕᖅᑎᑦᑎᐅᖅᓂᕐᓂᖓᑦ ᐊᒻᒪᓗ ᐱᐅᓯᐊᖅᓯᐅᔪᓐᓇᖅᑐᓂᒃ ᐊᑐᓕᖅᑎᑦᑎᓂᕐᓂᖓᑦ ᐊᔨᑦᑐᖅᑎᑦᑐᓂᒃ ᐃᓕᓴᐅᑎᕐᓂᖓᑦ ᐱᓕᕆᐊᖏᑦᓂᖓᑦ.

ᐊᑦᖁᐅᒪᓂᕆᔨᖏᑦ ᖃᐅᔨᓴᐊᖏᖅᑕᑦᑎᓂᕐᓂᖓᑦ ᐊᒻᒪᓗ ᐊᐅᓪᓕᑎᓂᕐᓂᖓᑦ <ᑦᓇᐅᑦᑕᑦ, ᓇᓴᐅᑎᓂᒃ/ᑎᑎᖅᑲᓂᒃ ᖃᐅᔨᓴᐃᓐᓂᑦ, ᐅᓂᐸᒃᓕᐅᕆᓂᖅ, ᐊᒻᒪᓗ ᐃᓕᓴᐅᑎᓂᖅ ᖃᓄᐃᖓᓂᐅᔪᑦ ᐊᐅᓪᓚᖅᑎᑦᑎᓂᕐᓂᖓᑦ ᒪᓕᒃᑕᐅᔨᓴᓇᓂᑦ ᐱᓕᕆᐊᖓᓂᐊᖅᑐᖅ ᐊᒃᑲᓂᔨᔨᓐᓇᑦ. ᐅᖅᖃᓄᖅᖃᖅᑕᑦᑎᓂᖅ ᑕᐸᔨᓇᓐᓂ ᐊᔨᓴᖓᖅᔨᓂᖃᖅᑐᐃᓐᓇᕆᐊᖃᖅᑐᖅ ᒪᓕᒃᓂᓂᐊᖓᓕᑦ ᐱᓴᐅᔭᔨᓇᓂᑦ ᐊᒻᒪᓗ ᐃᓱᒪᓕᑕᐅᔨᓇᓂᑦ ᐊᔨᖏᑦᓂᓐᓇᑦ ᑲᑐᔾᔨᖃᑎᒌᓇᓂᑦ. ᐊᒃᑲᓂᔨᔨᔨᑦ ᐅᔨᔨᓴᖓᑦ ᐃᓕᓴᐅᑎᓂᐅᔨᔪᑦ ᔪᐢᓗ ᐅᔨᔨᓴᖓᑦ:

- ᐱᓕᕆᐊᖓᔪᒪᔨᑦ, ᐊᑐᖅᑐᑦ ᒪᓕᒪᐃᑦ, ᐊᒻᒪᓗ ᒪᓕᒪᕋᓭᑦ;
- ᐃᒃᐱᕈᓂᖅᑲᐃᐅᔨᑦ ᐅᒪᖅᑎᑦᖏᓂᖅᖅᑐᓂᓄᑦ ᐃᓕᓴᐅᑎᔨᓂᒃ (VECs) ᐊᒻᒪᓗ ᐃᒃᐱᕈᓂᖅᑲᐃᐅᔨᑦ ᐃᓄᐃᑦᐱᓵᖅᑕᐅᔨᓂᒃ (VSECs) ᖃᐅᔨᓴᐊᖅᑕᐅᖅᑕᑦᑎᓂᐊᕐᓗᑎᒃ;
- ᐃᓄᐃᑦ ᖃᐅᔨᒪᔭᑐᖅᑎᓂᒃ ᓇᓂᔨᐅᔨᔨᑦ;
- ᖃᐅᑎᒃᑯᖅᑕᑦᑎᓂᖅᖅᑎᑦ, ᖃᓄᑎᕈᐅᓂᖅᖅᑎᑦ, ᐊᒻᒪᓗ ᓄᓇᐅᐸ ᐃᓂᖅᒪᑕ ᐊᖅᕈᓂᖅᓄᑦ ᑎᑭᐅᑎᓄᑦ ᖃᐅᔨᓴᐊᖅᑕᐅᖅᑕᑦᑎᓂᕐᓂᖓᓐᓂᒃ;
- ᑐᒃᓯᕿᐅᑕᐅᔨᑦ ᖃᓄᐃᓕᓚᐅᖅᓯᐅᑎᓂᕐᓂᖓᑦ ᐸᑦᓇᐅᑦᑕᑦ, ᑕᒪᒃᑯᐊᓕᖅᑐᑦ ᒪᓕᒃᑕᐅᔨᓂᒃ ᐊᐅᓪᓚᖅᑎᑦᑎᓂᕐᓂᖓᑦ ᒪᓕᒃᑕᐅᔨᓴᓇᓂᑦ; ᐊᒻᒪᓗ
- ᖃᓄᐃᖅᑐᓂᕐᓂᖓᑦ ᓇᓗᓇᐃᖅᓯᓂᖅ ᐊᒻᒪᓗ ᖃᓄᐃᖅᑐᓂᕐᓂᖓᑦ ᐊᐅᓪᓚᖅᑎᑦᑎᓂᕐᓂᖓᑦ <ᑦᓇᐅᑦᑕᑦ, ᑕᒪᒃᑯᐊᕐᓗᐃᑦ.

ᐱᔪᓚᐊᖏᑦᓴᓐᓂᑦ, ᖃᐅᔨᓴᐊᖏᑦᑕᑦᑎᓂᕐᓂᖓᑦ ᑐᑦᓴᓐᓂᔨᑦ ᐊᑦᖁᑲᑕᐅᔨᓂᐊᖅᑎᑦ ᖃᓄᐃᓕᓴᐅᑎᔨᓂᑦ ᐱᓕᕆᐊᖓᔪᓇᑦᓂᐅᓚᑦᑕ ᐱᓕᕆᐊᖓᐃᓇᖅᑐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᑐᑦ ᐊᐃᔅᑐᖅᓯᒪᔨᑦ ᐱᓕᕆᐊᔪᓐᓇᖅᑐᓂᒃ ᐅᕐᓂᓚᓇᓂᒃ ᑐᑦᓴᓐᓂᔨᔨᓂᒃ ᐱᔨᔪᑎᖅᖅᑐᓂᒃ ᓴᓇᒪᔪᓇᓂᒃ ᑲᑐᔾᔨᖃᑎᒌᓂᖅᖅᑎᑦ ᐅᕐᓂᓚᓇᓂᒃ ᐊᐃᔅᑐᖅᓯᒪᔨᑦ ᐱᔨᔪᓇᖅᑎᓂᕐᓂᖓᑦ.

AGNICO EAGLE

EXECUTIVE SUMMARY

The Environmental Management and Protection Plan (EMPP) describes the overall intent and direction for environmental management at Agnico Eagle Mines Limited (Agnico Eagle) Meliadine Gold Project (Project). This document outlines and describes project-specific management plans, mitigation measures, adaptive management and other standards and requirements for specific areas of environmental management. It is Agnico Eagle's intent to comply with and manage the conditions of the Nunavut Impact Review Board Project Certificate (#006), the Nunavut Water Board Type A Water Licence (2AM-MEL1631), and requirements pertaining to relevant laws and regulations. Agnico Eagle has also developed standard operating and inspection procedures that take into account licenses, permits and legal requirements pertaining to the Project.

A cyclical feedback loop will be employed where operations are planned and implemented, monitoring data collected and analyzed, and practices adjusted to promptly reduce or eliminate any observed negative impacts throughout the life of the Project. Continual use of this feedback loop will allow adaptive management decisions to be made, and shall lead to improvements to the environmental management systems as necessary over time.

The EMPP allows flexibility to respond to changes, for example, in the mining development plan, the regulatory regime, the biophysical environment, technology, research results, and the understanding of Inuit Qaugimajatuqangit (IQ). Thresholds and indicators to trigger management actions are provided, where applicable, in the management plans associated with licenses and permits, along with a system of accountability.

Monitoring and adaptive management are essential tools for ensuring that a project progresses as planned, that mitigation measures are successful, that the procedures and practices are effective and that potential adverse impacts are avoided or minimized. Management Plans and relevant Standard Operating Procedures outline mechanisms such as monitoring, which will be used to refine and modify any mitigation measures.

The design of monitoring and management plans, data analysis, reporting, and integration of results into operational procedures will be carried out by Agnico Eagle. Consultation on the same may lead to changes to meet the needs and concerns of other stakeholders. Agnico Eagle has incorporated the following

- objectives, applicable laws, and regulations;
- the Valued Ecosystem Components (VECs) and Valued Socio-economic Components (VSECs) to be monitored;
- IQ findings;
- frequency, duration, and geographic extent of monitoring;
- proposed action plans and reporting procedures; and

- quality assurance and quality control programs.

When applicable, monitoring programs will be designed so that the results can be coordinated with ongoing regional initiatives or programs with the relevant government organizations or regional authorities.

As a function of Agnico Eagle's adaptive management several management plans have been revised and/or updated, including, but not limited to, the following:

- Environmental Management and Protection Plan Version 8 - Jan, 2019
- Water Management Plan Version 3 - Jan, 2019
- Incinerator Management Plan Version 5 – Dec, 2018
- Landfill Management Plan Version 7 Dec - 2018
- Quality Assurance/Quality Control Plan – Version 3, Dec, 2018
- Aquatic Effects Monitoring Plan – Version 2 - Oct, 2018
- Mine Waste Management Plan – Version 4 - Dec, 2018

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	November 2012			First draft of the Environmental Management and Protection Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013	1.2	2-4	Add Project phases to Table 1-1 and details on adaptive management	John Witteman, Env. Consultant, Agnico Eagle
		3.2	11-13	Add details on adaptive management in design of plans	
		4.5	20-21	Independent audits and reviews	
3	April 2014	1.2	5	Monitoring and mitigation plans vs licensing process	John Witteman, Env. Consultant, Agnico Eagle
		1.3	5	Revision throughout life-of-mine	
		1.3	7	Added Table 1-3	
		2.1	8	Updated Sustainable Development Policy	
		4	16 and 18	Added design, practices and procedures; link with VECs and VSECs	
4	April 2015			Update of entire document for Water Licence Application	John Witteman, Env. Consultant, Agnico Eagle
		4.2.2	24	New section on Traditional Knowledge (IQ)	
		4.2.3	25	New section on Inspections	
5	June 2016	Executive Summary		Revised Section to reflect receipt of Water Licence	Golder Associates, Ltd.
		1		Revised Introduction	
		4.2.1		Revised Environmental Monitoring to meet Water Licence	
		4.2.3		Revised Inspections	
		4.4		Revised Table 4-4 to meet Water Licence	
6	March 2017	Table 4-1 Figure 4-2		Revised Table as per approved new sampling location nomenclature	Manon Turmel, Agnico Eagle Mines Ltd.

7	February 2018	All	Revised to reflect current conditions at Site and reduce repetition	Alex Gauthier and Jennifer Brown, Agnico Eagle Mines Ltd.
8	December 2018	All	Revision required by part I Item 2 of the NWB water Licence 2AM MEL1631, Update relevant Management Plan Version and Date	Dan Gorton, Kevin Buck, Martin Theriault
9	March 2019		Addition of the tables 4.1, 4.2 and 4.3 (monitoring programs and list of constituents in each parameter group) Introduction to reflect the actual mine plan Change references to Appendix B	

ACRONYMS

CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
AEMP	Aquatic Effects Monitoring Program
Agnico Eagle	Agnico Eagle Mines Limited
DFO	Fisheries and Oceans Canada
DOE	Department of Environment
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EMPP	Environmental Management and Protection Plan
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
HTO	Hunting Trapping Organization
IP	Inspection Plan
IQ	Inuit Qaugimajatuqangit
KIA	Kivalliq Inuit Association
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission
NWB	Nunavut Water Board
PDCA	Plan, Do, Check, Adjust
QA/QC	Quality Assurance and Quality Control
RMMS	Responsible Mining Management System
TC	Transport Canada
VEC	Valued Ecosystem Component
VSEC	Valued Socio-Economic Component

SECTION 1 • INTRODUCTION

1.1 Purpose and Scope

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the proposed Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. There are four phases to the development of Tiriganiaq: 3.5 years construction (Q4 Year -5 to Q2 Year -1), 8.5 years mine operation (Q2 Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forward). Approximately 14.9 million tonnes (Mt) of ore will be produced. The produced ore will be milled over approximately 8 years of mine life at a rate of approximately 3,000 tonnes per day (tpd) in Year 1 to Year 3 and 5,000 tpd in Year 4 to Year 8.Mining facilities include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), a water management system that includes collection ponds, water diversion channels, and retention dikes/berms, and a Water Treatment Plant (WTP)

The Environmental Management and Protection Plan (EMPP) provides Agnico Eagle with direction to measure and manage environmental effects of the Project throughout the life of mine. It is a site-specific plan that describes the systematic means by which Agnico Eagle will consistently manage and control potentially adverse impacts, and enhance potential project benefits identified through the Environmental Assessment (EA) process and the subsequent licensing and permitting of the Project.

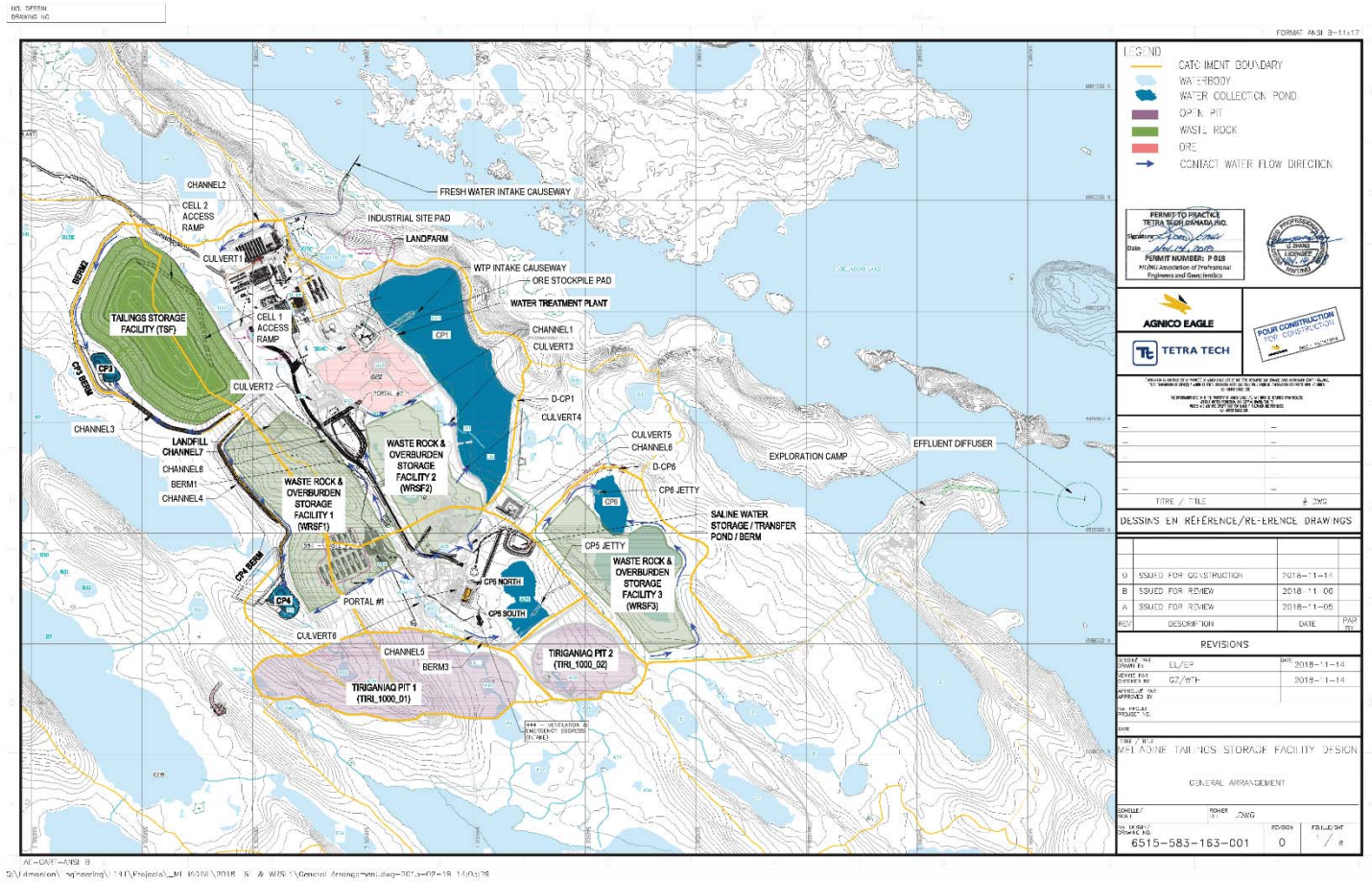
The goal of the activities related to the EMPP is to ensure that Agnico Eagle complies with laws, regulations, and authorizations, and to enable the achievement of goals set out in Agnico Eagle's Sustainable Development Policy. This plan applies to the pre-development, construction, operations, and closure phases for the Project.

The EMPP defines the sequence of policy, planning, implementation, monitoring, and review processes that will ensure that the Project complies with commitments made throughout the EA process, applicable regulated standards and Agnico Eagle's environmental standards. The Plan also contemplates implementation of adaptive management activities for ongoing improvement.

The EMPP encompasses a suite of project specific management plans that set out the Project's standards and requirements for different areas of environmental management. Many of the plans are required by law or by conditions of the NIRB Project Certificate, and the NWB Type A Water Licence

2AM-MEL1631 issued for the Project. The plans and measures are specific to activities and phases of the Project

Figure 1-1 General Site Plan



1.2 Environmental Management Documentation

The structure of the Project's environmental management documentation is shown in Table 1-1. Socio-economic plans are also included. For specific details, please consult the individual plans.

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System							
				Project Phase			
Plan			Purpose	Construction	Operation	Closure	Post-Closure
6513-MPS-01	Incineration Management Plan	Version 5, Dec 2018	To outline the operation of an incinerator located at the site.	√	√	√	
6513-MPS-03	Roads Management Plan	Version 5, Mar 2018	To manage access, service, and haul roads proposed in the Project areas, covering construction, operations, and final closure (the Plan also covers temporary closure).	√	√	√	
6513-MPS-04	Borrow Pits and Quarries Management Plan	Version 6, Mar 2018	To outline environmental aspects of developing, using, and closing the borrow pits and quarries necessary for the overall Project. May be used throughout the Project's life as necessary (when quarries and borrow pits will be required).	√	√	√	
6513-MPS-05	Spill Contingency Plan	Version 7, Mar 2018	To ensure the efficient cleanup of spills related to the Project and to promote prevention, safety and environmental awareness on and off site..	√	√	√	√
6513-MPS-06	Landfill and Waste Management Plan	Version 7, Dec 2018	To describe how non-combustible, non-hazardous, solid industrial wastes will be managed using a landfill, and how remaining non-hazardous waste will be managed.	√	√	√	
6513-MPS-07	Environmental Management and Protection Plan	Version 8, Dec 2018	To provide overarching direction for environmental and socio-economic management for the Project.	√	√	√	√
6513-MPS-08	Ore Storage Management Plan	Version 1, Apr 2015	To address the management of ore mined at the Project.		√		
6513-MPS-09	Mine Waste Management Plan	Version 3, Mar 2018	To address the management of all waste rock and overburden generated through all phases of the Project, and all tailings generated during the operational phase of the Project.	√	√	√	√
6513-MPS-10	Mine Plan	Version 1, Apr 2015	Provide a summary of consolidated information on the design, operation, production and environment management of the mining and milling facilities.	√	√	√	
6513-MPS-11	Water Management Plan (includes	Version 3, Dec 2018	To provide a consolidated source of information on the strategies that will be applied to intercept, collect, contain, conserve, and monitor water in	√	√	√	√

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System							
				Project Phase			
Plan			Purpose	Construction	Operation	Closure	Post-Closure
	Freshet Action Plan)		the Project's area, thus preventing potential adverse impacts on water.				
6513-MPS-12	Hazardous Materials Management Plan	Version 6, Dec 2018	To describe how solid and liquid hazardous materials, including hazardous waste, will be managed and. Includes the Fuel Management Plan.	√	√	√	
6513-MPS-14	Explosive Management Plan	Version 5, Mar 2018	To provide information on explosives transport, storage, manufacture, and handling at the Project.	√	√		
6513-MPS-15	Landfarm Management Plan	Version 3, Dec 2018	To outline the storage and remediation of petroleum hydrocarbon contaminated soil, snow, and ice that may be generated at the Project.	√	√	√	
6513-RMM-01	Risk Management and Emergency Response Plan	Version 4, Apr 2015	An assessment of the potential risks from natural hazards, in both aquatic and terrestrial environments, plus a response plan to emergencies. Includes risk assessment and management if incidents and mechanical and procedural malfunctions emergency response plan.	√	√	√	√
6513-CRP-01	Preliminary Closure and Reclamation Plan	Version 1, Apr 2015	To develop a conceptual plan which outlines how the various mine components will be decommissioned, reclaimed and/or closed following temporary closure or final mine closure. Includes care and maintenance.			√	√
6513-QQY-01	Quality Assurance/Quality Control	Version 3, Dec 2018	Provides consolidated information on the quality assurance and quality control measures for the Project.	√	√	√	
6513-REP-03	Aquatic Effects Monitoring Program (AEMP) Design Plan	Version 2, Oct 2018	To provide information on monitoring the aquatic environment and on mitigation measures to protect and minimize potential impacts on the aquatic environment.	√	√	√	√
	Greenhouse Gas Emissions Reduction Plan	Version 1, Dec 2018	To discuss monitoring, mitigation and adaptive management strategies for the reduction of greenhouse gas emissions over the life of the project.	√	√	√	√
	Conceptual Fisheries		To discuss measures to be implemented to offset the loss of fish habitat resulting from Project	√	√	√	√

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System						
			Project Phase			
Plan		Purpose	Construction	Operation	Closure	Post-Closure
Protection and Offsetting Plan		activities and components. Not applicable at this time.				
Air Quality Monitoring Plan	Version 1, Nov 2015	To present air quality monitoring and management, and emissions and dust reduction/control strategies.	√	√	√	
Noise Monitoring Plan	Version 2, Mar 2017	To provide information on monitoring and mitigation of noise.	√	√	√	
Terrestrial Environment Management and Monitoring Plan (TEMMP)	Version 1, Nov 15	To include appropriate mitigation and monitoring for selected terrestrial species.	√	√	√	√
Shipping Management Plan	Version 7, Mar 2018	To present all Project-related shipping of dry cargo and fuel to Rankin Inlet.	√	√	√	
Oil Pollution Prevention Plan	Version 1.3, Feb 2018	To present the requirements for emergency procedures, equipment, and resources specific to the Rankin Inlet Oil Handling Facility (Itivia) tank farm), as well as preventive measures.	√	√	√	

The EMPP is not a static document; it should be updated periodically as site and external conditions change and as knowledge is gained. Requirements to refine the EMPP may result from changes in operations, technologies employed, the phase of the Project, the result of research findings commissioned by Agnico Eagle, improvements in safety procedures, and/or greater understanding of traditional knowledge (IQ). Changes to laws and regulations, environmental conditions, and other external factors can also have a bearing on the EMPP.

SECTION 2 • BACKGROUND

2.1 Sustainable Development Policy

The Sustainable Development Policy is Agnico Eagle's commitment to operate in a safe social and environmentally responsible manner. It forms the basis of the EMPP and defines the framework within which Agnico Eagle operates. Environmental commitments from the Policy are listed below.

PROTECT THE ENVIRONMENT

We aim to minimize the effects of our operations on the environment and maintain its viability and its diversity. To achieve this, we:

- *Minimize the generation of waste and ensure its proper disposal;*
- *Manage tailings, waste rock and overburden to ensure environmental protection;*
- *Implement measures to conserve natural resources such as energy and water;*
- *Implement measures to reduce emissions to air, water and land, and to minimize our footprint;*
- *Implement measures to reduce our greenhouse gas emissions and address climate change;*
- *Integrate biodiversity conservation and land use planning considerations through all stages of business and production activities;*
- *Rehabilitate sites to ensure physical and chemical stability and in consultation with the communities in a timely manner.*

2.2 Regulatory Setting

Appendix A provides a listing of the various territorial and federal laws, regulation, and guidelines applicable to the Project.

The main authorizing agencies that participated in the review of the Project's Type A Water License (Nunavut Water Board) and the authorizing Project Certificate (Nunavut Impact Review Board) are the following:

- Nunavut Impact Review Board (NIRB);
- Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC);
- Nunavut Planning Commission (NPC);
- Nunavut Water Board (NWB);
- Kivalliq Inuit Association (KIA);
- Fisheries and Oceans Canada (DFO);
- Environment and Climate Change Canada (ECCC);
- Rankin Inlet Hunting Trapping Organization (HTO)
- Transport Canada (TC);
- Nunavut Research Institute;

- Department of Environment (DOE), Government of Nunavut (GN);
- Department of Culture and Heritage, (CH)[1], GN;
- Community and Government Services (CGS), GN; and
- Hamlet of Rankin Inlet.

2.3 Environmental Management and Protection Plan Effectiveness

It is Agnico Eagle's intent to ensure the effectiveness of the EMPP by:

- applying best management practices and using best available information throughout the life of the Project;
- employing adaptive management to address any concerns that may be raised through monitoring;
- seeking continual improvements in environmental and socio-economic management;
- implementing procedures to comply with the conditions imposed by the NIRB Project Certificate and the NWB issued Type A Water Licence;
- consulting with Kivalliq communities and Inuit organizations to understand and address their concerns and to develop guidance for environmental and socio-economic management;
- consideration for incorporating Inuit Qaujimajatuqangit (IQ) into management decisions;
- complying with laws, regulations, and authorizations,
- managing environmental risks associated with the Project through the use of the Precautionary Principle[2] to prevent risks of serious or irreversible harm to the environment;
- assigning roles and responsibilities in making decisions and responding to environmental and impacts that may occur; and
- Reducing or eliminating potentially adverse impacts while maximizing beneficial effects.

2.4 Flexibility in the Environmental Management and Protection Plan

Adaptive management can improve long-term management outcomes. This is possible due to flexibility of this Plan and all other Management Plans developed by Agnico Eagle. Decision-making will meet management objectives and accrue information needed to improve future environmental management (Holling 1978). Flexibility allows for adjustments to operating procedures and refinement of mitigation measures based on what has been learned through experience, monitoring, and research.

[1] Formerly Department of Culture, Language, Elders and Youth (CLEY)

[2] The *Canadian Environmental Protection Act* (1999) defines the Precautionary Principle as follows: "*…where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*

SECTION 3 • ENVIRONMENTAL MANAGEMENT SYSTEM

3.1 Responsibilities and Resource Allocation

The Responsible Mining Management System (RMMS), developed by Agnico Eagle, is expected to provide information related to two key questions:

1. *Does the RMMS effectively conserve and protect the environment in which the mine operates and allow traditional pursuits to continue unimpeded?*

2. *Does the RMMS achieve the goals found in Agnico Eagle's Sustainable Development Policy?*

The RMMS is designed to provide a framework to ensure adequate protection of the environment. It includes the flexibility for continual improvement over time. RMMS verifies that the assignment of environmental management responsibilities and resource allocation to environmental management, monitoring, and mitigation has been considered.

The use of adaptive environmental management allows scenarios to be tested and mitigation measures to be planned and developed beforehand. This allows for a rapid response to adverse effects and reduces the length of time land and water potential impacts could persist. In the event inadequacies are detected in the RMMS, the flexibility afforded by adaptive management allows these to be addressed quickly and in a comprehensive manner.

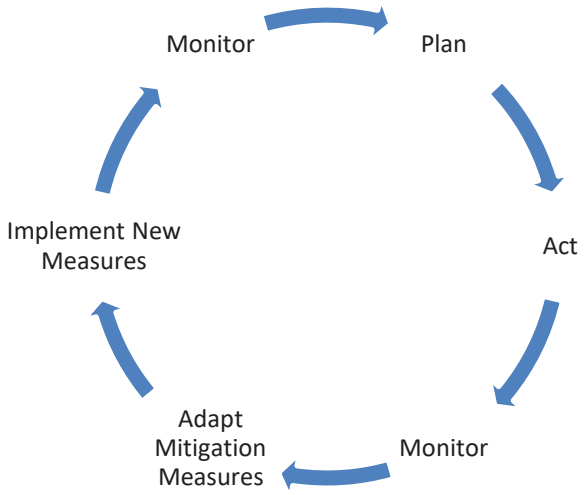
Responsibility for decision-making and providing the resources for the implementation, maintenance, and improvements to the EMPP rests with mine management with input from Agnico Eagle's corporate office. Management responses to potential adverse effects will be based on the analysis of monitoring results and an understanding of the cause and effect, the severity and duration of the adverse effect, and the impact on traditional pursuits. Decisions made using an adaptive management process will improve the EMPP's effectiveness in addressing environmental effects while maintaining the economic viability of the mine. The Environment Superintendent, as a member of the mine senior management team, will have input to collective decisions.

The response initiated and resources provided would be commensurate with the gravity and duration of the observed effect. The goal is to remove the cause of the adverse effect or reduce the observed effect to an acceptable level. This could include administrative actions, such as adjustments to standard operating procedures, especially if negative effects persist.

3.2 Design of Mitigation and Monitoring Plans

Environmental mitigation and monitoring plans outline specific procedures and actions considered essential in accomplishing defined tasks required by the Project. These plans (e.g., Water Management Plan [Agnico Eagle 2018], Terrestrial Environment Management and Monitoring Plan [Agnico Eagle 2017], Borrow Pits and Quarries Management Plan [Agnico Eagle 2018], etc.) include various responses, mitigation measures and strategies designed to be corresponding to the potential

adverse effects. The Plans also include monitoring provisions and programs designed with the objective of assessing effectiveness of the planned mitigation measures after such measures have been implemented. These Plans will assist Agnico Eagle in modifying its work activities and in making improvements to its mitigation measures during all phases of the Project. Adaptive management is a cycle that is applicable to all activities under the RMMS.



In this way, Agnico Eagle can continue to monitor the effectiveness of its mitigation measures, both against regulatory requirements and against the outcomes predicted through the FEIS and permitting processes, and then to adaptively adjust its mitigation measures until the effectiveness of such mitigation measures meet the expected or required outcomes. Agnico Eagle has incorporated initial trigger or threshold levels/points, for example, in the Aquatic Effects Monitoring Plan (AEMP) that, when reached or exceeded, would allow Agnico Eagle to initiate further mitigation measures or adaptively adjust its activity to reverse or stop unwanted outcomes. These initial threshold points will be the subject of continued assessment and would be reviewed and, where appropriate, revised in subsequent updates to the site AEMP.

In the instance of economic hardship (be it internal project economic hardship or external economic hardship recession or collapse in the price of gold]), Agnico Eagle will adjust its operational plans to the prevailing economic condition but it will not sacrifice its commitment to operate in accordance with statutory requirements or compromise its internal mandate to operate in a safe, responsible and sustainable manner. It is understood that Agnico Eagle will consult the NIRB and the NWB to determine whether any potential change to the Project would result in a change to the scope of the Project and potentially require an additional environmental review.

In the event of a transfer of ownership, Agnico Eagle expects that, as a precedent condition to such a sale or transfer, the new owner would be obligated to continue to meet all of the same requirements under the NIRB Project Certificate/NWB Water Licence/or other authorizations, and to continue to operate in a safe, responsible, sustainable manner under the Project's RMMS/EMPP.

In developing the monitoring and management plans for the Project, Agnico Eagle has included the following elements, where applicable:

- objectives of the monitoring program, applicable laws, and regulations;
- discussion of actions to be taken in case of non-compliance with the law or regulations;
- the Valued Ecosystem Component (VEC) to be monitored, and applicable criteria/thresholds and regulations, including, if relevant, the obligations imposed on contractors by the environmental provisions of their contracts;
- description of how the efficiency of mitigation measures will be evaluated;
- description of the frequency, duration, and geographic extent of monitoring with justification for each, and identification of personnel who will conduct the collection, analyse and interpretation of data;
- proposed actions in the event that observed results or impacts differ from those predicted;
- proposed reporting scheme for monitoring results, including format, reporting intervals, and responsible territorial and federal authorities;
- identification of organizations to which to communicate results of monitoring efforts: Inuit organizations, institutes of public government, territorial, and federal authorities, etc.;
- plans for integration of monitoring results with other aspects of the Project, including adjustments of procedures and refinement of mitigation measures;
- procedures/mechanisms to assess the effectiveness of monitoring and adaptive management programs; and
- quality assurance and quality control (QA/QC) measures to be applied to monitoring and management programs.

The initial design of monitoring and management plans, data analysis, reporting, and integration of results into operational procedures will be carried out by Agnico Eagle. Consultation on the same may lead to changes to meet the needs and concerns of other organizations.

Monitoring will use a hierarchical sequence of responses when criteria levels or compliance limits are exceeded, thereby triggering corrective actions.

Mitigation measures as well as corrective and preventative actions will be implemented by applicable mine departments or contractors with support from the Meliadine Environmental Department. This could include the evaluation of mitigation measures in place and updates to operational procedures. Communication will be maintained with Inuit organizations, authorizing agencies and the public in describing any adverse effect observed and what corrective action is being used to mitigate it.

3.3 Mitigation of Adverse Environmental Effects

Mitigation is a means of eliminating, reducing, or controlling a potential adverse environmental effect at the Project, including restitution for any damage to the environment caused by such effects through

replacement, restoration, compensation, or other means (JRP 2010). The ranking of mitigation options is as follows:

- **Avoidance** – using an alternate site or technology to avoid the adverse effect all together. This is the most desirable.
- **Minimization** – taking actions to minimize and/or contain effects to the maximum extent possible during engineering design, construction, operation and closure.
- **Rectification** – taking actions to rehabilitate or restore the affected environment after the fact.
- **Compensation** – this is used as a last resort to offset adverse environmental effects. This is the least desirable.

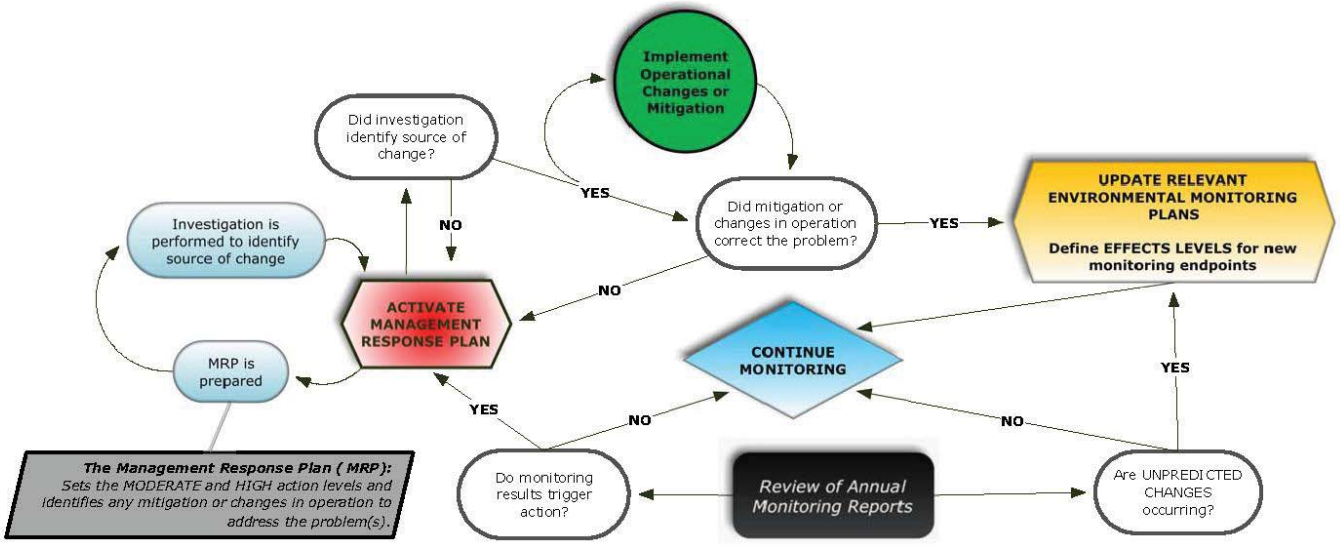
Environmental effects monitoring programs will monitor the effectiveness of mitigation measures. These programs will include a reporting and response system; through adaptive management, strategies (see Section 4).

SECTION 4 • FOLLOW-UP AND ADAPTIVE MANAGEMENT PLAN

Each of the management plans developed for the Project include an intrinsic process of continuous improvement that is aimed at evaluating the effectiveness of the design features, mitigation measures, operating practices, and procedures put in place.

Making use of adaptive management requires the recognition that it is a structured, iterative approach to environmental management decision-making (CPR 2011). Many VECs applicable to the Project are part of dynamic natural systems where uncertainty can be a significant factor. The goal is to reduce uncertainty over time by incorporating learnings from design, monitoring, mitigation, and changes in operations into environmental management at the proposed mine site. Where applicable, an adaptive management strategy or approach will be used for those VECs that will be monitored by Agnico Eagle. The adaptive management process is shown in Figure 4-1.

Trends will be documented and compared to the pre-established goals/thresholds. Any corrective action plan will also be documented through the RMMS.



Adaptive Management Plan triggered when EFFECT(S) LEVELS exceed pre-determined LOW ACTION LEVELS or UNPREDICTED CHANGES are occuring (i.e., conclusions of monitoring response framework).

Outcome may include engineering/mitigation, changes to Effluent Quality Criteria (EQC), and updated monitoring programs.

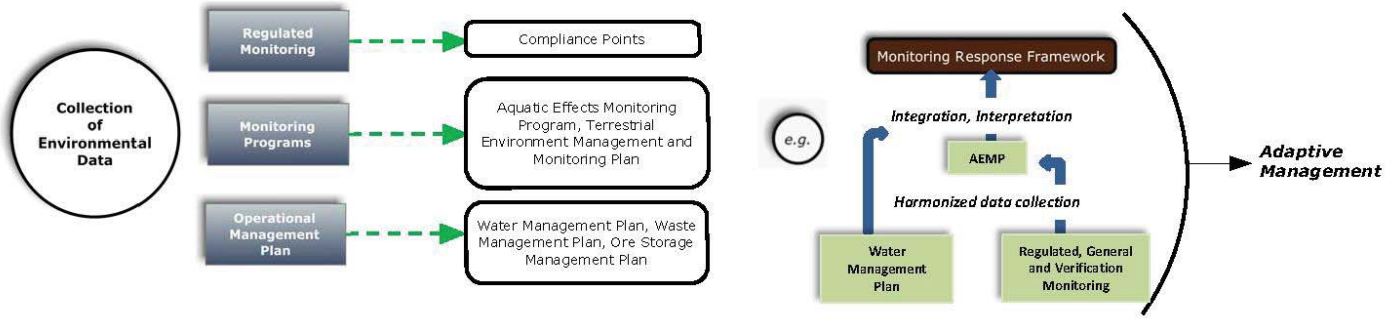


Figure 4-1 Adaptive Management Process

4.1 Adaptive Management and Precautionary Principle

It is through monitoring that any unanticipated adverse environmental impacts can be discovered. Adaptive management is particularly useful in implementing the appropriate remedial measures in these instances. Additionally, the objectives of monitoring and adaptive management are to verify that:

- commitments are fulfilled;
- regulatory and other requirements are met;
- adverse effects are avoided or minimized; and
- benefits are enhanced.

The precautionary principle, in conjunction with adaptive management, will be used in decision-making. In the face of uncertainty, conservative approaches will be used with an aim to reducing uncertainty over time via monitoring and mitigation.

Inspection precedes maintenance. Inspections, combined with monitoring, will signal when adaptive management must be used to mitigate possible negative effects (see Section 4.2.3 Inspections).

4.2 Performance Measurement and Monitoring

To effectively communicate performance, it is important to select the appropriate indicators. As part of the Mining Association of Canada, Agnico Eagle reports its global performance through its annual Corporate Social Responsibility report. This report includes, notably, the indicators of the Global Reporting Initiative and Towards Sustainable Mining Initiative. Those will be incorporated into the Meliadine RMMS. Indicators to follow will be selected by taking into account:

- the compliance with relevant regulatory requirements and permitting targets;
- activities trends; and
- the progress towards achieving targets.

The RMMS will link the compliance thresholds to appropriate corrective actions and establish accountability.

The performance of the management plans will be monitored and the results communicated. Independent researchers or consultants may be engaged to review performance where necessary. The accuracy of the environmental impact predictions and the effectiveness of the mitigation measures will be verified through that process. If unusual or unforeseen adverse environmental impacts are noticed, corrective action will be put in place. Through the adaptive management process, the existing mitigation measures will be adjusted or new mitigation measures implemented if necessary. External reporting will be completed, as required. As a result, site Management Plans may be revised or modified as required.

A follow-up program will verify the effectiveness of any mitigation measures taken in response to expected and unexpected adverse environmental effects. An environmental effects monitoring

program, will monitor the effectiveness of all mitigation measures. This program will include a reporting and response system.

4.2.1 Environmental Monitoring

Environmental monitoring, for the purposes of the EMPP, consists of the following:

- Regulated discharge monitoring occurs at monitoring points specified in the Type A Water License, other licenses, or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (e.g., water license) or regulation (e.g., Metal and Diamond Mining Effluent Regulations). Enforcement action occur if discharge limits are exceeded for a parameter.
- Verification monitoring is carried out for operational and management purposes by Agnico Eagle. This type of monitoring provides data for decision-making and builds confidence in the success of processes being used. There is no obligation to report verification monitoring results, although some monitoring locations and these results can be mentioned in environmental management plans (e.g., sampling to verify soil remediation in the landfarm) or the Annual Reports required by regulators.
- General monitoring is commonly included in a water license specifying what is to be monitored according to a schedule[3]. It covers all types of monitoring (e.g., geotechnical, lake levels, etc.). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, including quality assurance/quality control provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB or the NIRB.

All three types of monitoring will be used at the Project. A summary of Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure is included in the Aquatic Effects Monitoring Program Design Plan (AEMP) (Golder 2018) and the list of parameters for sample analysis is included in the Type A Water Licence.

[3] Referred to in NWT and old NWB licenses as the Surveillance Network Program.

Table 4.1 Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure

Station	Type of monitoring	Description	Phase	Monitoring Parameters	Frequency
Mine Site					
MEL-D-1 to TBD	Regulated Monitoring	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes	Construction	As defined in the Water Management Plan referred to in Part D, Item 12	Prior to discharge and Weekly during discharge
				Volume (m3)	Daily during periods of discharge
MEL-SR-1 to TBD	Regulated Monitoring	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries	Construction, and Operation	As defined in the Water Management Plan referred to in Part D, Item 18 and Part I, Item 11	Prior to Construction, Weekly during Construction
				Group 1	Monthly during open water or when water is present upon completion
MEL-11	General Aquatic monitoring	Water Intake from Meliadine Lake	Construction, Operation, and Closure	Full Suite	Monthly during periods of intake
				Volume (m3)	Daily during periods of intake
MEL-12	Verification monitoring	Water treatment plant (pre-treatment) coming from CP1, off the pipe and not in the pond	Construction (prior to release), Operations, and Closure	Group 1	Monthly during periods of discharge
MEL-03-01 (and AEMP Stations)	General Aquatic monitoring	Mixing zone in Meliadine Lake, Station 1; and MMER exposure stations for final discharge point within mixing zone	Construction (prior to release), Operations, and Closure	Full Suite, Group 3 (MMER)	Monthly during periods of discharge

MEL-14	Regulated Monitoring	Water treatment plant from CP-1 (post-treatment), end of pipe (before offsite release) in the plant before release.	Construction (upon effluent release), Operations, and Closure	Full Suite, Group 3	Prior to discharge and Weekly during discharge
				Volume (m3)	Daily during periods of discharge Once prior to discharge and Monthly thereafter
				Acute Lethality	Once prior to discharge and Monthly thereafter
MEl-15	Verification monitoring	Local lake E-3	Operations, and Closure	Group 2	Bi-annually during open water
MEL-16	Verification monitoring	Local Lake G2	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-17	Verification monitoring	Local Pond H1	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-18	Verification monitoring	Local Lake B5	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-19	Verification monitoring	CP-2 Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-20	Verification monitoring	CP-3 Collection of drainage from dry stacked tailings	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-21	Verification monitoring	CP-4 Collection of drainage from WRSF1	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-22	Verification monitoring	CP-5 Collection of drainage from WRSF1 and WRSF2	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present

MEL-23	Verification monitoring	CP-6 Collection of drainage from WRSF3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-24	Verification monitoring	Seepage from the Landfill between the landfill and Pond H3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-25	Regulated Monitoring	Secondary containment area at the Itivia Site Fuel Storage and Containment Facility	Construction, Operation, Closure	Group 4, Volume (m3)	Prior to discharge or transfer of Effluent

Table 4-2 List of Constituents in Each Parameter Group

Parameter Group	Parameters
1	pH, turbidity, hardness, alkalinity, chloride, fluoride, sulphate, total dissolved solids (TDS), total suspended solids (TSS), total cyanide, ammonia nitrogen, nitrate, nitrite, phosphorus, ortho-phosphate, total metals (aluminum, arsenic; barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc).
2	**Total and dissolved metals**: aluminum, antimony, arsenic, barium, beryllium, boron cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc. **Nutrients**: ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorus, total organic carbon, dissolved organic carbon, and reactive silica. **Conventional Parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, turbidity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, TDS, TSS, total cyanide, free cyanide, and weak acid dissociable (WAD) cyanide.
3	**MDMER parameters**: total cyanide, arsenic, copper, lead, nickel, zinc, radium-226, TSS, pH, sulphate, turbidity, and aluminum. **MDMER additional requirements:** Effluent volumes and flow rate of discharge, Acutely Lethality tests (Rainbow Trout and *Daphnia magna*) and environmental effects monitoring (EEM).
4	Total arsenic, total copper, total lead, total nickel, TSS, ammonia, benzene, toluene, ethylbenzene, xylene, total petroleum hydrocarbons (TPH), and pH.
Full Suite	Group 2, TPH, and turbidity.
Flow	Flow datalogger
Field measurements	Field pH, specific conductivity, dissolved oxygen, and temperature.

MDMER = Metal and Diamonds Mining Effluent Regulations; P = phosphorus; N = nitrogen

Table 4-3 Summary of Aquatic Effects Monitoring Program Study Design

Area	Core (or Target Study)	Number of Stations per Area	No. of Samples per Station	Parameters	Sample Type	Collection Frequency within Program	Program Frequency
Exposure Area (near-field and mid-field)[a]	Water Quality	5	1	major ions, nutrients, metals	composite; from specific depth	once during under-ice; monthly during discharge period	annual
		5	1	chlorophyll *a*	composite; from specific depth or depth-integrated	monthly during discharge period	
	Benthic Invertebrates	5	5	benthic invertebrate taxonomy	composite from 5 grabs	once per year	every 3 years
	Sediment Quality	5	5	particle size, total organic carbon, nutrients, metals	composite grab	once per year	every 3 years
	Plankton[b]	5	1	phytoplankton taxonomy	composite; depth-integrated	monthly during open-water period	TBD
		5	1	zooplankton taxonomy	composite; vertical tow of water column		
	Fish Health[c]	n/a	60[d]	lengths, weights, sex, fecundity, age, external and internal health	individual fish	once per year	every 3 years
	Fish Tissue Chemistry[c]	n/a	40[d]	metals	carcass (adults only), muscle, liver, kidney	once per year	every 3 years
Reference Area 1	Water Quality	5	1	major ions, nutrients, metals	composite; from specific depth	monthly during open-water period	annual

Area	Core (or Target Study)	Number of Stations per Area	No. of Samples per Station	Parameters	Sample Type	Collection Frequency within Program	Program Frequency
(northeast bay)		5	1	chlorophyll *a*	composite; from specific depth or depth-integrated		
	Benthic Invertebrates	5	5	benthic invertebrate taxonomy	composite from 5 grabs	once per year	every 3 years
	Sediment Quality	5	5	particle size, total organic carbon, nutrients, metals	composite grab	once per year	every 3 years
	Plankton[(b)]	5	1	phytoplankton taxonomy	composite; depth-integrated	monthly during open-water period	TBD
		5	1	zooplankton taxonomy	composite; vertical tow of water column		
	Fish Health[(c,e)]	n/a	60 [(d)]	lengths, weights, sex, fecundity, age, external and internal health	individual fish	once per year	every 3 years
	Fish Chemistry[(c,e)]	n/a	40 [(d)]	metals	carcass (adults only)	once per year	every 3 years
Reference Area 2 (northwest bay	Water Quality	5	1	major ions, nutrients, metals	composite; from specific depth	once per year	annual
		5	1	chlorophyll *a*	composite; from specific depth or depth-integrated	once per year	annual

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Area	Core (or Target Study)	Number of Stations per Area	No. of Samples per Station	Parameters	Sample Type	Collection Frequency within Program	Program Frequency
	Benthic Invertebrates	5	5	benthic invertebrate taxonomy	composite from 5 grabs	as required[f]	as required[f]
	Sediment Quality	5	5	particle size, total organic carbon, nutrients, metals	composite grab	as required[f]	as required[f]
	Plankton[b]	5	1	phytoplankton taxonomy	composite; depth-integrated	as required[f]	as required[f]
		5	1	zooplankton taxonomy	composite; vertical tow of water column	as required[f]	as required[f]
	Fish Health[c,e]	n/a	60 [d]	lengths, weights, sex, fecundity, age, external and internal health	individual fish	once per year	every 3 years
	Fish Chemistry[c,e]	n/a	40 [d]	metals	carcass (adults only)	once per year	every 3 years
Reference Area 3 (southwest bay)	Water Quality	5	1	major ions, nutrients, metals	composite; from specific depth	once per year	annual
		5	1	chlorophyll *a*	composite; from specific depth or depth-integrated	once per year	annual
	Benthic Invertebrates	5	5	benthic invertebrate taxonomy	composite from 5 grabs	as required[f]	as required[f]

Area	Core (or Target Study)	Number of Stations per Area	No. of Samples per Station	Parameters	Sample Type	Collection Frequency within Program	Program Frequency
	Sediment Quality	5	5	particle size, total organic carbon, nutrients, metals	composite grab	as required[(f)]	as required[(f)]
	Plankton[(b)]	5	1	phytoplankton taxonomy	composite; depth-integrated	as required[(f)]	as required[(f)]
		5	1	zooplankton taxonomy	composite; vertical tow of water column	as required[(f)]	as required[(f)]
Peninsula Lakes	Water Quality	3	1	major ions, nutrients, metals	composite; from specific depth	Twice during open water season	annual

Notes:
(a) Only the Near-field area, and Reference Areas 1 and 2 are planned for sampling fish health and fish tissue chemistry.
(b) Plankton monitoring is not a core component of the AEMP but was planned as a targeted study to evaluate the usefulness of plankton monitoring for future monitoring.
(c) Fish health and tissue chemistry sampling for the AEMP is currently scheduled for 2021.
(d) Sample size is for Threespine Stickleback; Lake Trout sample sizes will be determined prior to next AEMP Fish Health/Tissue Chemistry program.
(e) Lake Trout will not be collected from the Reference Areas.
(f) Reference Area 2 was sampled to provide additional baseline data; further sampling will depend on triggering by water quality results from the Mid-field area or Reference Area 1.
"Metals" include non-metals (e.g. selenium) and metalloids (e.g., arseni

4.2.2 Use of Inuit Qaugimajatuqangit in Environmental Management and Monitoring

IQ consists of Inuit values, preferences and traditional knowledge; it is about the relationships between humans, animals, and the environment. It is location specific and reflects the particular conditions in specific geographic locations. IQ, although normally undocumented, is shared information within the community, and maintains the means and knowledge of living off the land, continues traditional land use activities, and promotes a cultural life style, all of which sustained Inuit for generations.

IQ is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. As such, IQ represents a valid and essential source of information in the design and implementation of environmental management and monitoring programs. Improvements have been incorporated based on stakeholder review, and through the inclusion of traditional knowledge from communities and Inuit organizations throughout the Kivalliq region. Agnico Eagle expects to continue active engagement with communities and Inuit organizations, which should lead to further inclusion of traditional knowledge in periodic updates to the design and implementation of environmental programs. Agnico Eagle has and will continue to engage with the KIA to advance the use of IQ. This will ensure that the combination of science and IQ leads to environmental management and monitoring that meets the expectations of government, communities, and Inuit organizations.

4.2.3 Inspections

Agnico Eagle is responsible for inspection and maintenance of all mine components, and the inspection and monitoring of mine activities. A regular inspection program will lead to the early identification of areas where improvements are needed. The early resolution of any deficiencies will result in less ongoing maintenance and repair of mine components, and a reduction in the risk of adverse environmental effects.

Inspections ensure that Project mine components are constructed, operated, maintained, managed, and closed in an environmentally sound, safe, and efficient manner. Further, inspections assist in obtaining better environmental outcomes for all activities and more timely maintenance of mine components throughout the mine life.

For the most part mine environmental personnel having knowledge and experience with the mine components and activities carry out the inspections. Training is provided by Agnico Eagle to effectively and efficiently complete inspections. Inspections result in month-end summary reports that are distributed to mine management and regulators. This allows action to be taken to address any deficiencies in components or activities. Inspection reports are retained on site by the respective inspecting departments.

4.2.3.1 Scope of Inspection Program

The Inspection Program (IP) is relevant to all phases of the mine life, including pre-development, construction, operation, closure, and any periods of care and maintenance. Inspections are conducted throughout the entire mine site and associated components. Inspections are also carried out at the Itivia site in Rankin Inlet. This includes, but is not limited to, mine components such as, open pits, quarries, borrow pits, roads, storage pads, waste rock storage facilities, diversion channels, dikes, sumps, berms, tailings storage facility, landfill, incinerator, landfarm, explosives plant, and pipelines. It includes such activities as the pumping of water and waste, discharge to the receiving environment, spill cleanup, and fuel transport on Agnico Eagle's roads.

4.2.3.2 Inspection Priority and Risk Analysis

Inspection priorities are based on analyzing all mine components / activities and their respective risks. Installations and activities are qualitatively[4] ranked as "high risk", "medium risk" and "low risk" with those posing a "high risk" receiving inspections that are more frequent[5]. If needed, the inspection schedule will be adjusted to accommodate an increased inspection frequency of mine components and/or activities requiring more attention.

The criteria used in determining risk arising from the use of water or discharging to water include the following:

- potential effect on the environment (e.g., due to the location of mine components and sensitivity of the nearby receiving environment);
- potential effect on public health (e.g., potable water treatment or sewage treatment);
- safety risks (e.g., the integrity of roads throughout freshet or following a major rain event);
- potential social impacts (e.g., dust from Agnico Eagle's roads); and,
- potential financial or economic impact resulting from an accident, malfunction, or spill (e.g., tanker truck leaving the all–weather access road, spilling fuel, and requiring significant resources for the cleanup).

4.2.3.3 Routine and Non-routine Inspections

Routine inspections are planned and scheduled on a reoccurring basis and cover the following:

- inspections required under authorizations;
- inspections of mine components where the management of water and waste takes place; and,

[4] If there is a disagreement on the level of risk based on a qualitative determination, a quantitative determination will be undertaken using accepted methods found in the literature (IMPEL 2012).

[5] Agnico Eagle has the capacity to carry out an inspection program. All activities and mine components identified in this inspection program affecting the use of water or the discharge of waste to water will be inspected, irrespective of the level of risk.

- activities that could affect water and waste management.

Non-routine, event, or unplanned inspections cover the following:

- environmental complaints or concerns raised by the public;
- accidents, malfunctions and spills;
- after major rain events;
- instances when the quality or quantity of water on the mine site is not meeting expectations; and
- instances where discharge criteria to the receiving environment approach, but do not exceed, Water License limits or the Metal Mining Effluent Regulations.

Inspections will have a strong seasonal component with some inspections suspended over the winter and others reduced. Agnico Eagle foresees a high frequency of inspections of engineered structures occurring just before and during freshet, followed by less frequent inspections over the remainder of the open water season. For example, inspections of culverts, bridges, ditches, and sumps will be suspended over the winter, and would resume before freshet and continue over the summer until freeze-up. Increased inspections during freshet will ensure mitigation measures employed to manage the higher spring flows prove effective, and that the integrity of bridges and culverts are not compromised.

Year-round inspections at a set frequency will occur for mine components such as the potable water treatment plant, the sewage treatment plant and the landfill. These are not directly influenced by the changing weather experienced at the mine site over the year.

Table 4-1 below provides a summary of proposed inspections of mine components and mine activities; this includes some unrelated to the use or water or the discharge of waste to water. Specific details are included in the respective management plans and/or procedures and indicate inspection methods or procedures, and frequency. It also identifies the department responsible for the inspection. Ultimately, the environmental department at Agnico Eagle will be responsible for ensuring that all monitoring and inspections are completed.

Table 4-4 Summary of Proposed Inspections

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Dikes	Visual inspection for erosion of or seepage through or under the dikes, including movement of crests and slopes. The environment department would collect samples of any seepage.	High. Failure of a dike could have significant adverse effects on the downstream environment	Engineering	Weekly prior to freshet when the dikes are clear of snow, and weekly over the open water season. Monthly during the winter to check for seepage
Open Pits	Visual inspection for seepage and collection of samples, if it safe to do so	Low. Water seeping into open pits will be controlled and directed to CP1	Open Pits Mining Environment Engineering	Weekly at freshet and monthly thereafter over the open water season
Waste Rock Storage Facilities	Visual Inspection for seepage and collection of samples, if it safe to do so. Thermistor Installation	Low. Ditches will intercept any seepage from the waste rock and direct the water to CP1. Thermistors monitor the rate of freeze back and permafrost development progress	Open Pits Mining Engineering Environment	Visual inspection, monthly over the open water season and thermistors monitored four times per year.
Ore Stockpiles	Visual Inspection for seepage and collection of samples, if it safe to do so.	Low. Ditches will intercept any seepage from the ore stockpiles and direct the water to CP1.	Engineering	Visual inspection, monthly over the open water season
Tailings Storage Facility	Thermistor Installation	Low. Thermistor cables will be installed in the TSF to monitor the permafrost development progress within the facility during the operations stage	Engineering Environment	Four times per year
Berms	Visual inspection for erosion of or seepage through or under the berms, including movement of crests and slopes.	High. Failure of berms upstream from pits could pose a safety hazard.	Engineering	Weekly inspection just before, during and just after freshet; Monthly after freshet is over in the open water season
Culverts	Visual inspection for snow and/or debris blockage of culverts.	Medium. Snow can be removed from the front and back of the culverts before freshet	Energy and Infrastructure Environment Engineering	Just prior to freshet and daily during the first days of freshet; also following major rain events. Weekly during period of flow. Monthly after freshet is over in the open water season

Table 4-4 Summary of Proposed Inspections (continued)

Roads	Visual inspection for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment	Low. Affected area will be repaired using granular material and/or crushed rock.	Energy and Infrastructure	Weekly over the summer (approximately mid-May , from the start of the freshet period to October, prior to the fall freeze-up)
Water ponding against roads	Visual inspection of roads after freshet and major rain events.	Low. Ponding can be dealt with by pumping the water or by installing a culvert in the road where water is ponding.	Energy and Infrastructure Environment	Weekly over the open water season and following freshet and major rain events
Bridges	Visual inspection for snow dams prior to freshet	High. Snow dams could lead to the bridge being overwhelmed at freshet with resultant damage. Snow dams may also result in flooding upstream from the bridge, potentially impacting existing heritage resources.	Energy and Infrastructure	Prior to freshet to allow time for any snow dams to be removed and weekly during freshet to confirm that snow dams were breeched.
Snow removal from roads	Visual inspections to ensure skidoo trails are not being blocked by snow removed from the roads	Low. Pushing snow onto skidoos trails that cross Agnico Eagle's roads will make it difficult for trail users to cross the roads.	Energy and Infrastructure Environment	Following each major winter storm and clearing of snow off the roads.
Road dust	Visual inspection of the road for excessive dust generation and deposition.	High. Dust can impact on the environment along the roads, and be a safety risk due to limited visibility.	Energy and Infrastructure Environment	Weekly when roads are very dry and/or when road traffic is heavy. Inspections will be suspended during rainy days and over the winter.
Caribou near or on roads	Visual inspection of hunting activities along the road when large numbers of caribou are near-by.	High. Hunters should observe the 1 km no shooting zone along the road	Environment	Weekly, year round, and more frequently when during caribou migration periods.
Watercourses and watercourse crossings	Visual inspection of infrastructure to identify defects, cracks or any other risks to structural integrity, sediment or other debris accumulation, or bed erosion or scour	Low. Infrastructure will be repaired after deficiencies are noted, when it is safe to do so.	Energy and Infrastructure Engineering Environment	Weekly during the open water, during the freshet period, and unscheduled inspections following a major rain event.

Table 4-4 Summary of Proposed Inspections (continued)

Sumps	Visual inspection of sumps and the measurement of freeboard.	Medium. Sumps need to be pumped down prior to freeze-up to accommodate the coming year's freshet.	Engineering	One inspection before freeze-up to ensure the water level in the sumps is low to allow for inflow during freshet. Weekly during freshet, immediately after a major rain event and weekly otherwise over the open water season. Monthly after freshet is over in the open water season
Collection Ponds	Visual inspection and measurement of freeboard in contact ponds	Medium. The storage capacity of the pond needs to be increased before freeze-up to accommodate next year's freshet.	Engineering	One inspection before freeze-up to ensure the water level in the sumps is low to allow for inflow during freshet. Weekly during freshet, immediately after a major rain event and weekly otherwise over the open water season; Monthly after freshet is over in the open water season
Diversion Channels	Visual inspection of the channel for permafrost degradation and excess snow and ice accumulation leading to potential blockages.	Medium. Permafrost degradation may result in bank slumping and channel instability. Diversion channels need to be clear of snow prior to freshet to allow for water flow.	Engineering	(1) Prior to and at freshet; (2) Immediately after a major rain event; and (3) Weekly for the remainder of the ice-free season
Potable Water Treatment Plant	Visual inspection for cleanliness and that the plant is operating as required. Water samples for testing will be collected.	High. Plant provides potable water to the camp and its proper operation is necessary for human health.	Energy and Infrastructure	Ongoing as prescribed by the Dep't of Health or Public Health Authorities. Daily inspections are expected
Sewage Treatment Plant	Visual inspection for cleanliness and collection of samples for testing	Medium. The sewage treatment plant discharges to CP1, which has a dike to control flow to Meliadine Lake. The water in CP1 is reclaimed for use in processing ore, or receives additional	Energy and Infrastructure Environment	Weekly

Table 4-4 Summary of Proposed Inspections (continued)

		treatment if necessary before release to Meliadine Lake.		
Tank farms at the mine site and at Itivia	Visual inspection of water level within the secondary containment structure, and evidence of any spills or leaks. A geotechnical consultant performs a geotechnical inspection annually (between the months of July and September) of the bulk fuel secondary containment structures.	Low. Due to snow accumulation, melting and precipitation, contact water will unavoidably collect inside the secondary containment area. This water will be sampled and tested before discharge to CP1 Water from the Itivia tank farm will be returned to site, if necessary Spills and leaks will be cleaned up.	Energy and Infrastructure Environment	Weekly by Energy and Infrastructure Supervisor Weekly manual or electronic dip tests are conducted for inventory reconciliation of fuel in the tanks by sites services The geotechnical consultant inspects the tank farms annually.
Diesel Power Generating Plant	Visual inspection. Locate leak(s) and report promptly.	Low. All spills in Generating Plant will be held within the building.	Energy and Infrastructure	Weekly by powerhouse operator
Other Fueling Stations	Visual Inspection for leaks or spills and keep a written log of inspections to be made available to an Inspector upon request	Low. Fueling stations will have an impermeable liner to capture spills or leaks	Energy and Infrastructure Environment	Weekly by Energy and Infrastructure Supervisor
Hazardous Material Storage Areas	Visual inspection for proper storage of hazardous wastes	Low. Hazardous waste will be stored in areas having containment or in sea cans	Energy and Infrastructure Environment	Weekly by Energy and Infrastructure Supervisor
Waste Shipments	Inspect shipping forms to ensure they meet regulatory requirements	Low. Employees or contractor preparing waste for transport will be trained in the transportation of dangerous goods.	Warehouse/ Logistics Environment	Waste will be shipped south during the latter part of the shipping season. The shipping forms will be inspected monthly year round for sea cans that are full and have been sealed for shipment.
Landfarm	Visual inspection for water ponding outside the perimeter berm and water accumulating within the landfarm.	Low. The landfarm will have an impermeable liner and an oil: water separator will be used to remove excess water from the landfarm.	Energy and Infrastructure Environment	At freshet and weekly for the remainder of the summer.
Landfill	Visual inspection for orderly use of the landfill, absence of blowing debris, and	Low. The landfill has a berm to reduce blowing debris, and a ditch will	Energy and Infrastructure	Weekly over the entire year for the orderly use of the landfill and

Table 4-4 Summary of Proposed Inspections (continued)

	leachate at the base of the landfill during the summer.	intercept any leachate coming from the landfill.	Environment	for evidence of blowing debris. Inspections for leachate following freshet and weekly thereafter over the open water season.
Incinerator	Visual inspection for cleanliness and the proper management of all waste delivered to the facility.	Low. All waste delivered to the facility will either be incinerated or managed for future off site recycling or disposal.	Energy and Infrastructure Environment	Weekly to ensure wastes generated at the mine are being properly managed.
Emulsion Plant	Visual inspection for spillage of NH_4NO_3 outside the explosives factory and at storage locations. All Plant components inspected as per regulations	High. If NH_4NO_3 gets into water, it can negatively affect fish.	Emulsion Plant Manager	Weekly, year round, or at a frequency required by regulation.
Quarries / Borrow Pits	Visual inspection for slumping and seepage from the quarries/borrow pits.	Low. Loose rock will be pulled down from the quarry face. Seepage sampled.	Energy and Infrastructure Environment	Weekly at freshet and monthly thereafter over the open water period. Also, after major rain events.
Freshwater Jetty	Visual inspection for erosion and settlement of the jetty	Low. If there is settlement of the jetty, additional clean waste rock will be added.	Engineering	Annually following Meliadine Lake becoming ice free
Pipelines	Visual inspection for leakage or damage to the pipeline	Low. If the freshwater pipeline were to fail, the pumps in Meliadine Lake can be remotely turned off. Other pipelines discharge to or from CP1.	Energy and Infrastructure	Weekly, year round
Spills	Document the recovery of spilled material and clean-up of any remaining residuals	This could range from low to high risk depending on what was spilled, where it occurred, and success of spill recovery efforts.	All departments; Environment to follow-up	Inspections begin when a spill is reported and continues on a regular basis until the spill is cleaned up. The frequency of inspections will be dependent on what was spilled, where it occurred, and success of spill recovery efforts.
Spill Kits	Inventory of spills response equipment and materials in each spill kit	Low. Spills kits will be restocked after use.	All departments; Environment to follow-up	Quarterly by Environment Technician

Table 4-4 Summary of Proposed Inspections (continued)

Archaeological Sites	Inspect archaeological sites and report annually	Low	Environment	The location of archaeological sites has been identified and Agnico Eagle will take photos of the sites inspected and when new construction is planned in these locations.

4.2.3.4 Periodic Revisions of the Inspection Program

Periodic Revisions of the Inspection Program. The effectiveness of the inspection program will be evaluated annually to determine the extent to which it achieved the desired environmental and maintenance outcomes. Updates to the program may be prompted by changes in policies or legislation, changes in operations and/or technology at the mine, or as part of corrective action.

4.3 Incident Investigations and Corrective Actions

One of the most important aspects in investigating incidents, accidents, and non-conformities is to analyse situations and try to find root cause(s). Through this process, actions taken to address those incidents, accidents, and non-conformity should result in permanent and positive changes to the RMMS as well as on site Plans and affirm continuous improvement. It is important that employees with responsibilities with regard to a situation under investigation be part of the process in identifying and assessing causes.

The following standard steps will be followed when conducting an investigation:

- identify the cause(s);
- prepare a report on the findings;
- develop a plan for corrective, mitigation, and preventive action(s)[6];
- implement the plan;
- evaluate the appropriateness and effectiveness of the corrective action(s);
- incorporate changes for continuous improvement; and,
- record and communicate changes arising from the continuous improvement.

Additional detail is provided in the Risk Management and Emergency Response Plan.

4.4 Communication and Reporting

The sharing and communication of information is an important part of the EMPP. Internal communications will be recorded and distributed to managers before being filed for future reference. Agnico Eagle will maintain and preserve internal and external records.

External reporting will detail the activities at the mine site (including accidents and incidents), the monitoring being carried out, how it complies with authorizations and meets environmental goals. Communications shall utilize available modern means of presenting information on environmental performance to interested parties through community liaison meetings, Agnico Eagle Nunavut website (http://www.aemnunavut.ca/), training initiatives, public notices, compliance reports, annual reports, community presentations, formal correspondence, updates to management and mitigation plans, radio announcements, etc. All efforts will be made to keep Inuit organizations, communities, authorizing agencies, the business community, and the public informed of environmental

[6] In the case of spills this would include the verification of its cleanup through inspections and, if necessary, the collection of samples.

performance of the Project. As a member of the Mining Association of Canada, Agnico Eagle is committed to "Towards Sustainable Mining (TSM)" Guiding Principles, one of which is to be "proactively seeking, engaging, and supporting dialogue regarding our operations." The "Towards Sustainable Mining" Guiding Principles are part of Agnico Eagle's RMMS. Agnico Eagle communication initiatives support this guiding principle.

Table 4-5 Internal and External Record Keeping

Record Type	Responsible Department
training records	Human Resources; Training Department
standard operating procedures	All departments*
inspection reports	Engineering and Environment
consultation records	Community Affairs
construction records	Engineering
tailgate/toolbox meetings records	Environment
spill, accident, incident, and non-conformity investigation reports, including follow-up, preventive and adaptive action plans and reports	Environment
medical test reports	Health and Safety
health surveillance reports	Health and Safety
health and safety claims files	Health and Safety
audits and assurances	All departments*
management reviews	Management
management meetings	Management
environmental audits	Environment
monitoring data and reports	Environment
exposure measurement records	Health and Safety
hazard identification, risk assessment, and risk control records	All departments*
site visits by local community members	Human Resource and Community Affairs
tours by of government officials	Environment
government reports	Environment
waste backhauled/ confirmation of proper disposal	Environment
watercourse crossings digital photographic	Environment

photographic records of site conditions before and after completion of operations	Environment
photographic records before, during and after construction;	Environment

4.5 Audit, Review, and Update

It is expected that regulatory agencies will inspect the Project over its life for compliance with permits, regulations, and licences. Audits will also be conducted internally; however, independent researchers or consultants may also be engaged to complete the audits. Management reviews will also be conducted to determine the continued suitability, adequacy and effectiveness of the RMMS. The internal inspection process described previously can also be considered as an audit procedure. Outputs of the audits and management reviews could include:

- recommendations to revise the Environmental, Health, and Safety Policies and Management Plans;
- revision to established objectives and targets; and,
- specifications for corrective actions for individual management plans.

SECTION 5 • WATER LICENCE 2AM-MEL1631 PART I, ITEM 2

As requested in the Nunavut Water Board Water Licence No: 2AM-MEL1631 Part I, Item 2

The Licensee shall update the Environmental Management and Protection Plan for submission to the Board for approval in writing, at least ninety (90) days prior to Operations. The updates are to take into account commitments made with respect to submissions received during the technical review of the Application, as well as final submissions and issues raised during the Public Hearing Process, where applicable.

a. Comprehensive Receiving Environment monitoring to identify changes to the aquatic environment associated with mine activities;
b. Linkage between monitoring results and adaptive management response;
c. Sampling and analysis plans;
d. Thresholds for contaminant levels in CP1 and triggers for mitigation measures; and
e. Monitoring under Fisheries Authorizations, NWB Licence Compliance Monitoring, Metal Mining Effluent Regulations (MMER) Environmental Effects Monitoring, and Groundwater Monitoring

a. Comprehensive Receiving Environment monitoring to identify changes to the aquatic environment associated with mine activities;

Since the Water License was issued, Agnico Eagle has submitted an Aquatic Effects Monitoring Program (AEMP) report. Agnico has addressed comments received from the NWB which were implemented in the 2018 AEMP Program. The AEMP is a comprehensive study that considers Water Quality sampling, Sediment Quality sampling, an assessment of the benthic community and an assessment of plankton abundance. The study considers both the proximity of near field sampling stations as well as far field stations. As mine operations are set to begin in the first half of 2019 it is especially important to have this initial pre-operation information which future monitoring results can be compared to. The 2019 AEMP will contain trigger levels which can initiate adaptive management/mitigation measures prior to any detrimental environmental impacts.

In addition, the study design for Agnico Eagle's Environmental Effects Monitoring Program (EEM) was approved by Environment Canada. In Dec, 2018 Environment Canada also approved Agnico Eagle's request to submit the results of the EEM as part of the AEMP as requirements for both programs have met the NWB and Environment Canada's criteria to conduct the program.

b. Linkage between monitoring results and adaptive management response

It is noted in Table 1 that most individual, site specific environmental management plans have been revised since the NIRB Project Certificate and NWB Type A Water License were issued. Many of the Plans are 2018 versions. The Mine Plan, Ore Storage Plan and the Closure and Reclamation Plan are the only plans that have not been revised since the issuance of permits; mainly because they are

reflective of the Operations phase of the mine (which has not commenced) The Water Management and Mine Waste Management Plan will be revised on a yearly basis moving forward. The reason for this is that these Plans encompass major components of mine operation and there are many changes that can occur. Thus as an adaptive strategy the plans are revised to ensure we comply with our permits and prevent adverse environmental impacts.

In addition, through a comprehensive site wide inspection program whereby Agnico Eagle monitors different departments for compliance with our permits and management plans any non-conformity or observed deficiency can lead to corrective actions being taken and/or modifications of individual management plans.

To summarize, Agnico Eagle has revised or modified most of the environmental management plans approved for the project since the Water License was issued. This was in response to legal requirements or observations (inspections) on site where there have been changes or modifications to existing management plan requirements. Therefore, Agnico Eagle has demonstrated adaptive management as a strategy to prevent or mitigate any adverse environmental impact. Any revisions or modifications (along with the reasons) are referred to in the Document Control Section of the specific management plans.

c. Sampling and analysis plans;

Agnico Eagle has developed comprehensive sample and monitoring plans. These include the Air Monitoring Program (includes noise monitoring and particulate from site operations), Roads Management Plan (dustfall sampling), Freshet Action Plan (TSS sampling at critical areas during spring freshet), Compliance sampling at CP1 to name a few.
As mentioned in the previous section many individual environmental management plans have been revised to reflect sample monitoring programs (ie., Freshet Mgt Plan). Individual Plans should be consulted for specific details regarding sampling and analysis.

d. Thresholds for contaminant levels in CP1 and triggers for mitigation measures;

Thresholds for contaminant levels in CP1 are linked with the NWB Licence Compliance Monitoring and Metal and Diamond Mining Effluent Regulations (MDMER) regulations. Sampling is completed as per the requirements of the Water License and MDMER in CP1 during discharge events to ensure water discharge criteria are met.

With respect to TSS monitoring during CP1 discharge events Agnico has developed triggers for mitigation. Rating curves predicting TSS concentration as a function of turbidity and TDS as a function of conductivity were developed with simple linear regressions. The regressions applied *in situ* conductivity and turbidity readings and MEL-14 sample results. Rating curves are applied to continuous conductivity and turbidity readings taken from internal probes within the EWTP to predict TDS and TSS, respectively. Regarding conductivity, a trigger limit has been set to 1900 µS/cm which corresponds to 1,244 mg/L TDS (Appendix B). When this trigger is reached, discharge to Meliadine

Lake will be stopped. The correlation strength pertaining to the TDS-conductivity rating curve is R^2 = 0.85. Thus, the trigger limit was set below the maximum allowable concentration (1400 mg/l - TDS limit) to allow for uncertainty associated with the correlation.

Regarding turbidity, two trigger limits have been set. The first is set to 1.2 NTU which corresponds to app 15 mg/L TSS (Appendix B). When this first trigger is reached, sample frequency will be increased to twice per week for TSS at an accredited lab. The second trigger limit is set to 2.3 NTU which corresponds to app. 25 mg/L TSS (Appendix B). When this second trigger is reached, discharge to Meliadine Lake will be stopped. The correlation strength pertaining to the TSS-turbidity rating curve is R^2 = 0.79. Thus, the trigger limit was set below the maximum allowable concentration (15mg/l – TSS Max Ave Concentration and 30 mg/l - TSS Max Grab Concentration) to allow for associated uncertainty the correlation.

e. Monitoring NWB Licence Compliance Monitoring, Metal Mining Effluent Regulations (MMER) Environmental Effects Monitoring, and Groundwater Monitoring

As stated in section 4.2.1, regulated discharge monitoring occurs at monitoring points specified in the Type A Water License, other licenses, or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (e.g., water license) or regulation (e.g., Metal and Diamond Mining Effluent Regulations). Groundwater quality and quantity metrics are monitored at points and frequencies identified in the Groundwater Management Plan with the purpose of monitoring inflows and outflows of mine water and associated water quality.

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APPENDIX A • FEDERAL AND TERRITORIES LAWS, REGULATIONS AND GUIDELINES

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) *Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301) *Release and Environmental Emergency Notification Regulations* (SOR/2011-90)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil
Canada Wildlife Act (1985 w9)		
Species at Risk Act (2002 c.29)		Species at Risk Policies
Migratory Birds Convention Act (1994 c.22)	*Migratory Birds Regulations* (C.R.C., c. 1035)	
Canada Water Act (1985 c.11)		
Oceans Act (S.C. 1996, c. 31)		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	*Arctic Waters Pollution Prevention Regulations* (C.R.C., c. 354) *Arctic Shipping Pollution Prevention Regulations* (C.R.C., c. 353)	
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	*Transportation Safety Board Regulations* (SOR/92-446)	
Canada Shipping Act, 2001 (S.C. 2001, c. 26)	*Response Organizations and Oil Handling Facilities Regulations* (SOR/95-405) *Pollutant Discharge Reporting Regulations*, 1995 (SOR/95-351) *Environmental Response Arrangements Regulations* (SOR/2008-275) *Ballast Water Control and Management Regulations* (SOR/2006-129) *Vessel Pollution and Dangerous Chemicals Regulations* (SOR/2012-69)	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995

Acts	Regulations	Guidelines
		Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)
Navigation Protection Act		
Marine Liability Act (A.C. 2001, c.6)	*Marine Liability Regulations* (SOR/2002-307)	
Fisheries Act (R.S.C. c. F-14)	*Metal Mining Effluent Regulations* (SOR/ 2002-2222) *Marine Mammal Regulations* (SOR/93-56)	The Policy for the Management of Fish Habitat Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Transport of Dangerous Goods Act (1992, c.34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	
Explosives Act (1985 c.E-17)	*Explosives Regulations* (C.R.C., c. 599) *Ammonium Nitrate and Fuel Oil Order* (C.R.C., c. 598)	
National Fire Code of Canada (2010)		
Nuclear Safety and Control Act (s.c. 1997, c.9)	*General Nuclear Safety and Control Regulations* (SOR/2000-202)	
Canadian Human Rights Act (R.S.C., 1985, c. H-6)	Canadian Charter of Rights and Freedom	
Canada Labour Code (R.S.C., 1985, c. L-2)	*Canada Labour Standards Regulations* (C.R.C., c. 986) *Canada Occupational Health and Safety Regulations* (SOR/86 304)	
Territorial Lands Act (R.S. 1985, c. T-7)	*Northwest Territories and Nunavut Mining Regulations* (C.R.C., c. 1516) *Territorial Land Use Regulations* (C.R.C. 1524) *Territorial Quarrying Regulations* (C.R.C. c. 1527)	

Acts	Regulations	Guidelines
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c. 10)	*Northwest Territories Waters Regulations* (SOR/93/303)	
Nunavut Act (1993 c.28)	*Nunavut Archaeological and Paleontological Sites Regulations* (SOR/2001-220)	
Nunavut Land Claims Agreement Act (1993, c. 29)		
Territorial – Nunavut		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) *Used Oil and Waste Fuel Management Regulations* (NWT Reg 064-2003) [The removal of hazardous materials requires the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport. The Meliadine Project and the Meadowbank Mine are registered under a single permit for Agnico Eagle Mines Limited - Waste Generator Number - NUG100031]	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's Land Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Scientists Act (RSNWT (Nu) 1988, c S-4)	*Scientists Act Administration Regulations* (NWT Reg (Nu) 174-96)	
Historical Resources Act (RSNWT (Nu) 1988, c H-3)		
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	*Territorial Parks Regulations* (RRNWT (Nu) 1990 c T-13)	
Wildlife Act (RSNWT (Nu) 1988, c W-4)	*Wildlife General Regulations* (NWT Reg (Nu) 026-92)	

Acts	Regulations	Guidelines
	Wildlife Licences and Permits Regulations (NWT Reg (Nu) 027-92)	
	Wildlife Management Barren-Ground Caribou Areas Regulations (NWT Reg (Nu) 099-98)	
	Wildlife Management Grizzly Bear Areas Regulations (NWT Reg (Nu) 155-96)	
	Wildlife Management Zones Regulations (RRNWT (Nu) 1990 c W-17)	
	Wildlife Regions Regulations (NWT Reg (Nu) 108-98)	
Commissioner's Land Act (RSNWT 1988, c C-11)	*Commissioner's Airport Lands Regulations* (NWT Reg (Nu) 067-97)	
	Commissioner's Land Regulations (RRNWT 1990, c C-13)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations* (RRNWT (Nu) 1990 c S-1)	
	Work Site Hazardous Materials Information System Regulations (RSNWT 1988, C 81 (Supp))	
Mine Health and Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health and Safety Regulations* (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	*Workers' Compensation General Regulations* (Nu Reg 017-2010)	
Apprenticeship, Trade and Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	*Apprenticeship, Trade and Occupations Certification Regulations* (RRNWT (Nu) 1990 c A-8)	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	*Annual Vacations Regulations* (RRNWT 1990, c.L-1)	
	Educational Work Experience Regulations (RRNWT 1990, c.L-2)	
	Employment of Young Persons Regulations (RRNWT 1990, c.L-3)	
	Labour Standards Meal Regulations (RRNWT 1990, c.L-4)	
	Notice of Termination Exemption Regulations (RRNWT 1990 c.L-5)	

Acts	Regulations	Guidelines
	Pregnancy and Parental Leave Regulations (RRNWT 1990, c.8(Supp.))	
	Reciprocating Jurisdiction Order (RRNWT 1990, c.L-6)	
	Wages Regulations (RRNWT 1990, c.L-7)	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	*Electrical Protection Regulations* (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	*Petroleum Products Tax Regulations* (RRNWT (Nu) 1990 c P-3)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	*Fire Prevention Regulations* (RRNWT (Nu) 1990 c F-12)	
Hospital Insurance and Health and Social Services Administration Act (RSNWT 1988, c T-3)	*Territorial Hospital Insurance Services Regulations* (RRNWT (Nu) 1990 c T-12)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	*Camp Sanitation Regulations* (RRNWT (Nu) 1990 c P-12)	
	General Sanitation Regulations (RRNWT (Nu) 1990 c P-16)	
All-terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	*All-terrain Vehicles Regulations* (RRNWT (Nu) 1990 c A-1)	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	*Large Vehicle Control Regulations* (RRNWT (Nu) 1990 c M-30)	
	Motor Vehicle Registration and Licence Plate Regulations (NWT Reg (Nu) 054-94)	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	*Highway Designation and Classification Regulations* (NWT Reg (Nu) 047-92)	
Transportation of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c 81 (Supp))	*Transportation of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	

APPENDIX B • RATING CURVES PREDICTING TSS AND TDS CONCENTRATION

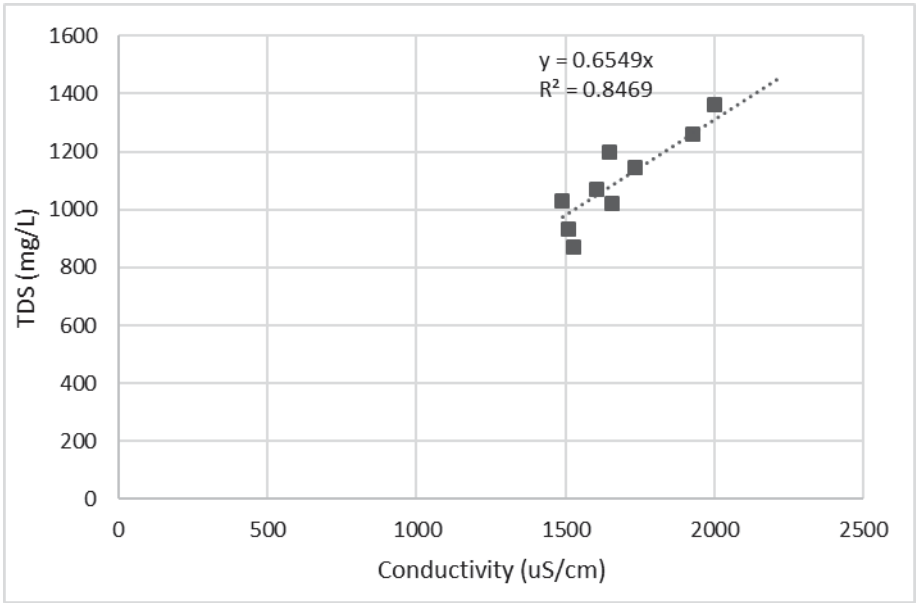

Figure 1: Rating curve relating conductivity to TDS.

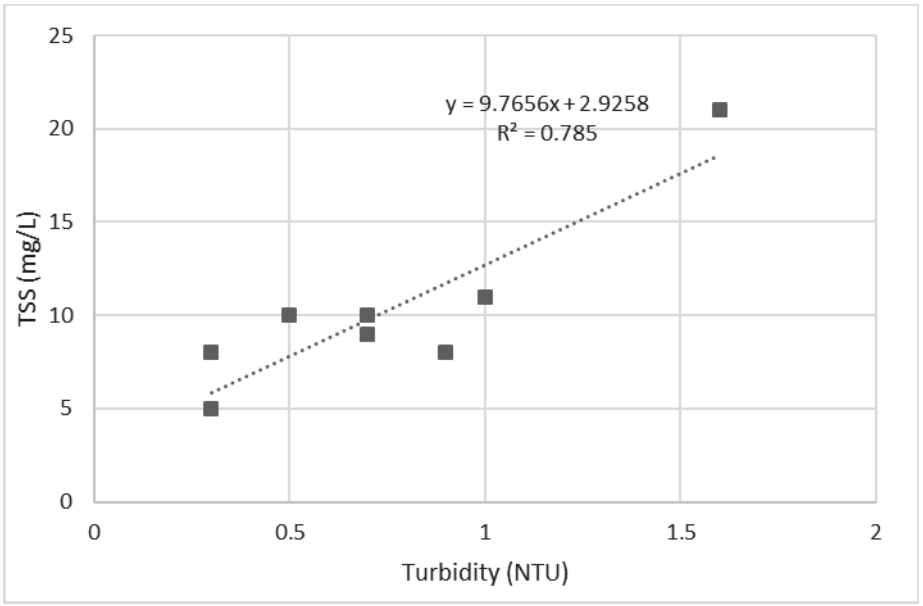

Figure 2: Rating curve relating turbidity to TSS.

AGNICO EAGLE

MELIADINE GOLD PROJECT

Landfill and Waste Management Plan

MARCH 2019
VERSION 7
6513-MPS-06

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ᐊᒃᓗᓄ ᐃᐃᒍ ᐅᓴᖅᑕᕆᐊᓕᓚᕕᓴᒃᓄᑦ (ᐊᒃᓗᓄᒃᓄᑦ) ᐱᓯᔨᓕᐊᔪᑦ ᑕᓯᖏᐊᕐᒥᑦ ᔪᓗᒍᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐱᓕᕆᐊᖅ), ᐃᓂᐅᔪᑉᑕᖅ 25 ᑭᓪᒥᑕᔨᓗᓂᒃ ᐅᖓᓱᓄᑎᒋᔪᖅ ᐅᐊᖓᓇᖓᓂᑦ ᑲᖏᖅᓯᓂᐅᑦ, ᐊᒻᒪᓗ 80 ᑭᓪᒥᑕᓂᒃ ᐅᖓᓱᓄᑎᒋᔨᓗᓂ ᓂᑎᖅᓯᓕᐊᓂᑦ ᐅᐊᖓᓇᖅᓯᓕᐊᓂᑦ ᐃᒡᓗᓀᓴᓕᐊᑦ ᑭᓯᐊᓂᕐᒥᑦ ᓄᓇᕗᓕᒥᑦ. ᐅᓴᖅᑕᕆᐊᖅ ᒪᑭᒍᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓴᓂᒃ (ᑎᓴᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 1 ᐊᒻᒪᓗ ᑎᓴᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 2 ᐊᒻᒪᓗ ᐃᓐᓇᐅᔪᖅ ᐊᐅᓪᓚᖅᑎᓂᔪᑦ ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᑎᓴᓂᐊᖅ ᔪᓗᑕᓕᒫᑦ). ᑎᑎᖅᑲᖅ ᐱᔨᔪᖏᖅᑐᖅ ᐊᒃᑕᐊᓂᒃ ᐊᐅᓪᓚᖅᑐᑦ <ᖁᓇᐅᑎᒃ (<ᖁᓇᐅᑎ) ᐱᓕᕆᐊᖁᑦ ᐊᒻᒪᓗ ᐃᓕᓴᔨᖅ ᑎᑎᖅᑲᓇᑦ ᐱᔨᔪᖏᓕᒫᒃ Type A ᐃᒪᖁᑦ ᓕᐃᔨᓴᑦ ᑐᐱᔪᐊᑎᑦ. <ᖁᓇᐅᑎ ᐅᖓᑲᐅᖓᖅᑐᖅ ᐊᒃᓗᓄ ᐃᐃᒍ ᐅᓴᖅᑕᕆᐊᓕᓚᕕᓴᒃᓄᑦ (ᐊᒃᓗᓄᒃᓄᑦ) ᖃᓄᖅᑑᑭᑎᓐᓄᒃ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓪᓚᖅᑐᖁᑦ ᑕᓯᖏᐊᕐᒥᑦ ᔪᓗᑕᓕᒫᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐱᓕᕆᐊᖅ).

ᒥᔅᓯᒪᐊᖅᓯᓂᖅ, ᐊᑐᐊᒃᓴᓂᔅᓂᐊᖅᑐᓂᒃ, ᐊᒻᒪᓗ ᐱᓕᐅᖅᑕᐅᒃᓴᓂᔅᓂᐊᖅᑐᓄᑦ ᐱᓕᕆᐊᒃᓴᒍᓕᐅᖅᑐᑦ ᐊᒥᓲᖏᓪᓂᖅᓴᐅᑎᓪᓂᔅᓂᒡᓕᑦ ᐊᒃᑕᑯᓕᐅᖅᑕᐅᓕᕐᕆᑦ. ᐊᒃᑕᑯᓂᒃ ᐊᑦᑎᕆᓂᖅ ᐊᑐᖅᑕᐅᖅᑕᒥᑦᑐᖅᑐᑦ ᐊᒃᑕᑯᓂᒃ ᐊᑐᖅᑕᐅᖅᑕᐅᒃᓴᓂᔅᓂᐊᖅᑐᓄᒃ ᐅᓪᓛᖅᑐᑦ, ᐊᑕᐅᑦᑎᐊᑯᑦ ᐋᓪᓂᔅᑐᑦᑐᓂ ᐱᓕᕆᐊᖅᑐᑦ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᐊᖅᓯᒪᓕᕐᕆᑦ.

ᐊᒃᑕᑯᓯᖏᓐᓄᒃ ᐱᓴᕆᐊᖅᑲᖅᑐᖅ ᐊᒃᑕᑯᓯᓂᐊᓚᑦᑐᓂ ᐅᑎᖅᑎᑕᐅᓂᖅ ᐊᔪᖅ, ᐋᓐᓂᔅᑕᐅᔪᖅᓴᓕᖅᑐᑦᑐᓄᑦ, ᐃᔨᓇᓴᓐᓂᒃ ᐊᒃᑕᑯᓂᒃ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᐊᖅ. ᐱᓕᕆᐊᖅ ᐃᖏᓕᑯᓂᕆᐊᖅᑐᖅ ᐅᑯᓂᖅᓯᖓᓕᖅ, ᐊᒻᒪᓗ ᐊᑐᖅᑕᒪᖅᓯᓚᑦᑐᓂ, ᓄᓇᓕᖓᑦ ᐱᓯᑯᓴᓂ ᐅᓴᓕᓐᓂᔅᓂᐊᖅᑐᓄᒃ ᐱᓯᑎᑎᕐᓂᐊᖅᑐᓂ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᐊᓂᖅ.

ᐊᒃᑕᑯᓯᖏᓐᓄᒃ ᐊᒃᑕᑯᓯᖅᑕᐅᔪᓂ ᐅᓴᖅᑲᓂᒃ ᑐᖅᑯᓯᖏᓐᓄᖅᓴᓕᖅᑎᑦᑐᖅ 1 (WRSF1) ᐃᓂᐅᔪᑉᑕᑦ ᓂᕆᖅᓯᓯᒪᔪᓂᒃ ᐱᖓᓱᓄᖅᓯᓯᒪᔪᓂᒃ ᐅᓴᖅᑕᕆᐊᓕᑦ ᐱᖓᓱᓄᖅᑎᑦᓯᐊᖅᑕᖅᖢᓱᓂᒃ. ᐊᒃᑕᑯᓯᖏᓐᓄᒃ ᐃᖅᑲᑕᒪᓐᓇᐅᑦᑎᐊᖅᑕᖅᑐᑦ ᐊᒻᒪᓗ ᐊᖅᑭᑦᑕᐅᓕᖅᓯᒪᓕᕐᕆᑦ. "ᐃᓂᐅᔪᑉᑕᑦ ᐊᖅᑭᑦᑕᐅᓕᖅᓯᒪᓕᕐᕆᑦ" ᐃᖅᑲᑕᒪᓐᓇᓂᑦᑐᓂ ᐊᑐᖅᑕᐅᖅᑲᑕᒪᓐᓇᓂᑦᑐᖅ ᐊᑐᖅᑕᐅᓂᓯᐃᓂ ᐃᑎᑕᐅᔪᓂᑦᑐᑎᒃ ᑐᑭᓯᓚᕐᓗᑎᒃ ᐊᒻᒪᓗ ᖃᓪᓗᓂᖅᑕᐅᖅᑲᑕᒪᓐᓇᓂᑦᑐᖅ. ᐊᒃᑕᑯᓯᖏᓐᓄᒃ ᐃᑎᑕᐅᖅᑲᑕᒪᓐᓇᖅᑐᖅ ᐊᒃᑕᑯᓯᓂᐊᓚᐅᔪᓂ ᐊᒻᒪᓗ ᒥᔅᓯᒪᐊᖅᑐᑦᑐᑎᒃ ᓄᓇᕗᑦᑐᑎᒃ ᐊᐅᓚᑦᑎᐊᓂᖅ ᐊᔾᔨᒌᒃᓴᓂᒃ ᐱᓕᕆᐊᖅᑐᑦᑐᑎᒃ ᐊᒃᑕᑯᓯᓂᐊᓚᐅᔪᓂᒃ ᐃᓚᖓᔪᖅᑐᑦ ᐊᒃᑕᑯᓯᖅᑕᐅᔪᓂᒃ ᐊᒻᒪᓗ ᓂᕆᔨᒋᑦᑐᖅ ᐊᐅᓚᑦᑎᐊᖅᑐᑦ ᐊᒃᑕᑯᓯᓂᐊᓚᐅᔪᓂᒃ ᐊᒃᑕᑯᓯᖅᑕᐅᔪᓂᒃ ᐊᐅᓚᑦᑎᐊᓂᖅ

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2 and is currently operating the underground Tiriganiaq gold deposit. This document presents the Landfill and Waste Management Plan (Plan) for the Project and forms a component of the documentation series produced for the Type A Water Licence Application. The Plan describes Agnico Eagle Mines Limited's (Agnico Eagle) strategies regarding waste management for the Meliadine Gold Project (Project).

Reduce, reuse, and recycle initiatives have been developed at the Project to minimize the quantity of waste generated. Waste segregation is being used to capture wastes suitable for reuse or recycling, while at the same time ensuring that hazardous waste is managed appropriately.

A landfill is required for the disposal of non-salvageable, non-hazardous, non-putrescible solid wastes from the construction, operation, and closure of the Project. The Project is totally independent of, and do not use, municipal facilities or services for waste management.

The landfill is located within the Waste Rock Storage Facility 1 (WRSF 1) which is located to the southwest of the main mine infrastructure. The landfill is being filled progressively and in an orderly manner. An "area method" of dumping is being used such that materials are dumped in rows and covered as required. Wastes are disposed directly on the landfill floor and compacted with heavy equipment against the berm or an existing row of debris that was compacted earlier. Controlling the materials that can be placed in the landfill is a strategy aimed to reduce the concentration of constituents in potential leachate and to minimize the attraction of wildlife to the landfill. Landfill operation will also conform to best management practices to reduce the potential for windblown debris.

Leachate from the landfill is anticipated to be weak due to the controls placed on materials acceptable for landfilling. Moreover, drainage from the landfill is largely expected to freeze within the WRSF with little to none migrating to the water collection infrastructure placed around the WRSF. Annual landfill operation will also involve clearing of snow prior to spring melt. However, in the event there is leachate from the landfill due to periods of heavy rainfall or spring freshet, the runoff will be collected, controlled and treated, if necessary.

The landfill will be covered with a minimum of 3.7 m of waste rock to isolate it from the environment and physically stabilize it during closure.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	November 2012			First draft of the Landfill and Waste Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			Draft Environment Impact Statement re-submission; rebranding	
3	April 2014	1.3 1.4 4.3.1 4.5 5 6 7	2-3 3 11 13-14 16-17 18 19	Addressed commitments made during review of Draft Environmental Impact Statement: - Leachate management - Landfill schedule - Asbestos management - Records and reports - More details on Standard Operation Procedures - More details on best practices and training	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			Complete update to correspond with the Mine Plan	John Witteman, Env. Consultant, Agnico Eagle
5	February 2017	- 1.1 4.1 4.4.1 - - -	All Pages 1 9 12 Title Page 3 4	- Changed effective date from April 2015 to March 2017 - Added statement “Plan will have to be updated and submitted 90 days prior to landfill construction” - Removed statement “paper lunch bags will be replaced by sturdy metal or plastic lunch boxes” - Added ultraviolet lamp tubes to the section on fluorescent lamp tube disposal, as both contain mercury and will be disposed of in the same way - Changed April 2015 to March 2017 - Landfill Site Location diagram added - Typical Sections for Landfill Closure diagrams added	Justin MacMillan, Environmental Technician, Agnico Eagle
6	March 2018		All Pages	General document update	Environment Department

7	March 2019	All Pages	Updated document to include mining the underground deposit and current operating conditions.	Randy Schwandt, Terry Ternes,
		1	Removed unnecessary paragraph about ore and waste rock tonnage from the Mine Plan.	
		Figure 2.1	Figure updated to show present Project status.	
		Figure 5.2	Figure shows extension of phase 1.	

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ARD/ML	Acid-Rock Drainage/Metal Leaching
CP1	Collection Pond 1
GN	Government of Nunavut
INAC	Indian and Northern Affairs Canada
NIRB	Nunavut Impact Review Board
Project	Meliadine Gold Project
WHMIS	Workplace Hazardous Materials Information System
WRSF	Waste Rock Storage Facility

UNITS

km	kilometre
m	metre
t	metric tonnes

SECTION 1 • INTRODUCTION

1.1 Purpose and Scope of the Plan

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The Landfill and Waste Management Plan (Plan) outlines the design, operation, and closure of a solid waste landfill as part of Agnico Eagle's Project. It also highlights the waste segregation strategies that are implemented to minimize the quantity of waste to be placed in the landfill or incinerated. The Plan was updated and submitted 90 days prior to permanent landfill construction.

The objectives of this Plan are summarized as follows:

1. To define the location, design, and operating procedures to be used in the landfill disposal of non-salvageable, non-hazardous, non-putrescible solid waste generated at the mine.
2. To define acceptable/non-acceptable types of solid waste to be placed in the landfill.
3. To describe plans to reduce/reuse/recycle Project wastes.
4. To define monitoring requirements for the landfill.

A landfill is required for the disposal of non-salvageable, non-hazardous, non-putrescible solid industrial wastes that cannot be incinerated and that result from construction, operations, and closure of the Project. The Project is operated totally independent of, and do not use, any municipal facilities or services for waste management.

Hazardous wastes will not be placed in the landfill. All hazardous materials will be packaged for shipment to a certified waste management company for treatment, recycling, and/or disposal. The Project also includes a landfarm to treat soils and rocks contaminated with hydrocarbons. The landfarm is described in the Landfarm Management Plan.

1.2 Location of the Landfill

The landfill is situated within the Waste Rock Storage Facility 1 (WRSF 1), which is located close to, and northeast of, the main mine infrastructure. The following criteria were considered in determining its location:

- Drainage – sites that will drain into areas where water will be collected and monitored as part of the overall site plan were preferred;

- Disturbed areas – sites within or near areas that will be disturbed as part of the future overall mine plan were preferred to minimise the environmental footprint of the Project;
- Access – sites located close to existing service or haul roads were preferred; and
- The landfill site had to be large enough to accommodate non-salvageable, non-hazardous, non-putrescible solid industrial wastes for the life of the Project, including the development of the other pits.

The first three criteria are recommendations from the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007).

1.3 Landfill Design

The landfill is not a conventional landfill; it is a controlled landfill where:

- Wastes is segregated with liquids, hazardous and putrescible waste all being diverted away from the landfill (Section 4.3 and 4.4). The segregation of waste involves a major commitment by Agnico Eagle to educating all its employees and contractors in directing wastes to the proper waste collection bins;
- Waste management includes an incinerator where all organic, office waste, and any waste coming in contact with food is incinerated. Ash from the incineration process is disposed of in the landfill (Section 4.6); and
- Waste in the landfill is not scattered all over the floor of the landfill, but placed daily at the active working face where the waste can be leveled, compacted, and covered (Section 5).

The landfill is located within the WRSF 1 as shown on Figure 1-1 and the extension of the landfill is shown in Figure 5-2. The active WRSF 1 sets the bounds of the landfill on its south and west sides, while berms were constructed on the north and east sides of the landfill (see Figure 1-2). The purpose of the berms is to confine the area for waste disposal and to act as a wind shield to reduce windblown debris. The landfill is a rectangular shape with the length perpendicular to the prevailing wind direction so that much of the waste will be protected from the wind by the berm. In August 2018 stage 1 cell was extended to the South East to allow for additional waste material to be placed in the cell.

Figure 1-1 Landfill Location for Meliadine Gold Project

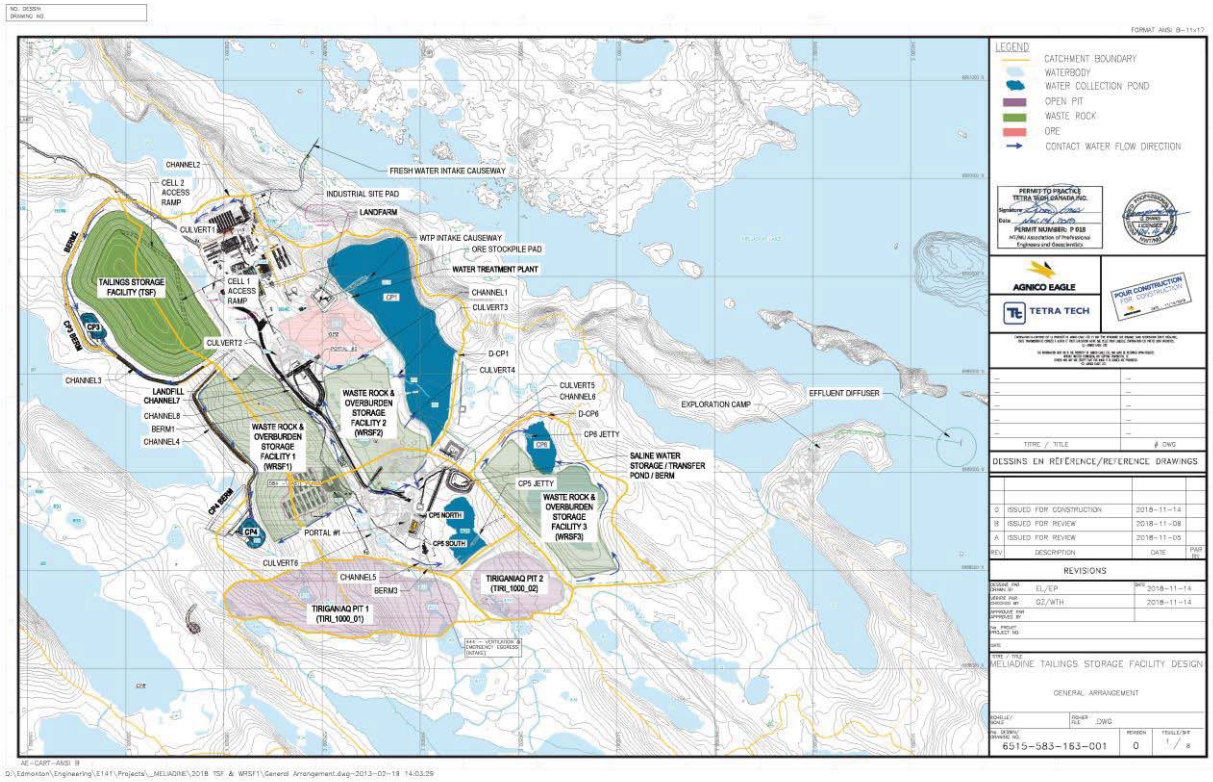
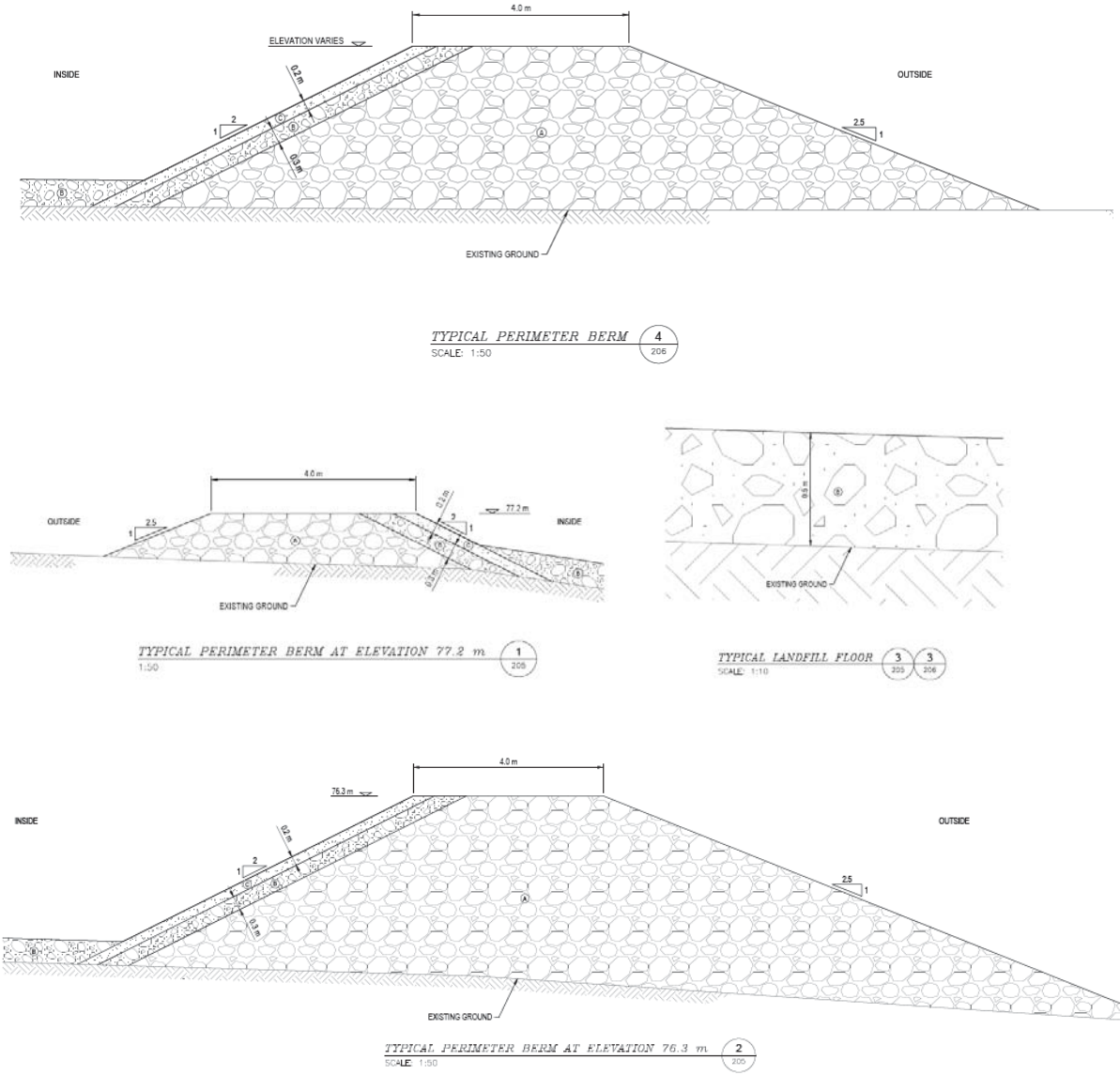


Figure 1-2 Typical Sections for Landfill Closure



AGNICO EAGLE

Both the floor and the berm of the landfill were constructed with material (rockfill and/or waste rock) sourced from waste rock from the underground development. The landfill floor is approximately 1.2 m thick. The design of the berms will not assume that they will be in a frozen state or permanently impermeable to leakage. The final design will take into account berm and subgrade stability.

Due to the restriction on wastes that can be landfilled (see Section 4.3), and since the landfill is located within the WRSF 1, the quantity of leachate is expected to be minimal (if any), and of low ionic strength. The landfill will nonetheless receive precipitation during the summer period, which could infiltrate the landfill before it can evaporate. In the event that leachate migrates from the landfill, it will be collected, monitored, and, if necessary, treated before being released to the receiving environment.

Closure design for the landfill is described in Section 7 and illustrated in Figure 1-2. Based on the design strategy for the landfill, and the management and operating procedures listed above, a liner is not considered necessary for the landfill.

1.4 Landfill Schedule

The landfill will be used for the construction, operations, and closure phases. It will not be required for post-closure. The exploration landfill approved under water licence 2BB-MEL0914[1] was used during the pre-development phase until the landfill for the mine had been constructed and became operational.

The schedule for the landfill is as follows:

- Years -3 to -1: Construction of the landfill will occur directly after the placement of minimum 1.2 m of waste rock or rockfill to serve as a base or foundation. This will occur during the first year of construction, with commissioning of the landfill directly thereafter. This will allow non-salvageable, non-hazardous, non-putrescible solid construction waste to be placed in the landfill;
- Years 1 to 8: The landfill will be used continuously during operations;
- Years 9 to 11: The landfill will be one of the last parts of mine infrastructure to close. It is expected to be extensively used during closure for demolition waste and will remain operational until it is no longer needed.[2]

[1] Although approved by the Nunavut Water Board, this landfill has not been built as of March 2015.
[2] The incinerator will close before the landfill.

SECTION 2 • RELATED DOCUMENTS

Related documents include the following:

- Risk Management and Emergency Response Plan;
- Hazardous Materials Management Plan;
- Incineration Management Plan;
- Environmental Management and Protection Plan;
- Preliminary Closure and Reclamation Plan; and
- Occupational Health and Safety Plan (Agnico Eagle 2014).

The Landfill and Waste Management Plan is part of the Environmental Management and Protection Plan, which provides overarching environmental direction for the Project.

SECTION 3 • REGULATORY SETTING

Waste management in Nunavut is regulated under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act*, the federal *Environmental Protection Act,* and the federal *Transport of Dangerous Goods Act*. Agnico Eagle is also be bound by the terms and conditions of its commercial lease with the Kivalliq Inuit Association and its water licence from the Nunavut Water Board.

In addition to mandatory requirements, a number of waste management guidelines are commonly used in the Northwest Territories and Nunavut. The most recent of these was developed for municipal solid waste and is titled: "*Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT*" (Ferguson Simek Clark 2003). *Environmental Guideline for Industrial Waste Discharge into Municipal Solid Waste and Sewage Treatment Facilities* (GN 2011c) were also used (Appendix D). While not all of the recommendations provided in these guidelines are appropriate for the management of industrial waste expected at the Project, principles considered applicable have been adopted in this Plan.

In addition, the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007) were followed regarding specific landfill design and mitigation for potential impacts pertaining to waste.

SECTION 4 • WASTE MANAGEMENT APPROACH

Waste[3] at the Project is divided into the following categories:

1. Domestic waste: general waste materials coming from the kitchen, cafeteria, lunch rooms, dormitories, and offices. Bins are located in high traffic areas for segregating wastes destined for incineration, landfilling, or recycling.

2. Medical waste: medical waste generated in the first aid/health room will require special handling and are placed in easily identifiable single use medical waste containers. Both the containers and its contents are incinerated.

3. Industrial waste: waste arising from operations in the truck shops, process plant, emulsion plant, paste plant, and warehouses. Each work area has specially marked bins for segregating waste for incineration, recycling, or disposal. Special bins or areas are set aside for hazardous waste. Large bulky items that cannot be incinerated will be prepared for shipment south for recycling, or be cleaned of any hydrocarbon contamination and have the electronics removed before disposal in the landfill.

4. Sewage: wastewater from the accommodation complex is treated in the Sewage Treatment Plant before being directed to Collection Pond 1 (CP1). Sewage sludge removed from the Sewage Treatment Plant will be added to the landfarm as nutrient amendment on an as needed basis. Excess sludge is either disposed of in the tailings storage facility, or stored in drums/totes to be shipped off site as hazmat.

5. Used oil and waste fuels: used engine oil, hydraulic fluids, and fuels that do not meet specifications for designated use. This does not include solvents or paints. Used oil and waste fuels are burned in waste oil burners if it is found acceptable. For more details on the used oil and waste fuels, refer to the Incineration Management Plan.

6. Incinerator ash: ash testing protocol developed by the Government of Nunavut in accordance with the *Nunavut Environmental Guideline for Industrial Waste Discharges* is implemented to ensure that the incinerator ash is suitable for disposal in the landfill (GN 2012). Ash not meeting the guidelines will be packaged in drums to be sent to a certified waste management facility for appropriate treatment, recycling, and/or disposal, or will be buried within the dry stacked tailings.

[3] Tailings, waste rock, and overburden are also considered waste materials. The Mine Waste Management Plan provides details on these wastes.

7. Hazardous waste: refer to the Hazardous Materials Management Plan for details on how hazardous waste will be managed.

4.1 Reduce/Recycle/Reuse Initiatives

Waste management begins by keeping all materials that can be economically recycled out of the waste stream destined for the landfill or incineration. The three R's of waste management - reduce, reuse, and recycle - is encouraged within the waste management program.

Reduce, reuse, and recycle initiatives will be developed at the Project to minimize the quantity of waste incinerated or directed to the landfill. To support this initiative, operating procedures will be developed to maximize the volume of materials that are recycled and/or reused. This will include eliminating the use of disposable materials where possible, and segregating waste destined for reuse, and recycle alternatives.

Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created (Environment Canada 2003). Waste management for the Project will include efforts directed at eliminating, where practicable, the use of disposable materials in everyday use, such as disposable cups, plates, and table ware. Workers will be encouraged to use ceramic mugs and stainless steel cutlery in the cafeteria or lunch rooms, and to carry personal drink containers or thermoses. If it is deemed to not affect the mill process, water will be recycled from CP1 for use in the mill with fresh water from Meliadine Lake only being used as makeup water. A tailings pond was not constructed; instead, Dry Stack Tailings technology is employed whereby tailings water will be reclaimed within the mill before the tailings are trucked for disposal. This will increase the volume of water available for recycling to the process. Low flush toilets and water saving showers heads are also used throughout the facility to conserve water.

Disposal bins are located in high traffic areas for small waste items such as alkaline and rechargeable batteries, obsolete computer equipment and supplies, and fluorescent light bulbs. Scrap metal will be collected on-site. These wastes will be packed for shipment off-site to licensed recycling depots.

All hazardous materials collected on-site are sent off-site to a licensed hazardous waste management company. Many of these materials end up being compatible with recycling after treatment. Examples include lead recovered from lead-acid batteries and oil filters becoming scrap metal after cleaning.

4.2 Collection and Handling of Waste

The strategy for the management of solid waste at the Project is to first identify and segregate acceptable disposal items from non-acceptable items. Within the acceptable disposal items, the second step is to segregate those items that can be economically recycled from those that cannot.

This segregation is done at the source by locating bins throughout the facilities for the collection of items suitable for recycling.

Waste is generated and segregated in all buildings and needs to be collected and transported to the incinerator (waste management) building for final disposal or incineration. The Site Services Department is responsible for the collection and transport of waste to the incinerator building.

All solid wastes that may contain medical waste from the Health Centre, food waste, food packaging waste, or other organic waste that could attract wildlife are incinerated in the on-site incinerator. This includes all garbage from the accommodation complex, kitchen, lunchrooms, and offices. These receive priority in being incinerated. Food wastes and wastes associated with food are collected daily, at a minimum, and immediately transported to the incinerator building. This waste is not allowed to remain unattended in vehicles at any time. The ash from the incinerator is disposed of in the landfill. Quaterly leachate samples of the ash are taken to confirm that the ash conforms to regulatory requirements.

The development of the landfill will minimize the area required for waste storage and re-handling of waste. Acceptable items that are disposed of in the landfill are those that are solid, non-salvageable, non-hazardous, inert, and non-putrescible with a low leachate and low heat generation potential. Controlling the materials that can be placed in the landfill is a strategy aiming at reducing the concentration of constituents in potential leachate. The landfill conforms to best management practices allowing for orderly landfill development, which reduces the potential for windblown debris.

Hazardous waste and materials that can be recycled are appropriately packaged (as per regulations under the *Transport of Dangerous Goods Act)* to be sent off-site to a licensed hazardous waste management facility or recycling facility, respectively. Management of hazardous materials is covered in detail in the Hazardous Materials Management Plan.

4.3 Waste Acceptable for Placement in Landfill

The following materials are acceptable for disposal in the landfill:

- Plastic (except expanded polystyrene);
- Steel, copper, aluminum, iron;
- White goods;
- Wire;
- Wood;
- Fiberglass insulation;
- Fiberglass;
- Roofing;
- Asphalt;
- Concrete;

- Carpet;
- Bricks;
- Ceramics;
- Rubber;
- Empty caulking tubes;
- Hardened caulk;
- Clothing;
- Air filters;
- Glass, including light bulbs (fluorescent bulbs will require special handling, see below for more details);
- Waste Asbestos (see below for more details);
- Small appliances (with batteries removed);
- Gyproc;
- Ash, provided it has cooled to 60 degrees Celsius or less;
- Vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed; and
- Treated soils from landfarm.

4.3.1 Waste Asbestos[4]

Waste asbestos includes any type of material with greater than 1 % asbestos by weight (GN 2011a). Asbestos that has been immersed or fixed in a natural or artificial binder or included in a manufactured product is not considered waste asbestos; it is considered a hazardous waste and will be disposed of accordingly. Waste asbestos can either be backhauled off-site for disposal in an approved facility or it can be landfilled. The following are guidelines for landfilling waste asbestos:

- Immediate burial and cover with 0.5 m of cover material;
- Burial where it will not be disturbed; and
- Maintenance of the location on a map or diagram for future reference.

In addition to following the *Environmental Guideline for the General Management of Hazardous Waste* (GN 2010a), Agnico Eagle will adhere to the Government of Nunavut's (GN) *Environmental Guideline for Waste Asbestos* (GN 2011a). Before landfilling waste asbestos, Agnico Eagle will review the steps in this guideline with the GN.

The complete *Environmental Guideline for Waste Asbestos* (GN 2011a) and *Environmental Guideline for the General Management of Hazardous Waste* (GN 2010a) can be found in Appendix A and the Hazardous Materials Management Plan, respectively. All Government of Nunavut environmental guidelines can be accessed online at http://env.gov.nu.ca/programareas/environmentprotection/legislation.

[4] It is unlikely that asbestos waste will result from mine operations. Agnico Eagle will avoid using asbestos wherever possible.

4.4 Waste Unacceptable for Placement in Landfill

Materials not listed in the previous section are unacceptable for placement in the landfill, unless approved in writing by the Meliadine Environment Department. These materials include the following:

- Organic matter, including food, sludge from the Sewage Treatment Plant, dead animals, paper, cardboard;
- Food containers and wrappings, unless cleaned;
- Hazardous wastes including mercury, batteries, solvents, glues, ethylene glycol antifreeze, adhesives (except empty caulking tubes);
- Electronics;
- Materials that can be recycled economically;
- Petroleum products, including materials contaminated with petroleum products; and
- Expanded polystyrene.

In particular, organic matter is not accepted in the landfill, thus eliminating the attraction of small mammals, carnivores, and/or raptors. This is accomplished by requiring all personnel to dispose of domestic waste in designated receptacles and by sending all collected domestic waste (e.g., from kitchen, offices, and living quarters) to the on-site incinerator. Regular inspections and toolbox meeting are held to raise the awareness and lower the risk of having organic matters in the landfill.

4.4.1 Fluorescent Lamp Tubes

Fluorescent tubes contain mercury phosphorus powder and traces of lead and cadmium are considered environmental contaminants under the Nunavut *Environmental Protection Act* (GN 2010b). The only disposal method for fluorescent tubes is through an approved hazardous waste recycling or disposal facility (GN 2003). Government of Nunavut guidelines on *Mercury-Containing Products and Waste Mercury* (GN 2010b) and E*nvironmental Guideline for the General Management of Hazardous Waste* (GN 2010a) are included in Appendix B and the Hazardous Materials Management Plan, respectively. These guidelines are followed and wastes having mercury are sent to a certified waste management company for treatment, recycling, and/or disposal.

Ultraviolet (UV) lamp tubes used in the wastewater and potable water treatment systems are disposed of in the same way as fluorescent lamp tubes, as they also contain mercury (vapour).

4.4.2 Ozone Depleting Substances

Ozone depleting substances include chlorofluorocarbons or halons. Common sources include refrigeration equipment, air conditioning equipment, motor vehicle air conditioners, and fire extinguishing equipment (GN 2011b). These materials are hazardous in nature; consequently, all disposal of ozone depleting substances takes place at an approved facility.

Any non-salvageable equipment containing ozone depleting substances will have the ozone depleting substances removed by a certified technician prior to disposal in the landfill. The *Environmental Guideline for Ozone Depleting Substances* is included in Appendix C.

4.5 Total Volume of Waste

The number of people working on-site, and the activities occurring at the time, will have a direct bearing on the volume of waste destined for the landfill, the incinerator, and the amount of materials removed from the waste stream for reuse and recycling. Also, purchasing policies that focus on reduced packaging will have a bearing on the volume of waste.

An estimate of waste volume is required to determine the appropriate size of the landfill. However, an exact waste volume is not a critical parameter in the design because of the flexibility of the design to accommodate extensions (larger to accept more waste) or contractions (smaller to accept less waste) within WRSF 1.

Table 4-1 indicates the estimated mass of waste destined for the landfill each year and cumulatively for the life of the Project. As mentioned earlier, the flexibility in the landfill design allows for greater flexibility in the landfill design and allows for increased volume in case more waste than estimated is generated. This ensures there will be enough room for all landfill waste for the life of the Project.

Table 4-1 Estimated Waste in Landfill

Project Phase	Waste Not Incinerated (t/year)	Ash From Incinerator (t/year)	Estimated Volume of Non-Hazardous Waste and Ash Produced (m^3/year)	Approximate Treated Soil From Landfarm (m^3/year)	Maximum Accumulated Waste Material in Landfill (m^3)
Construction	100	30	260	0	1,040
Operations	340	102	884	446	37,043
Closure	25	7.5	65	525	25,226
Total					**63,309**

As part of the larger waste management system, records are kept of the quantity of waste landfilled, the quantity of waste incinerated, type and quantity of materials recycled, and any analytical results. All this information will be submitted to regulators in an annual report.

4.6 Incinerator Ash Testing Protocol

Provided the materials that go into the incinerator are controlled to exclude all hazardous materials, then ash from the incineration process should be non-hazardous. An ash testing protocol, as described in Section 8.3 of the Incineration Management Plan, is implemented to ensure that the incinerator ash is suitable for disposal in the landfill.

SECTION 5 • LANDFILL MANAGEMENT

5.1 Site Development and Landfilling Method

The site for the landfill was prepared by first placing a foundation (or base) of 1.2 m of waste rock or and/or rockfill material directly on top of the natural ground to form a floor. A service road, accessible only to mine staff and Agnico Eagle's contractors, connects the landfill to other mine infrastructure. Berms surrounding the facility on three sides are built of waste rock and/or rockfill material. The design of the berms does not assume that they will be in a frozen state, or permanently impermeable to leakage. The berms will serve to confine the area for waste disposal and act as a wind shield to reduce windblown debris (Figure 5.1). In August 2018 the mine extended stage 1 of the landfill to the SE to accommodate additional waste (Figure 5.2).

Figure 5-1 Landfill Stage 1

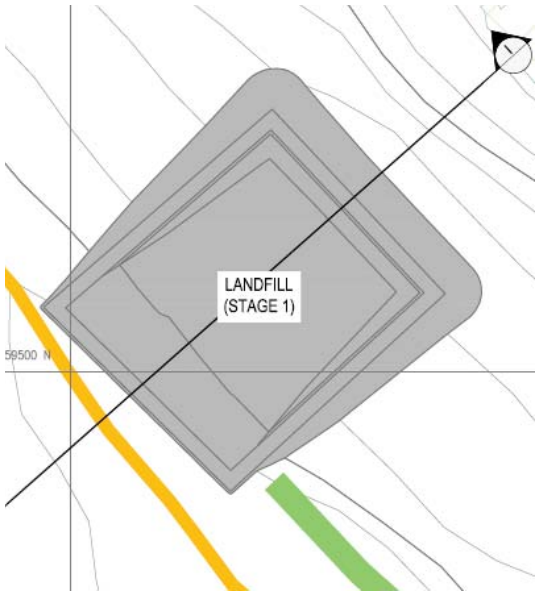
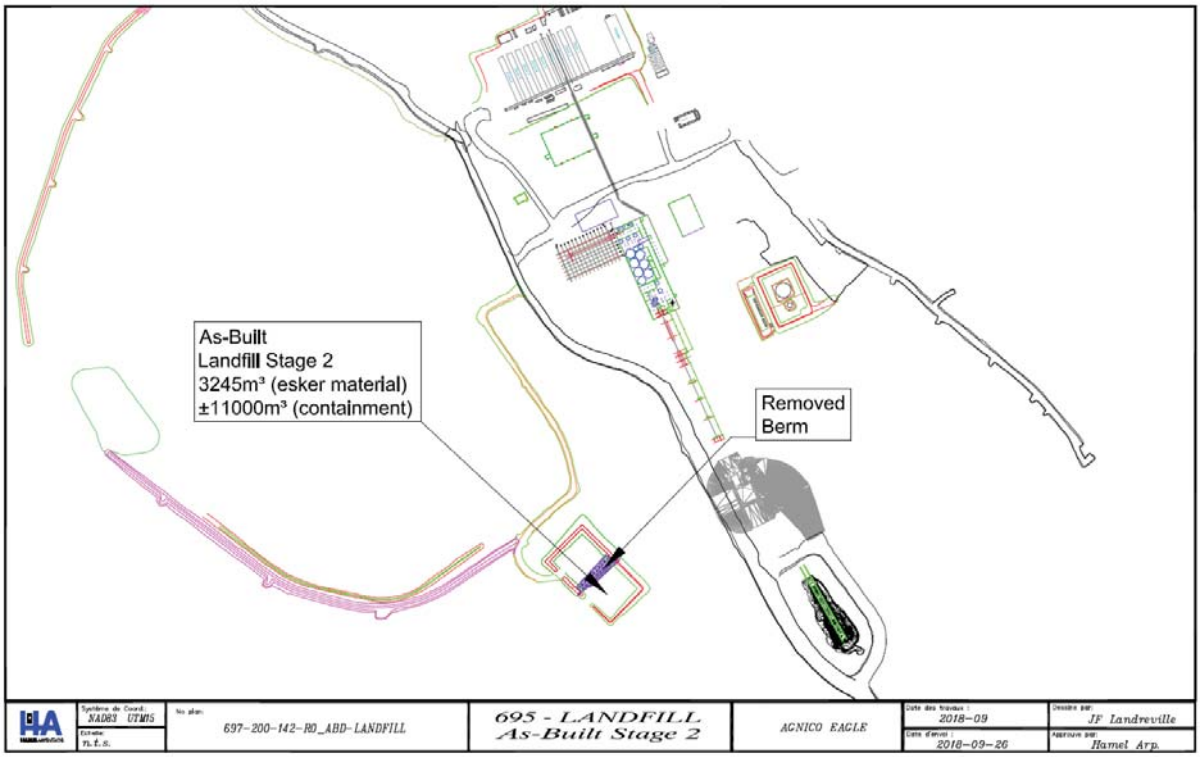


Figure 5-2 Landfill Stage 1 Extension



The Project's Site Services Department is responsible for the operation and maintenance of the landfill and will develop standard operating procedures for the facility. The landfill will progressively be filled in an orderly manner. Specifically, waste will be placed to full height at one end of the landfill and then the active waste area will progressively advance. An "area method" of dumping is used such that materials is dumped in rows and covered as required. Wastes is deposited directly onto the landfill floor and compacted with heavy equipment against the berm or an existing row of debris that was compacted earlier.

Areas where the waste has been placed to full height, compacted and levelled is progressively covered by placement of a minimum of 0.3 m thick of rock fill on top of the waste to reduce windblown debris.

Owing to its placement within the WRSF 1, the landfill will become encapsulated within waste rock. Agnico Eagle plans to use waste rock to surround and cover the landfill. Upon closure, the entire landfill will be covered with 3.7 m of waste rock.

5.2 Staffing and Equipment

The Project's Site Services Department collects waste throughout the mine site using trucks. Waste is segregated at the source with different waste streams following different paths. Trucks hauls waste destined for the landfill and dumps it at the working face where a dozer is used to spread, level, and compact the waste.

When activities such as capping and topping are conducted, visual monitoring of the dust will be completed. If dust is considered to be an issue, appropriate suppression methods will be employed. If dust is not observed to be an issue in the surrounding environment, the use of water as a dust suppression will be avoided to minimize ponding and leaching.

Landfill operation does not require a full-time attendant as waste will only be delivered to the landfill for short periods each day.

5.3 Leachate Management

The leachate from the landfill is anticipated to be of very low ionic strength (dilute) due to controls on materials to be placed in the landfill, and, as a result, site-specific landfill leachate management is not considered necessary.

In the event there is leachate from the landfill during periods of heavy rainfall or spring freshet, the runoff will be collected and directed to CP1[5], where it will be controlled and, if necessary, treated before release to the receiving environment. During operations, wastewater in CP1 could also be recycled and sent to the mill for use in the process.

In the event that greater volumes of leachate, or leachate with high ionic strength, is found coming from the landfill, an investigation would immediately be undertaken to determine the cause. This could lead to changes in the configuration and/or management of the landfill to further limit water coming in contact with landfill materials and/or modify the water management strategy in this area.

The toe of WRSF 1 is visually inspected monthly during the open water season and, if required, samples of water found ponding on the natural ground below the landfill will be collected and analysed. The collection of samples, their analysis and reporting of results are part of the Water Licence for the mine.

Because the landfill will be located in an area with underlying permafrost (see Permafrost Thermal Regime Baseline Studies in Agnico Eagle 2014), deep groundwater contamination from potential landfill leachate is not anticipated.

[5] Collection Pond 1 collects contact water runoff from a number of mine areas. For more details on CP1, refer to Water Management Plan.

5.4 Surface Water and Erosion Control

The perimeter berms of the landfill are constructed of rock material which has been compacted and is sloped on both sides. These berms are not subject to erosion, and are inspected visually during regular environmental inspections of the landfill. After periods of rainfall and snowmelt seepage from the landfill is monitored. When seepage is observed. Water samples are collected from an established downslope sampling location (MEL-24).

5.5 Operational Inspections

The Project's Environment Department undertakes periodic inspections of the landfill operations to verify compliance with applicable plans, including the condition of landfill works, evidence of erosion, excessive ponding or unusual landfill settlement, and adequacy of safety measures. The Environment Department also visually inspects the toe of the WRSF 1 monthly during the open water season for leachate from the landfill and, if present, collect samples for analysis.

SECTION 6 • TRAINING

All Agnico Eagle personnel and contractors working at the Project site are trained in waste management. This is included in the site orientation upon arrival, which includes the identification of waste bins and dumpsters for the different categories of waste, where these are located, and the signage associated with each. Stewardship of the environment is emphasized in that it is everybody's responsibility to properly dispose of waste, including wastes that can be recycled. This extends to ensuring wildlife does not have access to food or food wastes.

The success of the waste management system at the mine site will be dependent on the proper disposal of all waste by all employees and contractors. Waste management training beyond the initial orientation will occur in each department. Environment department staff will reinforce proper waste segregation and disposal at various departmental meetings.

The Project's Site Services Department will have enhanced on-the-job waste management training as they will be collecting and processing all mine site waste. They will be trained in identifying misdirected waste, identifying where to dispose of it and in recommending where further waste management training is required on-site.

All maintenance staff must successfully complete equipment training before they can operate machinery and vehicles related to waste management on-site. Additionally, crews handling waste will be fully trained in safe work procedures. Training programs will include Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goods (TDG). Training completion and retraining will be documented and tracked by the Project's Human Resources Department.

SECTION 7 • CLOSURE PLAN

The landfill is located within the WRSF 1. This location serves to minimize the area of surface disturbance, stabilize disturbed land surfaces against erosion, and return the land to a post-mining use that is chemically and physically stable, and consistent with past traditional pursuits and wildlife habitat. While waste rock will be disposed on land and in a manner that encourages total freezing. The design, operation, and/or closure of the WRSFs and landfill do not rely on total freezing. Any unacceptable leachate that is generated following closure of these facilities will be contained, collected, and/or treated, if necessary.

The following is a plan for closing the landfill; more information is available in the Mine Preliminary Closure and Reclamation Plan:

a) Estimate of Total Waste Volume at Closure

Upon closure, it is estimated that the landfill will have a volume of approximately 63,000 m^3 of waste.

b) Final Cover Design

The landfill will be covered with a minimum of 3.7 m of waste rock, and should thereafter be stable. When finalizing the design for the cover, the need for thermistors to be installed will be evaluated. The cover surface will be left irregular so as to capture snow, windblown sediment, and collect seeds.

c) Water Management

Contact water from the landfill at its closure will continue to be managed using best management practices in accordance with the Project's closure and reclamation plan.

SECTION 8 • PLAN REVIEW AND UPDATE

The Landfill and Waste Management Plan will be reviewed annually by the Meliadine Environment Department. This plan will be reviewed and updated on an annual basis, as required, to reflect changes in operations and/or technology. Improvements suggested through these reviews would be implemented in consultation with the Nunavut Water Board and Kivalliq Inuit Association.

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APPENDIX A • ENVIRONMENTAL GUIDELINE FOR WASTE ASBESTOS

Environmental Guideline for

Waste Asbestos

Department of Environment
Government of Nunavut

GUIDELINE: WASTE ASBESTOS

Original: January 2002
Revised: January 2011

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 waste asbestos. This Guideline does not replace the need for the owner or person in charge, management or control of the waste 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 management of waste asbestos.

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

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Introduction

Asbestos is the commercial term given to a group of silicate minerals that occur naturally in the environment. These minerals have separable long fibers that are heat resistant, strong and flexible enough to be woven or spun. Because of these characteristics, asbestos has been used in a wide range of manufactured products, mostly in building materials (i.e. roofing shingles, ceiling and floor tiles, wallboard, clapboard and asbestos cement products), friction products (i.e. automobile clutch, brake and transmission parts) and heat resistant insulation, fabrics, packaging, gaskets and coatings. Loose-fill vermiculite insulation may also contain small amounts of asbestos.

During the 1980s the health and safety risks associated with asbestos started to become known. As a result, the use of asbestos was banned or phased out throughout North America. Asbestos products may still be found when buildings are being renovated or demolished, or when carrying out repairs on older vehicles and electrical appliances.

Although asbestos is typically considered to be a human health hazard, the route of exposure is through breathing air and drinking water that contain the very small asbestos fibres. The *Environmental Guideline for Waste Asbestos* (the Guideline) provides information on the characteristics and potential environmental and human health effects of waste asbestos and guidance on its proper storage, handling and removal, transportation and disposal. It is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of waste asbestos is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the management of waste asbestos.

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 with authority to develop, coordinate, and administer the Guideline.

1.1 Definitions

Asbestos	A commercial term given to naturally occurring fibrous silicate minerals including crocidolite, amosite, chrysotile, fibrous anthophyllite, tremolite, actinolite and mysorite.
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 municipalities.
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.

Dangerous Good	Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* in any of the classes listed in the schedule provided in the *Transportation of Dangerous Goods Act*.
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.
Friable Waste Asbestos	Waste asbestos which can be crumbled by hand pressure when it is dry.
Minister	The Minister of Environment of the Government of Nunavut.
Qualified Person	A person who has an appropriate level of knowledge and experience in all relevant aspects of waste management.
Responsible Party	The owner or person in charge, management or control of the waste.
Transport Authority	The statute and regulations controlling the management of hazardous waste under that mode of transport. These include (a) Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations; Interprovincial Movement of Hazardous Waste Regulations and Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. (b) Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and (c) Marine – *International Maritime Dangerous Goods Code* (IMDG).
Waste Asbestos	A substance containing asbestos in a concentration greater than 1% by weight that is no longer wanted or is unusable for its intended purpose and is intended for storage or disposal. Waste asbestos does not include asbestos that is immersed or fixed in a natural or artificial binder.

1.2 Roles and Responsibilities

1.2.1 Department of Environment

The Environmental Protection Division is the key environmental agency responsible for ensuring parties properly manage waste asbestos and will provide advice and guidance on its management. 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 municipal 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 of Environment or by visiting the web site at http://env.gov.nu.ca/programareas/environmentprotection.

1.2.2 Generators of Waste Asbestos

The owner or person in charge, management or control of waste asbestos is known as the responsible party. In general, the responsible party must ensure asbestos is properly and safely managed from the time it is produced to its final disposal. This is referred to as managing the waste from cradle-to-grave. Information on the general management of hazardous waste in Nunavut, including generator, carrier and receiver responsibilities, can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste*.

Contractors may manage unwanted or waste asbestos on behalf of the responsible party. However, the responsible party remains liable for ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the waste, the responsible party may also be charged.

1.2.3 Other Regulatory Agencies

Other regulatory agencies may have to be consulted regarding the management of waste asbestos as there may be other environmental or public and worker health and safety issues to consider.

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 derives 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 *Asbestos Safety Regulations* provide specific requirements for the safe handling of asbestos in the workplace and for medical surveillance of workers.

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioners' Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste and sewage disposal facilities in most Nunavut communities.

Department of Health and Social Services

Activities related to the handling and management of waste asbestos 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 Economic Development and Transportation

The Motor Vehicles Division of the Department of Economic Development and Transportation is responsible for the safe transport of hazardous waste and other dangerous goods by road through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and road safety matters.

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* (CEPA)[1] and for regulating the interprovincial and international movement of hazardous waste, including waste asbestos, under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. Environment Canada is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

Indian and Northern Affairs Canada

Indian and Northern Affairs 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 waste asbestos may have on the quality of these lands and waters.

Local Municipal Governments

The role of municipal governments is important in the proper local management of waste asbestos. Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal disposal sites. Unwanted waste may be deposited into municipal landfill sites and sewage lagoons only with the consent of the local government. The local fire department may also be called upon if a fire or other public safety issue involving asbestos 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 disposal of waste asbestos may be controlled through the setting of terms and conditions in plans, permits and licenses issued by the Nunavut Water Board and other co-management boards and agencies.

[1] Asbestos is listed in Schedule 1 of the *Canadian Environmental Protection Act* as being a 'Toxic Substance"

Characteristics and Potential Effects of Asbestos

2.1 Characteristics

Asbestos is a naturally occurring silicate mineral with several unusual properties. Its long flexible silky fibres are strong enough to be spun or woven into a variety of blanket-like products. It is resistant to high temperatures, chemical corrosion and wear. A poor conductor of electricity, asbestos also insulates well against heat and electricity. This combination of properties gives asbestos performance characteristics that are difficult to match and, as a result, it has been used in a wide range of manufactured products over the years including building materials (i.e. roofing shingles, ceiling and floor tiles, wallboard, clapboard and asbestos cement products), various automotive friction products (i.e. clutch, brake and transmission parts) as well as heat resistant insulation, fabrics, packaging, gaskets and coatings. Although asbestos use was either banned or largely phased out in North America starting in the mid 1980s, it can still be found in many older buildings, vehicles and appliances. Appendix 3 provides a listing of products that have been manufactured in the past using asbestos.

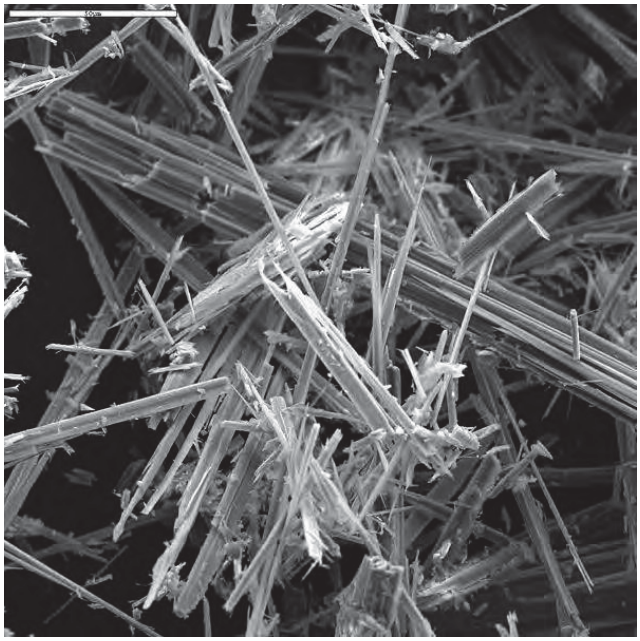

Figure 1 - Anthophyllite Asbestos Fibres
Source: Public Domain

2.2 Potential Effects on Environment and Human Health

Asbestos fibres are stable and do not break down into other compounds in soil, evaporate into air or dissolve in water. In other words, the basic silicate structure of the flbre remains largely intact in the environment. Small diameter fibres may remain suspended in air and water and be carried long distances while larger fibres tend to be deposited more quickly. Asbestos fibres are not able to move through soil.

Human exposure to asbestos occurs when the asbestos-containing material is disturbed in some way so as to release fibres into the air and water. Small amounts can also be released to the environment through the breakdown of natural deposits. Health risks occur when fibres are present in drinking water and in the air that people breathe. When inhaled, asbestos fibres can cause asbestosis (a scarring of the lungs which makes breathing difficult), lung cancer and mesothelioma (a rare cancer of the lining of the chest or abdominal cavity). The risk of contracting an asbestos related disease is greatest when fibre concentrations in the air are high and the exposure period is long, such as in the workplace. Smoking combined with asbestos inhalation also greatly increases the risk of lung cancer.

Waste Management

Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created.[2]

3.1 Pollution Prevention

Pollution prevention is a term used to describe methods and practices that minimize or eliminate the generation of waste. If asbestos is known to be present, removal of the asbestos material should only be undertaken by a qualified person and only when the material is beyond repair or, if it is in a building, when the building is undergoing renovation or demolition. Asbestos that is not disturbed or deteriorated does not, in general, pose a risk to human health and can be left alone.

Other pollution prevention opportunities for waste asbestos include:

Reduce

- Replace asbestos-containing materials with less hazardous materials. A number of materials have been developed as replacements for asbestos in manufactured products including fiberglass, carbon and graphite fibres and PTFE (polytetra fluroethylene).

Reuse

- Encapsulate existing asbestos material by sealing with paint or an epoxy product or cover the material with paneling or other non-asbestos product. The Workers' Safety and Compensation Commission, Chief Medical Officer of Health and your Regional Environmental Health Officer must be consulted prior to encapsulating or sealing existing asbestos material.
- Friable asbestos materials should never be reused for any purpose once it has been removed. Non-friable asbestos materials (i.e. asbestos cementous board) can only be re-used if it remains intact and unbroken. This will extend the life of the product and reduce replacement costs.

Public and commercial building and home owners should keep an inventory of asbestos material so as to inform users, contractors and regulatory and municipal authorities in the event of renovation or demolition activities or an emergency (i.e. fire).

3.2 Handling and Removal

The safe handling and removal of asbestos requires a thorough understanding of the potential risks and knowledge of abatement measures. As long as the asbestos fibres remain enclosed or tightly bound in the material, the fibres will not be released to the air and there is no significant health risk. However, asbestos materials that are disturbed, broken or removed can result in the release of fibres if adequate safety measures are not in place. Unfortunately, simply looking at the material may not confirm whether asbestos is present. If in doubt, have the material analyzed by a qualified person.

Homeowners should contact the Chief Medical Health Officer or Regional Environmental Health Officer before handling material that contains asbestos. Check the material regularly for any sign of damage or wear and have renovations or asbestos removal carried out by a trained and qualified person.

[2] Source – Canadian Council of Ministers of the Environment.

The *Asbestos Safety Regulations* provide employers with specific requirements for the safe handling of asbestos in the workplace. The *Regulations* require that employers:

- Provide workers with protective respiratory equipment, clothing and eye protection.
- Enclose the work area and ventilate the air using filtering equipment.
- Post warning signs and notices.
- Soak the asbestos material through its entire thickness with water during its removal to minimize release of asbestos fibres.
- Thoroughly clean the work area each day.
- Place all asbestos material and debris in clearly labeled, sealed and airtight containers.
- Provide training to workers in the use of protective equipment, the safe handling and disposal of asbestos waste and health information on the potential effects of asbestos exposure.
- Pay and arrange for a medical examination upon the written request of a worker involved in handling and disposing of asbestos materials and waste.

Employers should consult the *Asbestos Safety Regulations* in order to obtain a complete description of the regulatory requirements. A consolidated copy of the current *Regulations* is provided in Appendix 2. The authoritative text can be obtained by contacting the Workers' Safety and Compensation Commission or by downloading a copy from the Department of Justice web site at http://www.justice.gov.nu.ca/apps/search/docSearch.aspx.

The handling and removal of asbestos should only be undertaken by trained and qualified persons. The names of qualified asbestos abatement companies can be obtained by contacting the Workers' Safety and Compensation Commission or the waste management exchanges and associations listed in Appendix 10 of the *Environmental Guideline for the General Management of Hazardous Waste.*

3.3 Storage

Storage refers to the maintenance of waste asbestos while awaiting its transport and disposal. Storage is not acceptable for the long-term management of waste asbestos except under extraordinary circumstances and should be considered as a temporary measure only.

Waste asbestos should be stored in the following manner:

- Store wet waste asbestos in airtight, non-leaking plastic or 16 gauge steel drums. Dry asbestos can be stored in 6 mil plastic bags sealed within non-reusable drums or a second 6 mil plastic bag. Containers should be tightly sealed when not in use to prevent release of asbestos fibres.
- Each container must be clearly labeled "ASBESTOS" in accordance with the *Asbestos Safety Regulations.* If waste asbestos is being stored in an institutional, commercial or industrial location or if the asbestos is being stored for transport, the containers must also be labeled in accordance with the *Workplace Hazardous Materials Information System* (WHMIS) and relevant Transport Authority.
- Place all labeled containers in a secure and clearly marked area.
- Containers should be located so as to be protected from the sun, weather and physical damage.
- Workers must be trained in the safe handling and shipping for waste asbestos, have access to material safety data sheets and be provided with personal protective equipment. Only trained personnel should have access to the designated storage area.

If a commercial facility is used to store hazardous waste for periods of 180 days or more or the quantity of asbestos and other waste on-site at any one time exceeds the criteria set out in the *Environmental Guideline for the General Management of Hazardous Waste*[3], the facility must be registered with the Department of Environment as a hazardous waste management facility. Copies of registration forms are available at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment. Refer to the *Environmental Guideline for the General Management of Hazardous Waste* for additional information on the registration process.

3.4 Transportation

Friable waste asbestos should never be transported in bulk, but in storage containers as described in section 3.3 of the Guideline. The waste should be properly secured and transported within an enclosed vehicle or covered with a tarpaulin or net if transported in a vehicle that is not enclosed. A compaction type waste haulage vehicle must never be used to transport friable asbestos waste. Asbestos waste that is non-friable (i.e. asbestos that is immersed or fixed in a natural or artificial binder) does not need to be specially packaged for transport and disposal.

Under the federal *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations,* no person may transport hazardous waste in Canada for the purpose of disposal or recycling in a quantity greater than five litres or five kilograms unless it is accompanied by a completed manifest. Manifest forms are available from Nunavut's Department of Environment and completion instructions are included on the reverse side of each manifest. Further information on manifesting can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste* or Environment Canada's *User's Guide for the Hazardous Waste Manifest*.

Friable waste asbestos is classified as a Class 9 Miscellaneous Waste by the *Transportation of Dangerous Goods Act*. The classification, packaging, labeling and placarding of this waste must conform to the federal and territorial *Transportation of Dangerous Goods Act* and *Regulations*. Schedule I of the *Regulations* classifies waste asbestos as follows:

Shipping Name: WASTE Asbestos Blue (crocidolite)
Classification: 9
Product Identification Number: UN2212
Packing Group: II

Shipping Name: WASTE Asbestos Brown (amosite, mysorite)
Classification: 9
Product Identification Number: UN2212
Packing Group: II

Shipping Name: WASTE Asbestos White (chrysotile, actinolite, anthophyllite, tremolite)
Classification: 9
Product Identification Number: UN2590
Packing Group: III

[3] The criterion for Class 9 Miscellaneous Waste is 1000 kilograms or litres and the total aggregate quantity is 5000 kilograms or litres.

Non-friable asbestos is not a hazardous waste and does not need to be accompanied by a manifest.

The transport of waste asbestos by air must conform to the *International Air Transport Association* (IATA) *Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions,* while transport by marine must conform to the *International Marine Dangerous Goods Code*. Further information on transporting these materials can be obtained by contacting Transport Canada or by referring to the appropriate Transport Authority.

Hazardous waste generators, carriers and receivers operating in Nunavut must be registered with the Nunavut Department of Environment. A unique registration number is assigned to each registrant through the registration process, which enables completion of the manifest document. Copies of registration forms are available at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment. Refer to the *Environmental Guideline for the General Management of Hazardous Waste* for additional information on the registration process.

A listing of hazardous waste carriers, receivers and management facilities registered to operate in Nunavut is available by contacting Nunavut's Department of Environment.

3.5 Disposal

Friable waste asbestos may be disposed of at a municipal landfill site in Nunavut provided that authorization and approval has first been obtained from the local municipal government. The local municipal government must be registered with Nunavut's Department of Environment as a hazardous waste receiver before accepting the waste.

Upon arrival at the landfill site, the waste asbestos should immediately be buried and covered with at least 30 centimetres (one foot) of soil to ensure further direct contact with people and heavy equipment is avoided. Care should be taken to ensure the asbestos containment (i.e. plastics bags) is not broken or ruptured while being covered. A final cover of at least 60 centimetres (two feet) of soil should be placed over the waste asbestos within 24 hours. The excavation site should be separate from other disposal or burning activities and a sign erected so the asbestos is never disturbed. A detailed map or drawing of the excavation site location should also be maintained by the local municipal government for future reference.

Where friable asbestos is being unloaded for the purpose of disposal, the unloading must be carried out so that no loose asbestos waste or punctured, broken or leaking containers are landfilled. Any friable asbestos that is in a punctured, broken or leaking container must be repackaged in drums or two 6 mil plastic bags prior to its disposal.

Where local disposal of friable waste asbestos is not available, the asbestos should be transported for disposal by a registered hazardous waste carrier to a receiver or management facility that is registered to operate in Nunavut. A listing of hazardous waste carriers, receivers and management facilities is available by contacting Nunavut's Department of Environment. A listing of receivers and management facilities authorized to accept waste asbestos in other territories and provinces can be obtained by contacting the environment department in that jurisdiction or the Canadian waste exchanges and associations found in Schedule 10 of the *Environmental Guideline for the General Management of Hazardous Waste.*

Conclusion

Asbestos is a commercial term given to a group of fibrous silicate minerals that occur naturally in the environment. Because of its unique and unusual properties, asbestos has been used over the years in the manufacture of a wide range of products. These products include building materials, friction products, heat resistant insulation, fabrics, packaging, gaskets and various coatings. During the 1980s the human health and safety risks associated with asbestos started to become known. As a result, the use of asbestos was banned or phased out throughout North America. However, a variety of asbestos products may still be found when older buildings are being renovated or demolished, or when repairs are being carried out on older vehicles and electrical appliances. The *Environmental Guideline for Waste Asbestos* is an introduction to the management of asbestos. It provides information on the characteristics of asbestos, its possible effects on the environment and human health and guidance on its proper storage, handling and removal, transportation and disposal.

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

For additional information on the management of waste asbestos, or to obtain a listing 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

Alberta Environment. Guidelines for the Disposal of Asbestos Waste, (1989).
http://environment.gov.ab.ca/info/library/7247.pdf

Environment Canada. Asbestos Webpage.
http://www.ec.gc.ca/toxiques-toxics/Default.asp?lang=En&n=98E80CC6-1&xml=A183A275-6D44-4979-8C4F-371E7BF29B9F

Environment Canada. Risk Evaluation Determining Whether Environmental Emergency Planning is Required Under the *Environmental Emergency Regulations* set under the *Canadian Environmental Protection Act 1999.*
http://www.ec.gc.ca/publications/F55958A7-82AF-49ED-B20D-B48F6DC34FE2/Asbestos.pdf

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Government of Nunavut, Department of Justice. *Consolidation of Asbestos Safety Regulations.*
http://www.justice.gov.nu.ca/apps/search/docSearch.aspx.

Health Canada. Health Risks of Asbestos Webpage.
http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/asbestos-amiante-eng.php

Krytiuk Specialty Contracting Inc. What is Asbestos Webpage.
http://ksccanada.com/21.html

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 – *SAFETY ACT: ASBESTOS SAFETY REGULATIONS*

This consolidation is not an official statement of the *Asbestos Safety Regulations*. It is a current consolidation prepared for convenience of reference only. The authoritative text of the *Regulations* should be obtained from the Northwest Territories and Nunavut Workers' Safety and Compensation Commission.

1. In these regulations,

"Asbestos" means crocidolite, amosite, chrysotile, fibrous anthophyllite, tremolite, actinolite or any mixture containing any of these minerals;
"Asbestos dust" means dust consisting of or containing asbestos fibres;
"Asbestos process" means the handling of materials containing asbestos and includes:
(a) sawing, cutting, sanding or spraying materials,
(b) repair or maintenance of materials,
(c) cleaning or disposal of materials,
(d) mixing or applying asbestos shorts, cements, grouts, putties or similar compounds,
(e) storage or conveyance of materials.

2. These regulations apply to every establishment.

3. No person shall use crocidolite in any asbestos process.

4. No person shall apply, by spraying, insulation materials containing asbestos.

5. (1) An employer conducting an asbestos process shall:
(a) provide each worker who may be exposed to asbestos with respiratory equipment designed for use in asbestos processes and that has been approved by the Canadian Standards Association;
(b) provide each worker who may be exposed to asbestos with dustproof coveralls, gauntlets, eye protection and headgear;
(c) ensure that, at all times during the asbestos process, ventilation and air filtering equipment is in operation and removing asbestos dust from the air;
(d) enclose the work area to prevent the escape of asbestos dust;
(e) post warning notices in prominent places indicating that an asbestos process is in progress;
(f) ensure that, prior to disturbing any asbestos surface, the asbestos is soaked with water through its entire thickness;
(g) where a safety officer is of the opinion that it is not practicable to comply with the requirements in paragraph (d), ensure that any asbestos surface is kept wet as it is being disturbed;
(h) clean the work area surrounding an asbestos process thoroughly each day by vacuum equipment or a wet cleaning method approved by a safety officer; and
(i) ensure that all asbestos materials, debris and dust are placed in sealed, airtight containers and clearly labeled "ASBESTOS".

(2) A safety officer may, in writing, exempt an employer from the requirements of paragraph 1(a) where the safety officer is of the opinion that the nature of the asbestos process is such that the employer cannot, practically, comply with the requirements.

(3) An employer providing equipment under subsection (1) shall dispose of the equipment after use or shall remove all traces of asbestos dust and shall store the equipment in an airtight container.

6. An employer conducting an asbestos process shall provide the following training to any worker who is likely to come in contact with asbestos:
   (a) demonstration and instruction in the use of all protective equipment;
   (b) the safe handling and proper disposal of waste asbestos;
   (c) health education including information relating to pneumoconiosis, lung cancer, mesothelioma and the effects of smoking; and
   (d) any other information a safety officer considers necessary.

7. (1) Where an employer uses ventilation and air filtering equipment, the employer shall inspect and clean the equipment weekly.

   (2) A safety officer may designate a person in the workplace to inspect any ventilation and air filtering equipment yearly to report to the employer on the condition of the equipment and the need for repair.

   (3) An employer receiving a report recommending repair under subsection (2) shall complete the recommended repairs within 30 days of receipt of the report.

8. No person shall employ a minor where an asbestos process is being conducted unless
   (a) the process is conducted under constant supervision; and
   (b) the process has been inspected and approved by a safety officer.

9. (1) Within 30 days of receipt of a written request for a medical examination by a worker involved in an asbestos process, an employer shall arrange and pay the full cost of an examination by a physician.

   (2) The employer shall make arrangements for a medical examination that includes:
   (a) a complete physical examination with special attention to the respiratory system;
   (b) lung function tests including forced vital capacity and forced expiratory volume at one second; and
   (c) any medical procedures considered necessary by the examining physician for the diagnosis of asbestos related illness.

   (3) Upon written request by the Minister, a physician who has conducted an examination under subsection (2) shall provide the Minister with a report containing all information resulting from the examination.

   (4) Every report provided under subsection (3) is a privileged communication of the person making it.

APPENDIX 3 – ASBESTOS CONTAINING MATERIALS

The following products have in the past been manufactured using asbestos. If in doubt, confirm with the product's manufacturer as to whether it is asbestos-free.

- Acoustical Plaster
- Base Flashing
- Breaching Insulation
- Cement Pipes
- Chalkboards
- Ductwork
- Electrical Panel Partitions
- Fire Blankets
- Fireproofing Materials
- Heating and Electrical Ducts
- Joint Compounds
- Packing Materials
- Roofing Shingles
- Taping Compounds (thermal)
- Wallboard
- Vinyl Floor Tile
- Adhesives
- Blown-in Insulation
- Caulking and Putties
- Cement Siding
- Construction Mastics and Adhesives
- Electrical Wiring Insulation
- Elevator Brake Shoes
- Fire Curtains
- Flexible Fabric Connections
- High Temperature Gaskets
- Laboratory Gloves
- Pipe Insulation
- Spackling Compounds
- Textured Paints and Coatings
- Vinyl Sheet Flooring
- Cooling Towers
- Asphalt Floor Tile
- Boiler Insulation
- Ceiling Tiles
- Cement Wallboard
- Decorative Plaster
- Electrical Cloth
- Elevator Equipment Panels
- Fire Doors
- Flooring Backing
- HVAC Duct Insulation
- Laboratory Hoods and Table Tops
- Roofing Felt
- Spray-Applied Insulation
- Thermal Paper Products
- Vinyl Wall Coverings

Source - Krytiuk Specialty Contracting Inc.

APPENDIX 4 – GOVERNMENT AND INDUSTRY 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

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free)
Fax: 1-866-979-8501

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) 975-5774 Fax: (867) 975-5755

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

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

Government of Canada

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

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine
Fax: (204) 983-1734 Air

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

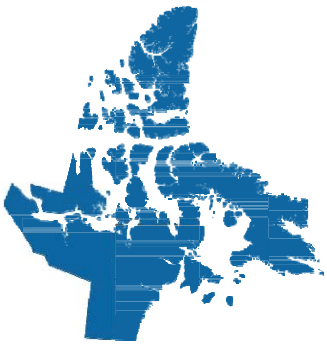
Industry

National Demolition Association
16 N. Franklin Street, Suite 203
Doylestown, Pennsylvania USA 18901-3536
Telephone: (215) 348-4949 Fax (215) 348-8422
Website: http://www.demolitionassociation.com

APPENDIX B • ENVIRONMENTAL GUIDELINE FOR MERCURY-CONTAINING PRODUCTS AND WASTE MERCURY

Environmental Guideline for

Mercury-Containing Products and Waste Mercury



Department of Environment
Government of Nunavut

GUIDELINE: MERCURY-CONTAINING PRODUCTS AND WASTE MERCURY

Original: November 2010

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 common mercury-containing products and waste mercury. This Guideline does not replace the need for the owner or person in charge, management or control of the product or waste 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 management of mercury.

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

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Introduction

Mercury is a naturally-occurring element that is found in soil, air and water around the world. It is constantly being released from natural sources such as volcanic eruptions and the weathering of soil and rock. It can exist as a gas or in a range of organic and inorganic forms that vary in toxicity and can cycle between the earth's land, water and air. Mercury is a persistent substance. If released into the atmosphere, it can remain airborne for long periods of time and be deposited in soil and water in the Canadian Arctic, an area with no significant local industrial sources of mercury. Almost all forms of mercury are toxic to some degree or can be converted through biological activity into the highly toxic organic form called methylmercury. Mercury may also build up, or bioaccumulate[1] and biomagnify[2], in living organisms. This results in animals such as predatory fish, fish-eating birds and mammals being at a higher risk of harm from mercury than those species which do not prey upon other organisms.

Mercury has been used for many years in a variety of consumer and industrial products because it is an excellent conductor of electricity and reacts predictably to changes in temperature and pressure. Common consumer and industrial products that can contain mercury include fluorescent lamps, thermometers and thermostats, batteries, dental amalgam, medical and other measuring devices, and electrical switches and relays. Although the use of mercury in these products has declined significantly over the past several decades, stockpiles of older mercury-containing products and the current technical requirements of products such as fluorescent lamps and specialized batteries suggests that the elimination of mercury use is not expected soon. For this reason, mercury-containing products must continue to be actively managed.

The Guideline for Mercury-Containing Products and Waste Mercury (the Guideline) provides information on the risks, hazards and best management practices associated with various mercury-containing products commonly used in Nunavut. It examines the characteristics and effects of mercury on the environment and human health, identifies non-mercury alternatives for common products and provides guidance on the proper cleanup, storage, transportation and disposal of unwanted mercury.

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 with authority to develop, coordinate, and administer the Guideline.

The Guideline is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of a mercury-containing product or waste mercury is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the management of mercury.

1.1 Definitions

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 municipalities.

[1] The accumulation over time of metals and other persistent substances within an organism from both biotic (i.e. other organisms) or abiotic (i.e. land, air and water) sources.

[2] The progressive buildup of metals or other persistent substances through successive trophic levels – meaning that it relates to the concentration ratio in the tissue of a predator as compared to that in its prey.

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.
Dangerous Good	Any product, substance or organism included by its nature or by the Transportation of Dangerous Goods Regulations in any of the classes listed in the schedule provided in the *Transportation of Dangerous Goods Act*.
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.
Hazardous Waste	A contaminant that is a dangerous good and is no longer wanted or is unusable for its original intended purpose and is intended for storage, recycling, treatment or disposal.
Mercury-Containing Product	A manufactured device or part of a device that contains elemental mercury which is integral to its function.
Minister	The Minister of Environment of the Government of Nunavut.
Qualified Person	A person who has an appropriate level of knowledge and experience in all relevant aspects of waste management.
Responsible Party	The owner or person in charge, management or control of the waste.
Transport Authority	The statute and regulations controlling the management of hazardous waste under that mode of transport. These include (a) Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations; Interprovincial Movement of Hazardous Waste Regulations* (CEPA) and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* (CEPA). (b) Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and (c) Marine – *International Maritime Dangerous Goods Code* (IMDG).
Waste Mercury	Mercury that is no longer wanted or is unusable for its intended purpose and is intended for storage, recycling, treatment or disposal.

1.2 Roles and Responsibilities

1.2.1 Department of Environment

The Department of Environment is the key environmental agency responsible for ensuring responsible parties properly manage unwanted mercury-containing products and waste mercury and will provide advice and guidance on its management, including proper disposal. 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 municipal 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 of Environment or by visiting the web site at http://env.gov.nu.ca/programareas/environmentprotection.

1.2.2 Generators of Unwanted Mercury-Containing Products and Waste Mercury

The owner or person in charge, management or control of the unwanted mercury-containing product or waste mercury is known as the responsible party. In general, the responsible party must ensure the unwanted product and waste mercury is properly and safely managed from the time it is produced to its final disposal. This is referred to as managing the product and waste from cradle-to-grave. Information on the general management of hazardous waste in Nunavut, including generators, carriers and receivers, can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste*.

Contractors may manage unwanted mercury-containing products and waste mercury on behalf of the responsible party. However, the responsible party remains liable for ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the waste, the responsible party may also be charged.

1.2.3 Other Regulatory Agencies

Other regulatory agencies may have to be consulted regarding the management of unwanted mercury-containing products and waste mercury as there may be other environmental or public and worker health and safety issues to consider.

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 derives its authority from the *Workers' Compensation Act* and the *Safety Act,* both of which require an employer to maintain a safe workplace and ensure the safety and well being of workers.

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioners' Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste and sewage disposal facilities in most Nunavut communities.

Department of Health and Social Services

Activities related to the management of unwanted mercury-containing products and waste mercury 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 Economic Development and Transportation

The Motor Vehicles Division is responsible for ensuring the safe transport of hazardous waste and other dangerous goods by road through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and road safety matters.

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* (CEPA). Mercury is listed as a Toxic Substance in Schedule I of CEPA and notices have been published in the Canada Gazette requiring the preparation and implementation of pollution prevention plans in regard to mercury releases from switches in end-of-life vehicles and dental amalgam waste. Environment Canada is also responsible for regulating international and interprovincial movement of hazardous waste, including unwanted mercury-containing products and waste mercury, under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. Environment Canada is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

Indian and Northern Affairs Canada

Indian and Northern Affairs 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 in Nunavut, including the impact waste mercury may have on the quality of these lands and waters.

Local Municipal Governments

The role of municipal governments is important in the proper local management of unwanted mercury-containing products and waste mercury. Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal disposal sites. Unwanted waste may be deposited into municipal landfill sites and sewage lagoons only with the consent of the local government. The local fire department may also be called upon if a fire or other public safety issue 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 disposal of unwanted mercury-containing products and waste mercury may be controlled through the setting of terms and conditions in plans, permits and licenses issued by the Nunavut Water Board and other co-management boards and agencies.

Characteristics and Effects of Mercury

Mercury is a naturally occurring element that can be released to the environment from natural sources or through human activities. Natural sources include the release of mercury from the Earth's crust through volcanic activity and the weathering of soil and rock. Human activities contribute to mercury levels in the environment primarily through the burning of coal and the burning and landfilling of products or waste that contain mercury.

Elemental mercury is a shiny, silver-white metal that is liquid at room temperature. It is a persistent element that can cycle between the earth's land, water and air for long periods of time. Through a process known as 'atmospheric mercury depletion events'[3] relatively high concentrations of mercury are now being found in the Canadian Arctic, a region with no significant industrial sources of the metal.

Several forms of mercury occur naturally in the environment with microorganisms and natural processes being able to change the mercury from one form to another. The most common natural forms of mercury found in the environment are metallic mercury, mercuric sulphide, mercuric chloride, and the organic form methylmercury. Being an element, mercury cannot be broken down or degraded further into harmless substances.

2.1 Effects on the Environment

All forms of mercury can accumulate in organisms to some degree. Of most importance is methylmercury, which is a fat soluble compound that readily bioaccumulates in living organisms and biomagnifies up the food chain. This can result in methylmercury levels in edible freshwater and saltwater fish, aquatic mammals and predatory birds that are thousands of times greater than levels in the surrounding water. Wildlife exposed to these high levels of methylmercury is at risk of harm. Depending upon the species and level of exposure, harmful effects can include slower growth, reproductive failure, death and the development of abnormal behaviors that can affect survival rates.

As little as 25 milligrams (or 25 thousandths of a gram) of mercury, the amount contained in many common consumer products, can contaminate as much as one hundred thousand litres of water beyond the safe limits for the protection of aquatic life[4].

2.2 Effects on Human Health

Mercury is a neurotoxin that can cause damage to the brain, central nervous system, kidney and lungs in humans. The severity of the toxic effect depends on the form and concentration of mercury and its route of exposure. Methylmercury readily enters the brain and can lead to health effects including personality changes, tremors, changes in vision, deafness, loss of muscle coordination and sensation, memory loss, intellectual impairment, and in extreme cases, death. Mercury can also cross the placental barrier of pregnant mothers affecting the fetus while in the womb. Affected children may exhibit reduced coordination and growth, lower intelligence and seizures.

[3] 'Atmospheric mercury depletion events' occur when a series of photochemical reactions involving halogens convert gaseous elemental mercury to a more reactive form. This new form of mercury then adheres to dust and other particles in the atmosphere and is deposited in the Arctic, sub-Arctic and Antarctic regions.

[4] The Canadian Council of Ministers of the Environment (CCME) has established 0.026 micrograms of inorganic mercury per litre of water as the water quality guideline for the protection of aquatic life.

Waste Management

Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created.[5]

Responsible waste management involves adopting methods and techniques that have been shown to prevent or reduce pollution. These policies, prohibitions of practices, maintenance and monitoring procedures can include reducing the amount of waste generated, reusing the waste for a different purpose or recycling the waste to produce a new product. Implementing these management practices is an effective way of reducing a person's costs, reducing pollution and reducing legal liabilities.

3.1 Pollution Prevention - Mercury-Containing Products and Non-Mercury Alternatives

Pollution prevention methods reduce or eliminate the creation of waste mercury. Scientific and technical advances in product manufacture and design have enabled the amount of mercury in many consumer, institutional, commercial and industrial products to be reduced or eliminated. In many cases, these non-mercury or low-mercury alternatives have the same performance characteristics and cost less to operate than the original mercury-containing product. The following sections introduce the common mercury-containing products used in Canada and their non-mercury alternatives.

Figure 1 - Compact Fluorescent Lamp Tube
Source – E. Paquin

3.1.1 Fluorescent and Other Lamps

Mercury is an essential element needed for the operation of most fluorescent, high intensity discharge and neon lamps. Light is produced when electricity passes through the lamp and excites the contained mercury vapour. The quantity of mercury in these lamps varies according to the type and size of the lamp. Table 1 describes the common types of mercury-containing lamps and their mercury content.

In recent years, industry has been able to reduce the amount of mercury in these lamps but, because it remains an essential element for the lamp's operation, small amounts of mercury continue to be used in their manufacture.

Figure 2 - Linear Fluorescent Lamp Tube

When fluorescent and other mercury-containing lamps burn out, much of the mercury tends to be absorbed by other lamp materials such as phosphorous and glass. However, a small amount of mercury still remains in vapour form, which can result in an inhalation hazard if the lamp is broken or crushed. Over 75% of the mercury used in lamps in Canada currently ends up in landfill sites.

[5] Source – Canadian Council of Ministers of the Environment.

Table 1. Mercury-Containing Lamps

Lamp Type	Description and Use	Mercury Content[6]
Linear Fluorescent	Linear fluorescent lamps are sealed glass tubes that are between 2 and 8 feet in length and contain small amounts of mercury, an inert gas and phosphor powder coating the inside of the tube. The lamps are commonly used in offices, stores, warehouses and homes.	3 to 50 milligrams
Compact Fluorescent	Compact fluorescent lamps (CFL's) have the same characteristics as linear fluorescent lamps except the glass tube has been replaced with a compact coil. CFL's are designed to replace the traditional incandescent lamp and are becoming increasingly common in homes and offices.	1 to 25 milligrams
Mercury Vapour Discharge	Mercury vapour lamps consist of a glass envelope with a pinched quartz glass tube and several electrodes within. Mercury vapour is contained within the glass tube. The lamps are used for street and floodlighting applications. The emitted light has a bluish glow.	25 to 225 milligrams
High Pressure Sodium Vapour Discharge	High pressure sodium vapour lamps (70 to 1000 watts) have the same physical characteristics as mercury vapour discharge lamps except they contain solid sodium, mercury and a small amount of neon and argon gas. Low pressure sodium vapour lamps (35 to 180 watts) do not contain mercury. Both are high intensity discharge lamps used for street and floodlighting applications. The emitted light has a yellowish glow.	20 to 145 milligrams
Metal Halide	Metal halide lamps have the same physical characteristics as mercury and sodium vapour discharge lamps except they contain metal halides, mercury and argon gas. Sodium iodide and scandium iodide are commonly used as the metal halide. These lamps are used to light sporting facilities where a very bright light is required.	25 to 225 milligrams
Neon	Neon lamps are similar to florescent lamps except that the colour emitted depends on the mixture of gases and the colour of the glass. Although the term refers to all gas discharge bulbs using noble gases, only the red lamps use neon. Red neon lamps do not contain mercury. Other neon lamps use argon, mercury and phosphor to produce additional colours.	Varies by colour and size

Non-Mercury Alternatives

Fluorescent and high intensity discharge lamps are currently the most energy-efficient lamps available for their specific applications and similar energy-efficient alternatives are currently not commonly available. Using these lamps in place of incandescent bulbs reduces the overall amount of greenhouse gases and other contaminants emitted from electrical generating stations powered by fossil fuels because of the lamp's energy efficiency. High-efficiency, low-mercury content lamps should be

[6] To assist in putting mercury content into the proper context, one Canadian penny weighs approximately 2300 milligrams.

purchased whenever possible. In some cases, light emitting diode (LED) lamps can be used to replace neon and other mercury-containing lamps, although LED lamps can be more costly and cannot be used in all applications.

Figure 3 – High Pressure Sodium Discharge Lamp

Figure 4 – Metal Halide Lamp

Figure 5 – Mercury Vapour Lamp

3.1.2 Thermometers and Other Measuring Devices

Mercury has been used in a variety of measuring devices because the liquid reacts predictably to changes in temperature and pressure. Table 2 describes various mercury-containing measuring devices that can be found in Nunavut. These devices can be found in homes, schools, laboratories, hospitals, nursing stations, as well as commercial and industrial facilities.

Figure 6 – Clinical Mercury Thermometer

Non-Mercury Alternatives

Various digital, mechanical and non-mercury liquid alternatives have been developed. Table 2 provides a list of several non-mercury alternatives for thermometers and other measuring devices. Availability, product effectiveness and relative cost should be considered when switching to a non-mercury alternative.

Figure 7 - Electronic Clinical Thermometers

Table 2. Mercury-Containing Measuring Devices

Device Type	Description and Use	Alternatives
Thermometer	Thermometers measure temperature. Held within a bulb at the base of the instrument, heat and cold causes the mercury to move up and down a thin tube where its position indicates the temperature. Various types of thermometers exist and can be found in homes, laboratories, schools and industries.	Digital, alcohol or spirit-filled thermometer
Barometer and Manometer	Barometers measure air pressure while manometers measure pressure differences. They consist of long tubes filled with mercury where air pressure causes the mercury to move up or down the tube. These devices are commonly used at airports and other weather stations.	Digital or aneroid barometer, digital manometer or needle bourdon gauge
Flowmeter	Flowmeters measure the rate of flow of gas, water and air streams. Although no longer manufactured, mercury-containing flowmeters are still used in water and sewage treatment plants, power stations and other industrial applications.	Digital or ball-actuated flowmeter
Hydrometer	Hydrometers measure the specific gravity and density of a liquid. They look similar to a thermometer except the bulb at the bottom is wider and weighted to keep the hydrometer upright when placed in a liquid. Hydrometers are commonly used in laboratories and in the production of alcohol.	Spirit filled hydrometer
Hygrometer	Hygrometers measure the moisture content of air. The most common type, the psychrometer, looks like a dual thermometer, one with a wet base and the other with a dry base. Hygrometers are used for weather forecasting.	Digital or spirit-filled psychometer
Medical Devices	Examples of medical devices that contain mercury include: sphygmomanometers (measure blood pressure), esophageal dilators (open the patient's throat during surgery), and gastrointestinal tubes (removal of intestinal obstructions).	Aneroid or digital sphygmomanometer

3.1.3 Thermostats

Mercury-containing thermostats are used to control residential, commercial and institutional heating and cooling systems. These thermostats contain small glass containers, or ampoules, of mercury which act as temperature-sensitive tilt switches to automatically control the furnace or other device. Each ampoule generally contains three grams of mercury, with each thermostat having up to six ampoules depending upon its application.

Figure 8 - Home Thermostat

Thermostats that contain mercury can be identified by removing the front cover of the device and visually inspecting its contents. If there are glass ampoules inside that contain a shiny silver-white liquid, it is most likely mercury.

Figure 9 - Touch Screen Digital Thermostat

Non-Mercury Alternatives

Mercury-containing thermostats can be replaced using relatively inexpensive digital thermostats. Most modern digital thermostats are programmable, which enables temperature in a building to be automatically adjusted according to a predetermined schedule. This results in energy and cost savings.

3.1.4 Batteries

Since the late 1990's North American battery manufacturers have eliminated or significantly reduced the mercury found in batteries. The use of mercury in the common alkaline battery has been eliminated while small amounts of mercury – anywhere from 5 to 25 milligrams - continue to be used in the manufacture of several types of button-cell batteries[7]. Button-cell batteries are small, thin energy cells that are not rechargeable. They continue to be used in a wide variety of electronic advices because of their small size and steady voltage output. Table 3 describes the common button-cell batteries in use today.

Examples of various sized button cell batteries.

Figure 10
Source – Vermont Department of Environmental Conservation

Table 3. Mercury-Containing Button-Cell Batteries

Battery Type	Common Uses
Zinc Air Miniature Batteries	Mostly used in hearing aids because of their high energy concentration and ability to continuously discharge energy. May also be used in small devices such as wristwatch pagers and ear speech processors.
Silver Oxide Button-Cell Batteries	Used in various devices such as hearing aids, watches, cameras and clocks. Silver oxide batteries may come in a large size as well as button-cell however, their manufacture is limited due to the price of silver.
Alkaline Manganese Oxide Button-Cell Batteries	Used in toys, calculators, remote control devices and cameras.

[7] Gas can form in button-cell batteries because of the corrosion of zinc causing the battery to leak. Mercury suppresses this corrosion. Button-cell batteries can contain up to 0.005 grams of mercury in the insulating paper surrounding the battery, or mercury can be mixed in the battery anode itself.

Mercuric oxide batteries contain mercury as the electrode and are useful in applications that require a high energy density and steady voltage output. Although North American battery manufacturers discontinued production of these batteries in 1996, larger mercuric oxide batteries may still be used in applications such as military, medical and industrial equipment.

Non-Mercury Alternatives

Few mercury-free alternatives currently exist for button-cell batteries and those that do exist are generally considered to have reduced performance and a higher cost. Observing battery packaging and labeling is the best method for identifying mercury-free or mercury-reduced button-cell batteries. Electrical devices that can operate on standard 110 volt power supplies (i.e. smoke and carbon dioxide detectors) should be purchased where practical rather than battery-powered devices. The use of rechargeable batteries is also a good alternative to non-rechargeable batteries where the replacements are compatible with the device.

3.1.5 Switches and Relays

Figure 11 - Mercury-Containing Switches
Source – California Department of Toxic Substances Control

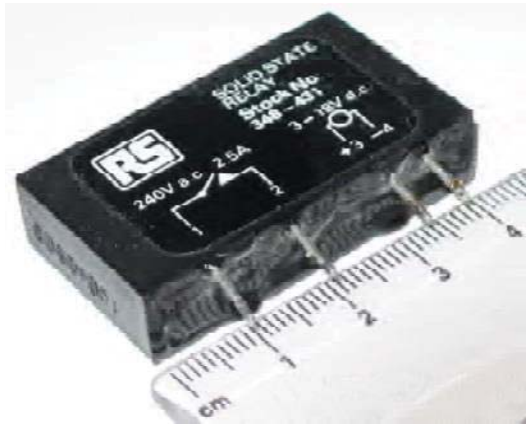

Figure 12 – Solid State Relay Switch

Switches are products that open or close an electrical circuit. When open, switches allow the electrical current to flow and when closed the circuit is broken and flow of current is stopped. Many older switches contain mercury because of the metallic liquid's excellent ability to conduct electricity. The most common consumer applications have been in tilt switches (i.e. older-model thermostats, hood and trunk lights on older-model vehicles) and float switches (i.e. boat bilge pumps).

Relays are products that open or close electrical contacts to control the operation of other electrical devices. They enable large electrical loads to be turned on or off by supplying relatively small currents to a control circuit.

Table 4 describes various mercury-containing switches and relays used in Canada and their available non-mercury alternatives.

Non-Mercury Alternatives

Mechanical and digital switches are widely available to replace mercury switches for all common applications. These vary in price depending on use and design. Not all non-mercury alternatives may be suitable for any one application without retrofit as electrical requirements must be strictly adhered to. If in doubt, the manufacturers or distributors of the specific equipment should be consulted.

Displacement and contactor relays are very specific for

their applications and non-mercury alternatives have generally not provided equal performance and reliability. Mercury wetted relays can be replaced by dry magnetic reed relays for most applications.

Table 4. Mercury-Containing Switches and Relays

Device Type	Description and Use	Alternatives
Float Switch	Float switches monitor liquid levels and are most commonly used in sump pumps. They are also used in boat bilge pumps, boilers, sewage treatment plants and pumping stations. The mercury is normally contained inside a sealed ampoule within a cylindrical outer casing.	Mechanical, optical, metallic ball, sonic or ultrasonic, pressure transmitter, alloy, thermal or capacitance float switches
Tilt Switch	Tilt switches are activated by a change in the switch position. They have been commonly used in older-model thermostats as well as applications that activate upon opening such as hood and trunk lights in older-model vehicles and chest freezers. Mercury tilt switches are typically small glass tubes with two electrical contacts at one end.	Metallic ball, electrolytic, mechanical, digital or capacitance tilt switches
Pressure Switch	Pressure switches are activated by a change in pressure. These switches have been used in HVAC systems, medical devices, automobiles (ABS brakes), appliances and other applications. Pressure switches are comprised of a diaphragm, piston or other pressure-response device coupled with a mercury ampoule.	Mechanical or digital switches
Temperature Switch	Temperature switches are activated by a change in temperature. These switches are used in a wide variety of applications including food warming trays, hot water boilers, ovens, sterilizers and heat exchangers. The switch is similar to a tilt switch and is usually attached to a temperature sensing device such as a bi-metallic strip.	Mechanical or digital switches
Relays	Relays are devices that open or close electrical control circuits to operate other devices in the same or different electrical circuit. They include displacement, contactor and wetted reed relays. Relays are commonly used in electronic circuit boards, commercial and industrial electric ranges and other cooking equipment.	Dry magnetic reed relays

3.1.6 Dental Amalgam

Dental amalgam is a mixture of metals that has been used for over 150 years to restore teeth. The metal mixture, commonly referred to as ‘silver fillings’, can consist of up to 50% mercury. Despite its use for many years, there is currently no evidence to suggest that mercury in dental amalgam is a risk to human health in the general population.

Mercury amalgam continues to be used for tooth restorations because of its durability, ease of use and low cost[8]. In the past, dentists mixed the amalgam on site using bulk mercury and metal powders. This practice resulted in a health risk to workers through physical contact with the elemental mercury and to the environment through spillage. Today, dental amalgam is purchased in pre-dosed amalgam capsules that come in different sizes.

In 2001, federal, provincial and territorial governments endorsed the *Canada-Wide Standard on Mercury for Dental Amalgam Waste* through the Canadian Council of Ministers of the Environment (CCME). The Standard called for dentists to apply 'best management practices' to achieve a 95% national reduction in mercury releases from dental amalgam by 2005. These practices include the installation, use and maintenance of International Organization for Standardization (ISO) certified amalgam separators, traps and filters to remove waste mercury from dental office wastewater. A report released in 2007 indicates that 70% of dentists operating in Canada were employing ISO certified amalgam separators (Environment Canada, 2007).

Non-Mercury Alternatives

There are several resin and composite materials that are substitutes for mercury amalgam. These include cast gold, bonded amalgam and dental ceramics. These alternatives are usually more costly than mercury amalgam fillings and may not be suitable for all procedures. Composite resins are tooth-coloured plastic materials often used to restore front teeth where a natural appearance is important. These resins can also be used as fillings on back teeth depending on the location and extent of tooth decay.

3.2 What to do if a Spill of Mercury Occurs

Cleanup actions must be started as soon as possible following a spill of mercury so workers and family members are not exposed to its hazards. When a thermometer or other liquid mercury-containing product is broken, the mercury will quickly form beads that accumulate in small pools and in the tiniest of spaces, making cleanup difficult. When a fluorescent or other mercury-containing lamp is broken or if mercury remains trapped (i.e. in tiny spaces, drains or soft surfaces such as carpet and furniture), mercury vapour is released directly to the air. Although mercury evaporates slowly at normal room temperature, dangerous levels of mercury vapour can build up in indoor air.

The following should be considered when cleaning up a spill of mercury:

- It can be very dangerous to touch liquid mercury directly or breathe mercury vapour. Immediately isolate the spill area by keeping people and pets away, closing all interior doors that lead to other rooms in the building and turning off heaters. Ventilate the area by turning on fans that vent directly to the outdoors and opening windows and exterior doors.
- Protect yourself by changing into old clothing and shoes that can be thrown away after clean up has been completed, removing all jewelry as mercury can adhere to metal and putting on gloves, preferably made of rubber, nitrile or latex.
- On a hard surface (i.e. linoleum, tile or concrete), push the mercury beads together using razor blades, stiff paper or cardboard, pick up the beads using a dustpan or stiff paper and carefully transfer the mercury into a wide-mouth container or plastic bag. Any remaining beads of

[8] Approximately 1.3 tonnes of mercury in new filling material is placed each year in the mouths of Canadians (CCME, 2001).

mercury can be picked up using tape, cotton balls or a moist paper towel. All debris should be placed inside the container or bag and the lid sealed tightly with tape.

- On a soft surface (i.e. carpet, couch or clothing), it is best to cut out the contaminated materials and place them into a sealable container or plastic bag. If you're not willing to cut out the materials, use cotton balls, moist paper towel or an eye dropper to pick up the spilled mercury and place it, along with any debris, into the container or bag.
- When a fluorescent or other mercury-containing lamp is broken, quickly ventilate the area by turning on fans that vent to the outdoors and opening all windows and exterior doors. Leave the area for at least 30 minutes and then follow the instructions for the type of surface to be cleaned.
- In every case, place the sealed container or plastic bag containing the mercury and debris into another container or bag for additional protection against breakage and leakage.
- Wash your hands thoroughly and take a shower immediately after the cleanup.

Never allow people who are wearing clothing or shoes contaminated with mercury to walk around the building, never use a broom or ordinary vacuum cleaner to clean up mercury, never pour mercury down a drain and never launder mercury-contaminated clothing in a washing machine.

Mercury spill kits are commercially available from safety supply companies to assist in the cleanup of spilled mercury. Although convenient, these kits may be expensive and are not absolutely necessary to clean up a small contained spill of mercury, such as from a mercury switch or thermometer. The following are some commonly available items that can be used to construct a mercury spill kit: rubber gloves, goggles or other eye protection, flashlight, sponge or cotton balls, wide duct or masking tape, eye dropper or syringe without needle, stiff index cards, plastic containers with tight-fitting lids and plastic bags with zipper seals.

All spills of mercury must immediately be reported to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130 (toll free) or e-mailed to: spills@gov.nt.ca . Spill reporting forms are available on the Department of Environment's website: http://env.gov.nu.ca/programareas/environmentprotection

The local nursing station or health authority should also immediately be notified.

3.3 Storage

Storage refers to keeping unwanted material while awaiting its transport, recycling or disposal. Except under extraordinary circumstances, storage is not acceptable for the long-term management of unwanted mercury-containing products and waste mercury and should be considered as a temporary measure only.

Unwanted mercury-containing products and waste mercury should be stored in the following manner:

- If the packaging that was used to originally ship the product is available and the product is unbroken, place it in the packaging and seal the package securely with tape.
- If the original packaging is not available or if the mercury is from a spill, place the product or container containing the mercury and any cleanup materials and debris inside a larger metal or plastic container. Place kitty litter or other oil absorbent packing material around the product or

small container to protect it from breaking or sudden shock. Secure the larger container with a tight fitting lid or tape.

- Clearly label all storage containers as containing mercury according to the requirements of the *Workplace Hazardous Materials Information System* (WHMIS) and relevant Transport Authority.
- Place all labeled storage containers in a clearly marked designated area which is separate from other waste to prevent its disposal with normal garbage.
- If mercury-containing lamps are being stored, do not crush the lamps as crushing will release vapours that may pose health and environmental hazards. Broken lamps are a hazardous waste.

If the storage facility is used for commercial purposes to store hazardous waste for periods of 180 days or more or the quantity of waste stored on-site exceeds the criteria set out in the *Environmental Guideline for the General Management of Hazardous Waste*, the facility must be registered with the Department of Environment as a hazardous waste management facility[9]. Copies of registration forms are available at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment. Refer to the GN *Environmental Guideline for the General Management of Hazardous Waste* for additional information on the registration process.

3.4 Transportation

Unwanted mercury-containing products and waste mercury may be classified as a hazardous waste for the purposes of transportation depending upon the quantity of waste being transported for recycling or disposal. Under the federal *Interprovincial Movement of Hazardous Waste Regulations*, no person may transport waste mercury in Canada in a quantity greater than five kilograms or five litres unless it is accompanied by a completed manifest[10]. Manifesting requirements for the international transport of waste are controlled under the federal *Export and Import of Hazardous Waste and Recyclable Material Regulations*. Manifest forms are available from Nunavut's Department of Environment and completion instructions are included on the reverse side of each manifest. Further information on manifesting can be obtained by referring to Environment Canada's *User's Guide for the Hazardous Waste Manifest* or the *Environmental Guideline for the General Management of Hazardous Waste*.

The classification, packaging, labeling and placarding of mercury-containing products and waste mercury while being transported must conform to the federal and territorial *Transportation of Dangerous Goods Act* and *Regulations*. Schedule I of the *Regulations* classify waste mercury as follows[11]:

Shipping Name: WASTE Mercury
Classification: 8
Product Identification Number: UN2809
Packing Group: III

[9] The criterion for Class 8 Corrosives is 1000 kilograms and the criterion for the aggregate quantity of hazardous waste is 5000 kilograms.
[10] In response to the 2007 federal government direction on streamlining regulation in Canada, the alignment of definitions in the *Interprovincial Movement of Hazardous Waste Regulations* (IMHWR) and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* (EIHWHRMR) is being undertaken by Environment Canada. Under the current proposal, the quantity of waste mercury requiring a manifest while being transported in Canada would be revised to less than 50 milliliters (ml) per shipment, which is the same as is currently required for international transport under the EIHWRHMR (Environment Canada, 2010).
[11] A wide variety of mercury-containing chemicals and compounds in addition to elemental mercury are available for use in Canada. Refer to Schedule I of the *Transportation of Dangerous Goods Regulations* for the specific classification, product identification number and packing group of these chemicals and compounds.

The transport of mercury-containing products and waste mercury by air must conform to the *International Air Transport Association* (IATA) *Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions,* while transport by marine must conform to the *International Marine Dangerous Goods Code*. Further information on transporting these materials can be obtained by contacting Transport Canada or the appropriate Transport Authority.

Hazardous waste generators, carriers and receivers operating in Nunavut must be registered with the Nunavut Department of Environment. A unique registration number is assigned to each registrant through the registration process, which enables completion of the manifest document. Copies of registration forms are available at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment. Refer to the *Environmental Guideline for the General Management of Hazardous Waste* for additional information on the registration process.

A listing of hazardous waste carriers, receivers and hazardous waste management facilities registered to operate in Nunavut is available by contacting Nunavut's Department of Environment.

3.5 Disposal

Municipal landfill sites and sewage lagoons in Canada have over the years become a major source of mercury to the environment. Unwanted mercury-containing products and waste mercury must never be thrown in the garbage and liquid mercury must never be poured down the drain[12].

Recycling and disposal options for unwanted mercury-containing products and waste mercury in Nunavut are limited. The majority of these materials are used in government, commercial, industrial and institutional facilities and any unwanted or end-of-life products should be safely stored until they can be transported to a registered hazardous waste receiver that is licensed to recycle or dispose of mercury. Names of Canadian recyclers and disposal companies are available by contacting the waste management exchanges and associations listed in Appendix 10 of the *Environmental Guideline for the General Management of Hazardous Waste.* Additional information on commercial processors of mercury-containing waste can be obtained through the following web site links:

- lamprecycle.org/ - The lamprecycle.org web site is an American resource of information on mercury-containing lamp recycling and lists several lamp recycling companies in Canada.
- www.almr.org/ - The Association of Lighting and Mercury Recyclers represents the majority of commercial processors of mercury-containing waste in the United States, some of which also operate in Canada.

Some Municipalities in Nunavut are starting to implementing programs aimed at collecting and safely storing unwanted or end-of-life fluorescent lamps and other mercury-containing products as part of their household garbage collection programs. Homeowners wishing to dispose of these wastes should contact their municipality for local disposal information.

[12] The *Guideline for Industrial Waste Discharges* prohibits the disposal of mercury in sewage lagoons and landfills if mercury is present in excess of 0.1 milligrams per litre (parts per million) based on leachate quality test results.

Conclusion

Mercury is a naturally occurring element that is found in soil, air and water around the world and which can take many different forms, some of which are harmful to humans and wildlife. Mercury has also been used for many years in a variety of consumer and industrial products because of its ability to conduct electricity and react predictably to changes in temperature and pressure. The Guideline is an introduction to the risks, hazards and best management practices associated with various mercury-containing products and waste mercury. It examines the characteristics and effects of mercury on the environment and human health, identifies non-mercury alternatives for common products and provides guidance on the proper cleanup of spilled mercury and the storage, transportation and disposal of unwanted products.

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

For additional information on the management of mercury-containing products and waste mercury, or to obtain a complete listing 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

Canadian Council of Ministers of the Environment (CCME). Canada-Wide Standards for Mercury-Containing Lamps, (2001).

Canadian Council of Ministers of the Environment (CCME). Canada-Wide Standards on Mercury for Dental Amalgam Waste, (2001).

Canadian Council of Ministers of the Environment (CCME). Canadian Water Quality Guidelines for the Protection of Aquatic Life – Inorganic Mercury and Methylmercury, (2003).

Environment Canada. Mercury and the Environment Webpage - http://www.ec.gc.ca/mercure-mercury/.

Environment Canada. Past Consultations – Updating the Regulatory Framework for Transboundary Movement of Waste and Hazardous Recyclable Materials, (2010).

Environment Canada. Proposed Risk Management Instruments for Mercury-Containing Products Consultation Document, (2007).

Environment Canada. Risk Management Strategy for Mercury-Containing Products, (2006).

Government of Nunavut, Department of Environment. Environmental Guideline for Industrial Waste Discharges, (2002).

Government of Nunavut, Department of Environment. Environmental Guideline for the General Management of Hazardous Waste, (2010).

Minnesota Pollution Control Agency. Cleaning Up Spilled Mercury in the Home – Household Hazardous Waste Fact Sheet #4.43b. (2003).

Northeast Waste Management Officials Association (NEWMOA). Mercury-Added Products Fact Sheets Website - http://www.newmoa.org/prevention/mercury/imerc/factsheets.

United Nations Environment Programme (UNEP). Global Mercury Assessment, (2002).

United States Environmental Protection Agency (USEPA). Mercury Releases and Spills Website – http://www.epa.gov/mercury/spills.

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 – 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

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free) Fax: 1-866-979-8501

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) 975-5774 Fax: (867) 975-5755

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

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

Government of Canada

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

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine only
Fax: (204) 983-1734 Air only

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

APPENDIX C • ENVIRONMENTAL GUIDELINE FOR OZONE DEPLETING SUBSTANCES

Environmental Guideline for

Ozone Depleting Substances

Department of Environment
Government of Nunavut

GUIDELINE: OZONE DEPLETING SUBSTANCES

Original: January 2002
Revised: April 2011

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 ozone depleting substances. This Guideline does not replace the need for the owner or person in charge, management or control of ozone depleting substances 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 management of these substances.

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

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Bottom Left - Florida Department of Environment Protection
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Introduction

A layer of colourless gas known as "ozone" surrounding the earth helps to filter the sun's harmful ultraviolet radiation from reaching the planet's surface. This layer is located in the stratosphere eight to ten kilometres above the earth. Scientific evidence shows that this ozone is being destroyed, and therefore this protective layer is becoming thinner, because of manufactured chlorofluorocarbons, halons and other similar substances being released into the air. These substances are commonly referred to as 'ozone depleting substances'.

As one of the early signatories to the *Montreal Protocol on Substances that Deplete the Ozone Layer*, Canada is committed to protecting the earth's ozone layer from further deterioration. The Protocol, developed in 1989 under the auspices of the United Nations Environmental Programme, provides a coordinated international response to the global problem of ozone depletion.

Canada's *National Action Plan for the Environmental Control of Ozone Depleting Substances and their Halocarbon Alternatives* was initially endorsed in 1998 through the Canadian Council of Ministers of the Environment (CCME) in response to Canada's commitments under the Montreal Protocol. The Action Plan is a national framework under which federal, provincial and territorial governments commit to implementing an ozone layer protection program focused on chlorofluorocarbons. The Action Plan was updated in 2001 to include all ozone depleting substances.

The original *Environmental Guideline for Ozone Depleting Substances*, which was approved by the Government of the Northwest Territories in 1999 and subsequently adopted by the Government of Nunavut in 2002, represented the Government's initial response to the National Action Plan. This version of the *Environmental Guideline for Ozone Depleting Substances* (the Guideline) provides updated information on the most common ozone depleting substances and their replacements, the impacts of ozone depletion and best practices respecting the phase-out, recovery, reuse and disposal of these substances. It focuses on the refrigeration, air conditioning and fire protection sectors, although ozone depleting substances have been used by many other sectors in Canada. The Guideline does not address the production, import or export of new or recovered ozone depleting substances as these activities are controlled under regulations administered by Environment Canada. It is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of an ozone depleting substance is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the management of these substances.

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 with authority to develop, coordinate, and administer the Guideline.

1.1 Definitions

Air Conditioning and Refrigeration Equipment	Equipment used to remove heat from one medium or another using an inert gas (i.e. ozone depleting substance). The Equipment may be stationary (i.e. building air conditioner, commercial or household refrigerator) or mobile (i.e. vehicle air conditioner).

Certified Service Technician	A person who is qualified to service air conditioning, refrigeration or fire extinguishing equipment through the successful completion of an environmental awareness course for ozone depleting substances approved by Environment 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 municipalities.
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.
Dangerous Good	Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* in any of the classes listed in the schedule provided in the *Transportation of Dangerous Goods Act*.
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.
Fire Extinguishing Equipment	A handheld, wheeled or fixed unit or system that is designed to control or extinguish a fire.
Minister	The Minister of Environment of the Government of Nunavut.
Motor Vehicle Air Conditioner	A mechanical vapour compression refrigerant system on a motor vehicle that is designed to provide cooling for the passenger compartment.
Ozone	A colourless gas containing three atoms of oxygen (O^3). In the upper atmosphere, ozone absorbs ultraviolet radiation thereby preventing the radiation from reaching the surface of the earth. In the lower atmosphere (i.e. near the surface of the earth), ozone is one of the detrimental component of urban smog.
Ozone Depleting Substance	A chlorofluorocarbon, hydrochlorofluorocarbon, halon or other substance that is sufficiently stable to reach the stratosphere and has the potential of reacting with and destroying ozone.
Qualified Person	A person who has an appropriate level of knowledge and experience in all relevant aspects of waste management.

Reclamation	The cleaning of recovered ozone depleting substances by filtering, drying, distillation or chemical treatment to meet or exceed industry-accepted reuse standards.
Recovery	The transfer of an ozone depleting substance into a container that is not part of the system from which the substance is transferred.
Recycle	The reuse of recovered ozone depletion substances by transferring the substance back into similar equipment after servicing.
Refillable Container	A container that meets the requirements of Transport Canada and is approved for multiple use.
Responsible Party	The owner, vendor or service technician in charge, management or control of the ozone depleting substance.
Servicing	Repairing, maintaining or adjusting a component of air conditioning, refrigeration or fire extinguishing equipment.
Transport Authority	The statute and regulations controlling the management of hazardous waste under that mode of transport. These include (a) Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations; Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. (b) Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and (c) Marine – *International Maritime Dangerous Goods Code* (IMDG).

1.2 Roles and Responsibilities

1.2.1 Department of Environment

The Environmental Protection Division is the key territorial government agency responsible for ensuring parties properly manage ozone depleting substances. 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 municipal 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 of Environment or by visiting the web site at:

http://env.gov.nu.ca/programareas/environmentprotection.

1.2.2 Owners, Wholesalers, Retailers and Service Technicians

Owners, wholesalers, retailers and service technicians in charge, management or control of an ozone depleting substance are considered to be the responsible party. The responsible party must ensure the substance is properly and safely managed from the time it is purchased to its final destruction so as to prevent its release to the environment.

Building, equipment and vehicle owners need to be aware of the presence of ozone depleting substances in their air conditioning, refrigeration and fire extinguishing equipment. Equipment that may be leaking or discharging these substances into the air must immediately be taken out of service, the leak stopped and the discharge reported to the Nunavut/NWT 24-Hour Spill Report Line at (867) 920-8130 (refer to table 3 on page 11 of the Guideline). Owners may also be affected by the phase-out of ozone depleting substances in Canada and should develop a plan for replacing the ozone depleting substance with an acceptable alternative.

Wholesalers and retailers of ozone depleting substances, other than where the substance is an integral part of the equipment, should sell replacement substances only to companies that employ certified service technicians.

A service technician may become certified by successfully completing an environmental awareness course for ozone depleting substances that is approved by Environment Canada. Only certified service technicians should maintain and repair air conditioning, refrigeration and fire extinguishing equipment that contain ozone depleting substances. Technicians should immediately advise the owner when they become aware of leaking equipment and the equipment must not be refilled or put back into service until the necessary repairs are completed.

Contractors may manage ozone depleting substances on behalf of the responsible party. However, the responsible party remains liable for ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the ozone depleting substance, the responsible party may also be charged.

1.2.3 Other Regulatory Agencies

Other regulatory agencies may have to be consulted regarding the management of ozone depleting substances as there may be other environmental or public and worker health and safety issues to consider.

Environment Canada

Environment Canada is responsible for controlling the import, manufacture, use in some cases, sale and export of ozone depleting substances through the federal *Ozone-depleting Substances Regulations* and *Federal Halocarbon Regulations* which have been adopted under the *Canadian Environmental Protection Act.* Environment Canada is also responsible for regulating the international and interprovincial movement of hazardous waste under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*.

Department of Community and Government Services

The Office of the Fire Marshal in the Department of Community and Government Services is responsible under the *Fire Prevention Act*, National Fire Code and National Building Code for ensuring adequate fire prevention and response measures are in place. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste and sewage disposal facilities in most Nunavut communities.

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 derives 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.

Department of Health and Social Services

Activities related to the management of ozone depleting substances 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 Economic Development and Transportation

The Motor Vehicles Division is responsible for ensuring the safe transport of hazardous waste and other dangerous goods by road through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and road safety matters.

Local Municipal Governments

The role of municipal governments is important in the proper local management of unwanted ozone depleting substances and equipment and vehicles that contain these substances. Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal disposal sites. Unwanted waste may be deposited into municipal landfill sites only with the consent of the local government. The local fire department may also be called upon if a fire or other public safety issue 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 disposal of ozone depleting substances may be controlled through the setting of terms and conditions in plans, permits and licenses issued by the Nunavut Water Board and other co-management boards and agencies.

Characteristics and Impacts of Ozone Depleting Substances

2.1 Characteristics

Ozone depleting substances generally contain a combination of chlorine, fluorine, bromine, carbon and hydrogen and are often referred to by the general term 'halocarbons'. Although each has its own unique chemical characteristics, ozone depleting substances are described as having low toxicity, low boiling points and low flammability. These characteristics have resulted in their wide use as refrigerants, fire extinguishing agents, blowing agents in manufacturing foam, propellants in aerosols and medical applications, and degreasing solvents.

Many halocarbons are highly effective in breaking down ozone. Unlike many other substances that are released into the atmosphere, ozone depleting substances are not 'washed' back to Earth by precipitation or destroyed by other chemicals but can remain in the atmosphere for several decades or more. This enables the substances to drift upward into the stratosphere where ultraviolet radiation from the sun releases the chlorine or bromine atoms which, in turn, destroy stratospheric ozone. Many ozone depleting substances are also powerful greenhouse gases with a much higher potential to enhance the greenhouse effect than carbon dioxide and methane.

Table 1 describes the characteristics of many common ozone depleting substances.

Ozone depleting substances are broadly grouped into the following categories, depending upon their molecular structures.

Chlorofluorocarbons — Chlorofluorocarbons, or CFCs, contain chlorine, fluorine and carbon atoms. First developed in the 1920s, they began to replace ammonia as a refrigerant gas in the 1930s and as an aerosol propellant in the 1940s. By the 1980s they were widely used as coolants in refrigerators and air conditioners, solvents in degreasers and cleaners, and as blowing agents in the production of foam.

Halons — Halons contain bromine, chlorine, fluorine and carbon atoms. The characteristics of halons make them very effective for extinguishing fires and are suitable for all types of fire extinguishing equipment ranging from industrial total flooding equipment to hand-held fire extinguishers popular for home or office use.

Hydrochlorofluorocarbons — Hydrochlorofluorocarbons, or HCFCs, contain chlorine, fluorine, hydrogen and carbon atoms. HCFCs have been developed for use as transitional or temporary replacements for CFCs because the hydrogen atom makes them less stable and therefore less damaging to the ozone layer. HCFCs are used mainly for foam blowing, refrigeration and air conditioning, solvent cleaning and, to a lesser extent, aerosols and fire protection.

Table 1.		Classification under Transportation of Dangerous Goods Regulations	ODP[a]	GWP[b]	Life Time[c]
Chlorofluorocarbons (CFC's)					
CFC-11	Trichlorofluoromethane	Not restricted under TDG	1.0	4600	45
CFC -12	Dichlorofluoromethane	UN 1029 Class 2.2 Non-flammable Gas	1.0	10600	100
CFC-113	Trichlorofluoroethane	Not restricted under TDG	0.8	6000	85
CFC-114	Dichlorotetrafluoroethane	Not restricted under TDG	1.0	9800	300
CFC-115	Chloropentafluoroethane	UN 1020 Class 2.2 Non-flammable Gas	0.6	7200	1700
All other chlorofluorocarbons		Consult TDGA for classification			
Halons (Bromofluorocarbons)					
Halon 1011	Bromochloromethane	Un 1887 Class 6.1 Toxic Substance	0.12	-	-
Halon 1211	Bromochlorodifluoromethane	Not restricted under TDG	3.0	1300	11
Halon 1301	Bromotrifluoromethane	Un 1009 Class 2.2 Non-flammable Gas	10.0	6900	65
Halon 2402	Dibromotetrafluoroethane	Not restricted under TDG	6.0	-	-
All other halons		Consult TDGA for classification			
Hydrochlorofluorocarbons (HCFC's)					
HCFC-22	Chlorodifluoromethane	Un 1018 Class 2.2 Non-flammable Gas	0.055	1700	11
HCFC-123	Dichlorotrifluoroethane	Not restricted under TDG	0.02	-	1
HCFC-124	Chlorotetrafluoroethane	UN 3297 Class 2.2 Non-flammable Gas	0.022	620	6
HCFC-141b	Dichlorofluoroethane	Not restricted under TDG	0.11	700	9
HCFC-142b	Chlorodifluoroethane	Not restricted under TDG	0.065	2400	18
HCFC-225ca	Dichloropentafluoropropane	Not restricted under TDG	0.025	-	2
HCFC-225cb	Dichloropentafluoropropane	Not restricted under TDG	0.033	-	6
All other hydrochlorofluorcarbons		Consult TDGA for classification			

a. 'Ozone Depleting Potential' is a measure of the capability of a chemical to destroy ozone. It is measured against CFC-11 which has an ozone depleting potential of one (1.0). As an example, one molecule of Halon 1301 has the potential to destroy ten times more ozone than one molecule of CFC-11.
b. 'Global Warming Potential' is a measure of the warming effect that the emission of a gas has on the atmosphere. It is measured as a factor relative to carbon dioxide (CO^2) which has a global warming potential of one (1.0). As an example, one molecule of CFC-11 has the potential to warm the atmosphere 4600 times more than one molecule of carbon dioxide.
c. 'Life time' is the number of years it takes for the substance to break down in the lower atmosphere.

2.2 Impacts

Ozone is very effective in absorbing ultraviolet radiation in the stratosphere. Its depletion, or thinning, allows more of this high-energy radiation to reach the Earth's surface. Releases of halocarbons, particularly chlorofluorocarbons and halons, enable photochemical reactions[1] to take place in the stratosphere that destroy the ultraviolet radiation-shielding layer of ozone.

Increased exposure to ultraviolet radiation by humans can lead to an increase in sunburn, skin cancer, eye cataracts, weakening of the immune system and aging of the skin (i.e. the skin becomes drier and

[1] The most important reaction is the photo-induced breaking of the carbon-chlorine or carbon-bromine bond. Once released, the radical chlorine and bromine atoms catalyze the conversion of ozone (O^3) into oxygen (O^2).

looses elasticity). Ecosystem impacts can also occur. This begins at the bottom of the food chain where plankton populations in the ocean have been reduced by increased ultraviolet radiation. Damage and impacts to vegetation, food crops, wildlife and domestic animals can also occur.

The atmospheric impact of ozone depleting substances is not limited solely to the reduction of ozone. Many of these substances are also powerful greenhouse gases with much higher 'global warming potentials' than carbon dioxide and methane.

The Management of Ozone Depleting Substances

> *Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created.*[2]

In the past, the refrigeration, air conditioning and fire protection sectors have incorporated ozone depleting substances as critical components in their equipment and processes. Although a large portion of Canada's ozone depleting substances consumption has been eliminated in recent years, a significant quantity remains in use or storage. Many of the same ozone depleting substances used by the commercial, industrial and institutional sectors were also used in domestic applications (i.e. household refrigerators, freezers, vehicle air conditioners). An inventory completed for the Government of the Northwest Territories in 1992 confirmed that approximately three-quarters of the ozone depleting substances in use in the Northwest Territories and Nunavut at that time were accounted for by the commercial, industrial and institutional sectors. As a result, this section focuses on the use of ozone depleting substances by the commercial, industrial and institutional refrigeration, air conditioning and fire extinguishing sectors in Nunavut. References are made to domestic sector use where appropriate.

3.1 Phase-out Objectives and Approaches

The overall strategy in Canada has been to eliminate the manufacture, import and export of ozone depleting substances and to phase-out their sale and use as suitable replacements become available. Several substances have been identified as being suitable replacements for chlorofluorocarbons in refrigeration and air conditioning equipment including hydrochlorofluorocarbons and hydrofluorocarbons. Unfortunately, these replacements are not totally benign (i.e. some are very powerful greenhouse gases) and an active approach to controlling their sale and use continues to be necessary.

Under the federal *Ozone-depleting Substances Regulations,* no person may use, sell or offer for sale halons in Canada. The Nunavut Office of the Fire Marshal should be consulted on suitable replacements for halon systems when the servicing, recharging or replacement of existing equipment is being considered[3].

Table 2 describes the phase-out objectives and approaches that apply to these ozone depleting substances in refrigeration, air conditioning and fire extinguishing equipment in Nunavut along with their primary replacement, hydrochlorofluorocarbons,. The phase-out objectives and approaches described in the table are consistent with those outlined in *Canada's Strategy to Accelerate the Phase-Out of CFC and Halon Uses and to Dispose of Surplus Stocks 2001* and the federal *Ozone-depleting Substances Regulations*.

[2] Source – Canadian Council of Ministers of the Environment.

[3] The United States Environmental Protection Agency periodically updates a list of acceptable alternatives to halons and other ozone depleting substances. The listing can be downloaded at http://www.epa.gov/ozone/snap/lists/index.html#halons.

Table 2. Phase-out Objectives

Objective	Phase-Out Date
Refilling or replacement of chlorofluorocarbon-containing small (< 5 horsepower), medium, (5-30 horsepower) and large (>30 horsepower) commercial, industrial or institutional refrigeration and air conditioning equipment with a suitable alternative.	September 2011 or next service
Refilling or replacement of chlorofluorocarbon-containing mobile air conditioning equipment with a suitable alternative.	September 2011 or next service
Refilling or replacement of chlorofluorocarbon-containing mobile commercial and industrial refrigeration and chiller equipment with a suitable alternative.	September 2011 or next service
Refilling or replacement of halon-containing handheld or wheeled fire extinguishing equipment with a suitable alternative, except for critical uses[a].	September 2011 or next service
Refilling or replacement of halon-containing fixed fire extinguishing equipment with a suitable alternative, except for critical uses[a].	September 2011 or next service
Use and sale of hydrochlorofluorocarbons, except dichlorotrifluoroethane (HCFC-123).	January 2020
Use and sale of dichlorotrifluoroethane (HCFC-123).	January 2030

a. 'Critical use' for halons only include fire extinguishing equipment in military equipment.

3.2 Releases to the Environment

Ozone depleting substances must not be released to the environment. Equipment owners, managers and service technicians should be made aware of the environmental and human health impacts of ozone depleting substance emissions and the use of alternatives. To prevent releases from occurring, compressors, condensers, evaporators, piping and all associated equipment fitted to them need to be thoroughly inspected according to manufacturers' specifications, or at least twice each year if no specifications exist. These inspections should be incorporated into the facilities' regular maintenance plan.

Leaking equipment must not be 'recharged' with an ozone depleting substance until all necessary repairs have been completed by a certified service technician.

Spills or releases of ozone depleting substances must be immediately reported to the Nunavut/NWT 24-Hour Spill Report Line by phoning (867) 920-8130 in accordance with Schedule B of the *Spill Contingency Planning and Reporting Regulations.* Table 3 describes the minimum reportable quantities for ozone depleting substances as described in Schedule B.

Table 3. Minimum Reportable Quantities Following a Release

Ozone Depleting Substance	Minimum Reportable Quantity
CFC-12, CFC-15, HCFC-22, HCFC-124, Halon 1301[a]	Any release from a container with a capacity greater than one hundred (100) litres
Halon 1011[b]	5 litres or 5 kilograms
All other ozone depleting substances	100 litres or 100 kilograms

a. Transportation of Dangerous Goods Class 2.2 Non-flammable Gas
b. Transportation of Dangerous Goods Class 6.1 Toxic Substance

3.3 Recovery, Reclamation and Disposal

Table 2 describes the phase-out objectives of ozone depleting substances currently in use in Nunavut. Owners of fire extinguishing equipment and commercial, industrial or institutional mobile and stationary refrigeration and air conditioning equipment should either replace existing chlorofluorocarbons and halons with acceptable alternatives by September 2011 or during the next scheduled equipment service, or provide the Department of Environment with a suitable phase-out plan for the substance.

3.3.1 Stationary Refrigeration and Air Conditioning Systems

All compressor rooms housing stationary refrigeration and air conditioning systems should have refrigerant detectors and alarms installed in accordance with the Canadian Standards Association publication *B-52 – Mechanical Refrigeration Code* to detect refrigerant leaks and emissions. A refrigerant level greater than 10 parts per million in the compressor room is an indication that one or more of the systems is leaking. While refrigerant alarms are important, they are not substitutes for the physical leak testing of the system itself, which should take place a minimum of one time each year. Leak testing should also immediately be undertaken upon finding that a refrigeration or air conditioning system appears to be short of refrigerant. Any leak must be repaired prior to the system being recharged with refrigerant or put back into service. Chlorofluorocarbons must not be used to 'top up' a system. Recommendations on acceptable alternative refrigerants should be sought from the equipment's manufacturer.

Refrigerant must be recovered during the servicing of equipment to avoid its venting or release to the atmosphere. All recovery equipment should meet the Air-Conditioning, Heating and Refrigeration Institute (AHRI) *Standard 740 – Refrigerant Recovery/Recycling Equipment* or the Underwriters' of Canada (ULC) *Standard C1058.5-2004 - Halon and Halocarbon Clean Agent Recovery and Reconditioning Equipment*.

Only refillable containers may be used to store recovered refrigerants. These containers are less likely to leak and their use eliminates emissions caused by the disposal of throwaway or recyclable containers. All containers must meet the specifications listed in the *Transportation of Dangerous Goods Act* and be labeled in accordance with the *Workplace Hazardous Materials Information System* (WHMIS).

The venting or release of refrigerants to the atmosphere for the purposes of disposal is unacceptable. Chlorofluorocarbons that are recovered from equipment must be returned to the original supplier, an independent reclaimer or licensed disposal facility for destruction. Contact Refrigerant Management Canada[4] (RMC) by telephone at 1-866-622-0209 or by email at rmc@hrai.ca for information on the nearest reclaimer or licensed disposal facility. Only hydrochlorofluorcarbons and hydrofluorocarbons may be reclaimed to their original properties and used to 'top up' or recharge refrigeration and air conditioning equipment.

Unwanted refrigeration and air conditioning equipment must be completely emptied of refrigerant by a certified service technician prior to its disposal. A weatherproof notice should be permanently attached to the equipment stating the date of servicing, name of the certified technician and servicing company, and a statement confirming the equipment no longer contains refrigerant. Household refrigeration and air conditioning equipment is exempt from this requirement as long as it is disposed of in a separate area of the landfill specifically set aside for the disposal of 'white goods'. Local municipal governments are encouraged to use certified service technicians to recover the refrigerant from stored 'white goods' when quantities warrant.

Additional design and service practices are described in Environment Canada's *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.*

3.3.2 Mobile Air Conditioning Systems and Chillers

The basic principles outlined in section 3.3.1 also apply to mobile air conditioners and chillers containing chlorofluorocarbons – recovery of the refrigerant during the installation, operation and servicing of equipment; avoiding the venting of refrigerants to the atmosphere; use of refillable containers to store recovered refrigerants; and servicing by certified service technicians.

Newer-model vehicle air conditioners and chillers already contain alternative non-chlorofluorocarbon refrigerants while older vehicles are likely to still contain CFC-12. The servicing of a motor vehicle air conditioner should be undertaken by a certified service technician in accordance with the Society of Automotive Engineers publication *SAE J1661 – Procedures for Retrofitting CFC-12 (R-12) Mobile Air-Conditioning Systems to HFC-134a (R-134a)* and *SAE J1989 - Recommended Service Procedure for the Containment of CFC-12 (R-12).* Owners and service technicians should refer to the manufacturers' specifications when choosing a replacement refrigerant.

All motor vehicle air conditioning systems and chiller refrigerant must be recovered before the vehicle is wrecked or scrapped. A certified service technician who is trained in the safe handling of refrigerants should remove the refrigerant, transfer it to a suitable refillable and labeled container, and arrange to have it transported to the original supplier, an independent reclaimer or licensed disposal facility for destruction. A personal motor vehicle delivered to a landfill by its owner is exempt from this requirement as long as the vehicle is disposed of in a separate area of the landfill specifically set aside for this purpose. Local municipal governments are encouraged to use certified service technicians to recover refrigerants from discarded vehicles when quantities warrant.

[4] RMC is a not-for-profit corporation established by the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) to ensure the responsible disposal of surplus ozone depleting substances from refrigeration and air conditioning equipment. The program is an EcoLogo™ certified program.

Additional design and service practices for mobile air conditioners and chillers are described in Environment Canada's *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.*

3.3.3 Fire Extinguishing Equipment

The basic principles outlined in section 3.3.1 also apply to halon fire extinguishing equipment - recovery of the extinguishant during servicing and decommissioning; avoiding release of halons during training and equipment testing; use of refillable containers to store recovered halons; and servicing by certified service technicians.

Owners of fire extinguishing equipment that contain halons should develop a management plan in accordance with the phase-out objectives described in Table 2. Fire extinguishing equipment may not be recharged with halons in Canada except for use in military applications. Owners should contact the Underwriters' Laboratories of Canada (ULC) for information on the nearest reclaimer or licensed disposal facility. The Office of the Fire Marshal should also be consulted on suitable replacement fire extinguishing equipment when decommissioning halon systems.

Existing halon equipment must be properly maintained for as long it remains in service in order to avoid releases to the environment and to ensure the facility or asset is not without adequate fire protection. The training of personnel and testing of equipment must not result in any release of halons. Alternative procedures, such as video demonstrations and the use of halon stimulants, should be used to achieve the same testing and training objectives.

The servicing and decommissioning of halon fire extinguishing equipment must only be undertaken by a certified service technician. All equipment and servicing procedures must comply with Underwriters' Laboratories of Canada *Standard ULC/ORD-C1058.5-2004: Halon and Halocarbon Clean Agent Recovery and Reconditioning Equipment* and the *Standard ULC/ORD-C1058.18-2004: The Servicing of Halon and Clean Agent Extinguishing Systems*.

The venting or release of halons to the atmosphere for the purposes of disposal is unacceptable and must be avoided. Should a release occur, it must immediately be reported to the Nunavut/NWT 24-Hour Spill Report Line at (867) 920-8130.

Additional design and service practices for fire extinguishing equipment containing halons are described in Environment Canada's *Environmental Code of Practice on Halons.*

3.4 Transportation

Under the federal *Ozone-depleting Substances Regulations,* any person wishing to import or export a controlled ozone depleting substance must first obtain a permit from Environment Canada. In addition, several ozone depleting substances are classified as either Class 2.2 or 6.1 dangerous goods under the *Transportation of Dangerous Goods Act* and must be transported in accordance to this Section.

Under the federal *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations,* no person may transport waste dangerous goods in Canada for the purpose of disposal or recycling in a quantity greater than five kilograms or five litres unless it is accompanied by a completed manifest. Manifest forms are available

from Nunavut's Department of Environment and completion instructions are included on the reverse side of each manifest. Further information on manifesting can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste* or Environment Canada's *User's Guide for the Hazardous Waste Manifest*.

The classification, packaging, labeling and placarding of several ozone depleting substances must conform to the federal and territorial *Transportation of Dangerous Goods Act* and *Regulations* while the substances are being transported. Schedule I of the *Regulations* classify these substances as follows:

Shipping Name:	WASTE Bromotrifluoromethane; or Refrigerant Gas R-13b1 Classification: 2.2 Product Identification Number: UN1009
Shipping Name:	WASTE Chlorodifluoromethane; or Refrigerant Gas R-22 Classification: 2.2 Product Identification Number: UN1018
Shipping Name:	WASTE Chloropentafluoroethane; or Refrigerant Gas R-115 Classification: 2.2 Product Identification Number: UN1020
Shipping Name:	WASTE Dichlorofluoromethane; or Refrigerant Gas R-21 Classification: 2.2 Product Identification Number: UN1029
Shipping Name:	WASTE Bromochloromethane Classification: 6.1 Product Identification Number: UN1887 Packing Group: III
Shipping Name:	WASTE Ethylene Oxide and Chlorotetrafluoroethane Mixture Classification: 2.2 Product Identification Number: UN3297

The transport of ozone depleting substances by air must conform to the *International Air Transport Association* (IATA) *Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions,* while transport by marine must conform to the *International Marine Dangerous Goods Code*. Further information on transporting these substances can be obtained by contacting Transport Canada or referring to the appropriate Transport Authority.

Hazardous waste generators, carriers and receivers operating in Nunavut must be registered with the Nunavut Department of Environment. A unique registration number is assigned to each registrant through the registration process, which enables completion of the manifest document. Copies of registration forms are available at http://env.gov.nu.ca/programareas/environmentprotection/forms-applications or by contacting Nunavut's Department of Environment. Refer to the *Environmental Guideline for the General Management of Hazardous Waste* for additional information on the registration process.

A listing of hazardous waste carriers, receivers and management facilities registered to operate in Nunavut is available by contacting Nunavut's Department of Environment.

3.5 Certification and Awareness Training

Only certified service technicians may service refrigeration, air conditioning and fire extinguishing equipment containing an ozone depleting substance. To achieve certification, a technician must successfully complete an environmental awareness training course approved by Environment Canada. A card indicating completion of training should be carried by the certified service technician at all times. Completion of training only enables the person to handle ozone depleting substances as provided in the Guideline and is not evidence of qualifications to otherwise service refrigeration, air conditioning or fire extinguishing equipment.

Only certified service technicians may purchase or possess an ozone depleting substance for the purpose of servicing equipment that already contains an ozone depleting substance. Companies employing certified service technicians must maintain records indicating the name, training date and qualifications of employees who are certified to service ozone depleting substance-containing equipment.

3.6 Labeling and Record Keeping

Each piece of refrigeration, air conditioning and fire extinguishing equipment containing an ozone depleting substance must be permanently labeled with the quantity and type of ozone depleting substance contained within that equipment. The label must be amended if the equipment has been 'evacuated' of ozone depleting substances or if the equipment is recharged with a different refrigerant or extinguishant.

An up-to-date service record should be maintained in close proximity to equipment containing ozone depleting substances, or with the owner of the facility. The record should include servicing dates, name of servicing company and certified technician, details on leak testing and detection, quantities of substances recovered or re-charged, and any other information pertinent to the servicing, operation and maintenance of the equipment. The record must be retained for the operating life of the equipment and be made available for inspection upon the request of an Inspector appointed under the *Environmental Protection Act.*

3.7 Sales Records

Any person who sells an ozone depleting substance, except where the substance is a component of another product, should maintain a sales record indicating the type of ozone depleting substance sold, the date of sale, the name of the person who purchased the substance and the name of that person's business. Only persons who are certified service technicians should purchase ozone depleting substances, except where the substance is a component of another product.

Conclusion

The *National Action Plan for the Environmental Control of Ozone Depleting Substances and their Halocarbon Alternatives* commits federal, provincial and territorial governments to implement an ozone layer protection program focused on all ozone depleting substances. The *Environmental Guideline for Ozone Depleting Substances* represents the Government of Nunavut's updated response to the National Action Plan. The Guideline focuses on the industrial, commercial and institutional refrigeration, air conditioning and fire protection sectors, although it is recognized that ozone depleting substances can still be found in older-model household refrigerators and freezers and older-model vehicle air conditioners and chillers. The Guideline provides information on the most common ozone depleting substances and their replacement, the impacts of ozone depletion and best practices respecting the phase-out, recovery, reuse and disposal of these substances.

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

For additional information on the management of ozone depleting substances, or to obtain a complete listing of 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

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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 – GOVERNMENT AND INDUSTRY 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

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free)
Fax: 1-866-979-8501

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) 975-5774 Fax: (867) 975-5755

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

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

Government of Canada

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

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine
Fax: (204) 983-1734 Air

Industry

The Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI)
2800 Skymark Avenue, Building 1, Suite 201
Mississauga, Ontario L4W 5A6
Telephone: 1-800-267-2231 (toll free)
http://www.hrai.ca

Refrigerant Management Canada (RMC)
http://www.refrigerantmanagement.ca

Underwriters' Laboratories of Canada
7 Underwriters Road
Toronto, Ontario M1R 3A9
Telephone: (866) 937-3852) Fax: (416) 757-8727
Email: customerservice@ulc.ca

APPENDIX D • ENVIRONMENTAL GUIDELINE FOR INDUSTRIAL WASTE DISCHARGES INTO MUNICIPAL SOLID WASTE AND SEWAGE TREATMENT FACILITIES

Environmental Guideline for

Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities

Department of Environment
Government of Nunavut

GUIDELINE: INDUSTRIAL WASTE DISCHARGES

Original: January 2002
Revised: April 2011

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 industrial waste. This Guideline does not replace the need for the owner or person in charge, management or control of industrial waste 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 management of this waste.

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 – Indian and Northern Affairs Canada
Bottom – John Tyman. "Inuit: People of the Arctic"

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Appendix 1 Environmental Protection Act
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Introduction

Waste is produced by a wide variety of industrial, commercial and institutional operations in Nunavut. Much of this waste can be safely disposed of in landfills (i.e. food and packaging waste) and sewage treatment facilities (i.e. toilet waste) operated and maintained by local municipal governments. These municipal facilities may not however, accept all types of waste because of their design (i.e. the absence of groundwater collection and treatment at landfills) or because the introduction of contaminants may be harmful to bacteria that decompose the waste. The disposal of hazardous waste may also make it difficult for municipalities to comply with the terms and conditions contained in water licenses issued to them by the Nunavut Water Board.

The *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* (the Guideline) provides guidance on the local management and disposal of waste from industrial, commercial and institutional operations. Specifically, it establishes limits on the type of waste that can be disposed of into municipal waste management facilities. It does not establish limits on discharges from facilities licensed through the Nunavut Water Board. The Guideline is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of industrial waste is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the management of waste.

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 with authority to develop, coordinate, and administer the Guideline.

1.1 Definitions

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 municipalities.
Composite Sample	A collection of three or more individual samples of equal volume, equal weight or sized proportionally to the flow of the liquid being sampled that are taken at regular intervals over a period of time.
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.
Dangerous Good	Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* in any of the classes listed in the Schedule provided in the *Transportation of Dangerous Goods Act*.

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.
Hazardous Waste	A contaminant that is a dangerous good and is no longer wanted or is unusable for its original intended purpose and is intended for storage, recycling, treatment or disposal.
Industrial Operation	An operation involved in the manufacturing, processing or provision of goods and services, including commercial and institutional operations.
Landfilling	The intentional depositing or placement of waste in or on land for the purposes of disposal.
Leachate	Effluent containing contaminants that is produced by water or other liquids flowing or percolating through a waste.
Minister	The Minister of Environment of the Government of Nunavut.
Non-Point Source Discharge	A non-specific or diffuse source of effluent entering the environment including run-off from an industrial compound or storage yard.
Process Effluent	Water mixed with treated or untreated waste that is discharged from an industrial operation.
Process Residuals	Solid, semi-solid or sludge waste resulting from an industrial operation.
Qualified Person	A person who has an appropriate level of knowledge and experience in all relevant aspects of waste management.
Responsible Party	The owner or person in charge, management or control of the waste.
Sewage Treatment System	A system for the collecting, conveying, pumping, treating and disposing of blackwater (water containing fecal matter and urine waste) and greywater (water drained from sinks, showers, kitchens and laundry facilities).
Solid Waste	Unwanted solid materials discarded from a household (i.e. single or multiple residential dwellings, other similar permanent or temporary dwellings), institutional (i.e. schools, government facilities, hospitals and health centres), commercial (i.e. stores, restaurants) or industrial (i.e. mineral, oil and gas exploration and development) facility. For clarity, solid waste does not include biomedical waste, hazardous waste or sewage sludge.

Standard Methods	A procedure set out in *Standard Methods for the Examination of Water and Wastewater* published jointly by the American Public Health Association, American Water Works Association and Water Pollution Control Federation, current at the date of testing.
Toxicity Characteristic Leaching Procedure	A testing procedure designed to determine the mobility of both organic and inorganic parameters in solid, semi-solid and sludge waste. The procedure is determined by United States Environmental Protection Agency (USEPA) Test Method 1311 and is intended to simulate the characteristics a waste may exhibit when disposed of in a landfill.

1.2 Roles and Responsibilities

1.2.1 Department of Environment

The Environmental Protection Division is the key environmental agency responsible for ensuring parties properly manage industrial waste and will provide advice and guidance on its management. 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 municipal 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 of Environment or by visiting the web site at:

http://env.gov.nu.ca/programareas/environmentprotection.

1.2.2 Generators of Industrial Waste

Industrial waste must be properly and safely managed from the time it is produced to its final disposal – or in other words from cradle to grave. The owner or person in charge, management or control of the industrial waste is known as the responsible party. The responsible party must determine the nature of the waste, including whether it is hazardous or non-hazardous, before the waste can be disposed of in a municipal solid waste landfill or sewage treatment facility. If the waste exceeds the criteria established in the Guideline, the waste must be managed as a hazardous waste. Further information on the management of hazardous waste in Nunavut, including generator, carrier and receiver responsibilities, can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste* or specific guidelines that have been developed for the major types of waste.

Contractors may manage industrial waste on behalf of the responsible party. However, the responsible party remains liable for ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the waste, the responsible party may also be charged.

1.2.3 Other Regulatory Agencies

Other regulatory agencies may have to be consulted regarding the management of industrial waste as other environmental or public and worker health and safety issues may also need to be considered.

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 derives 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.

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioners' Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste landfills and sewage treatment facilities in most Nunavut communities.

Department of Health and Social Services

Activities related to the management of industrial waste 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 Economic Development and Transportation

The Motor Vehicles Division is responsible for ensuring the safe transport of hazardous waste and other dangerous goods by road through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and road safety matters.

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* and for regulating 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*. Environment Canada is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

Indian and Northern Affairs Canada

Indian and Northern Affairs 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 in Nunavut, including the impact industrial waste may have on the quality of these lands and waters.

Local Municipal Governments

The role of municipal governments is important in the proper local management of industrial waste. Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal solid waste and sewage treatment facilities. Unwanted waste may be deposited into municipal waste facilities only with the consent of the local government. The local fire department may also be called upon if a fire or other public safety issue is identified.

Co-management Boards and Agencies

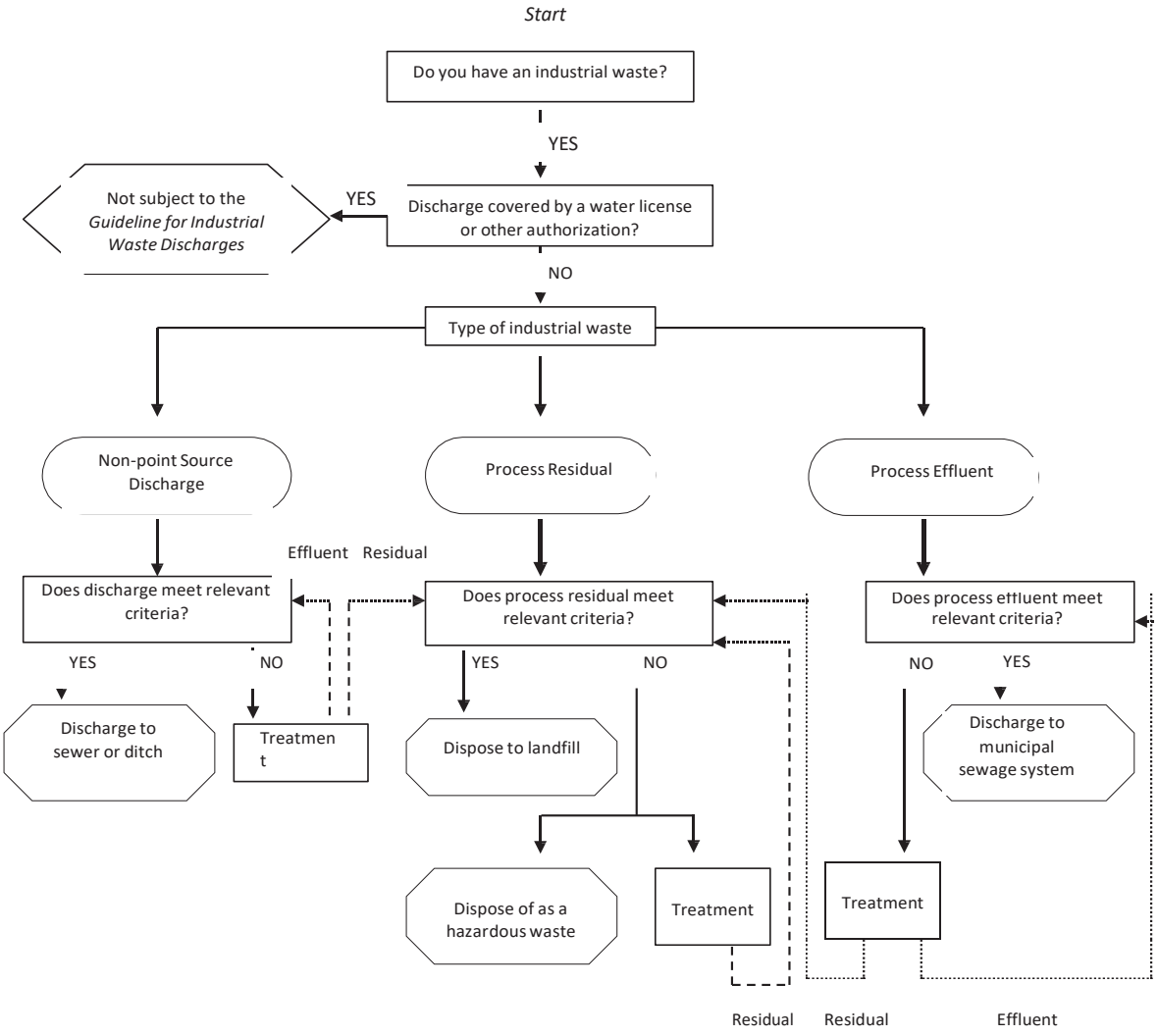
Co-management boards and agencies established under the Nunavut Land Claims Agreement have broad authority for land use planning, impact assessment and the administration of land and water. Activities involving the management and disposal of industrial waste may be controlled through the setting of terms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

Waste Management

Proper waste management simply makes good sense. Minimizing or eliminating the generation of hazardous and other industrial waste helps to reduce the hazards and costs associated with its handling, storage, transport, recycling, treatment and disposal. It also reduces the impacts waste could have on the environment, human and worker health and safety and reduces the global emission of greenhouse gases by minimizing the use of raw materials.

Once an industrial waste is created, the generator is responsible for its safe management from cradle- to-grave. Waste generators can prevent pollution and reduce costs by implementing proper waste reduction, reuse and recycling programs through changes to operational procedures, maintenance practices and raw material use. Treating and disposing of waste should be considered only when reuse and recycling options are not available or practical.

The following flowchart illustrates the decision process for managing industrial waste for treatment and disposal.



Sections 2.1, 2.2 and 2.3 do not apply to industrial wastes where a regulation or guideline governing that waste already exists, or where the waste is subject to an existing water license, land use permit, land lease or other authorization. A complete listing of guidelines can be obtained by contacting the Department of Environment or by visiting the web site at:

http://env.gov.nu.ca/programareas/environmentprotection.

Should a generator request a variance to any of the requirements established below, an assessment describing the anticipated effects of disposing the waste into a municipal sewage treatment system or landfill must be provided to the Nunavut Department of Environment and local municipal government. The assessment must indicate that a level of environmental protection equivalent to complying with the Guideline is being provided.

2.1 Process Effluent

Process effluent is water mixed with treated or untreated waste discharged from an industrial operation. For the purpose of the Guideline, process effluent does not include toilet waste and liquid from showers, baths, sinks and kitchens unless the liquid contains a contaminant that is not usually associated with that source (i.e. used antifreeze poured down a drain).

Process effluent that meets all the criteria established in Column 1 of Table 1 may be discharged to a municipal sewage treatment system with the consent of the local municipal government. Effluent that exceeds one or more of the criteria is a hazardous waste and either requires treatment to comply with the criteria or must be managed in accordance with the *Environmental Guideline for the General Management of Hazardous Waste*. Any residuals or sludge from the treatment of process effluent is subject to the standards established for process residuals – refer to Section 2.2.

All sampling, sample handling and chemical testing of process effluent must be consistent with accepted practices. Where a sample is required to determine the characteristics of the effluent, the sample must be a composite sample. Composite samples are obtained by combining three or more individual grab samples of equal volume, equal weight or sized proportionally to the flow of the liquid being sampled taken at regular intervals over a period of time, normally 24 hours. This ensures the collected liquid is representative of the process effluent. Chemical testing should be conducted by laboratories that have been formally recognized as competent to perform the specified tests by the Canadian Association of Environmental Analytical Laboratories (CAEAL)[1]. Chemical parameters should be tested using the appropriate analytical method as contained in the most recent edition of *Standard Methods for the Examination of Water and Wastewater* or other recognized testing methods (i.e. Canadian General Standards Board). Generators may use their knowledge of the effluent to reduce the number of parameters tested.

Generators wanting to discharge process effluent on commissioner's Land other than to a municipal sewage treatment system must first contact the Nunavut Department of Environment and local municipal government.

[1] CAEAL is a non-profit organization dedicated to raising the level of competency, consistency, capability and communication within environmental testing laboratories in Canada. Members of CAEAL voluntarily participate in programs of proficiency testing and accreditation.

Table 1. Criteria for Process Effluents, Process Residuals and Non-Point Source Discharges

Substance	Criteria (mg/L)		
	Column 1 Process Effluent	Column 2 Process Residuals[a]	Column 3 Non-Point Source Discharge
Aluminum	50	NC	1
Ammonia	NC	NC	10
Arsenic	1	2.5	1
Barium	5	100	1
Biochemical Oxygen Demand (BCOD)	500	NC	15
Cadmium	2	0.5	0.1
Carbon Tetrachloride (tetrachloromethane)	NC	0.5	NC
Chlorides	1500	NC	NC
Chlorine	NC	NC	1
Chromium	5	5	0.1
Copper	5	NC	1
Cyanide	2	NC	0.1
Fluoride	10	NC	2
Iron	50	NC	1
Lead	5	5	0.05
Mercury	0.1	0.1	0.0006
Methyl Ethyl Ketone	NC	200	NC
Nickel	5	NC	1
Non-aqueous Phase Liquids	NC	NC	Non-Visible Sheen
Oil and Grease	150	NC	15
pH Range	6.5 to 10.5	NC	6.0 to 10.5
Phenolic Compounds	1	NC	0.02
Phosphorous	100	NC	1
Polychlorinated Biphenyls (PCBs)	NC	50[b]	NC
Polychlorinated Dibenzo Dioxins and Furans	NC	0.0000015 I-TEQ[c]	NC
Selenium	NC	1	NC
Silver	5	5	0.1
Sulphates	1500	NC	NC
Sulphides	2	NC	NC
Suspended Solids	600	NC	15
Tetrachloroethylene	NC	3	NC
Tin	5	NC	1
Trihalomethanes (Total)	NC	10	NC
Uranium	NC	10	NC
Vinyl Chloride	NC	0.2	NC
Zinc	5	500	0.5

NC No criteria has been adopted for this substance

a. Refer to the *Canadian Environmental Protection Act (CEPA) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations - Schedule 6* for criteria regulating other process residuals.

b. Based on concentration by mass.

c. International Toxicity Equivalents.

2.2 Process Residuals

A process residual is any solid, semi-solid or sludge waste produced from an operation that is involved in the manufacturing, processing or provision of goods and services, including commercial and institutional operations.

Process residuals that meet the criteria established in Column 2 of Table 1 may be disposed of in a municipal landfill with the consent of the local municipal government. Process residuals that exceed one or more of the criteria are considered to be a hazardous waste and either requires treatment or management in accordance with the *Environmental Guideline for the General Management of Hazardous Waste*. The treatment of process residuals may result in a significantly different waste. Any liquid or solid waste resulting from the treatment of a process residual is subject to the criteria established in Column 1 and 2 of Table 1 to determine whether it is suitable for disposal in the local sewage treatment facility or landfill.

The recommended leachate testing procedure for process residuals is Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) as described in the United States Environmental Protection Agency Regulation 40CFR261. This testing method is designed to determine the acceptability of landfilling process residuals by simulating leaching characteristics the waste may exhibit when disposed of. Any leachate extract collected must then be tested using the appropriate analytical method contained in the most recent edition of *Standard Methods for the Examination of Water and Wastewater.* All testing procedures should be undertaken by a CAEAL recognized laboratory. Knowledge of the industrial process may reduce the number of parameters needed to be tested.

Nunavut's Department of Environment should be contacted by the generator if an alternative leaching procedure or chemical test is proposed.

2.3 Non-Point Source Discharges

A non-point source discharge is the release of wastewater from a diffuse source, such as run-off from an industrial compound or storage yard to an adjacent property, drainage ditch, stream or waterbody. Where a non-point source discharge is already covered by a water license issued by the Nunavut Water Board, the effluent criteria established through the license are to be complied with. The criteria established in Column 3 of Table 1 apply only where no license, permit or authorization has previously been issued for the discharge.

A non-point source discharge that meets the criteria established in Column 3 of Table 1 may be discharged directly to the environment with the consent of the local municipal government. Where one or more of the criteria are exceeded, the discharge must immediately be stopped, the discharge reported to the Nunavut/NWT 24-Hour Spill Report Line at (867) 920-8130, and the run-off contained for treatment and disposal. Any collected run-off may be disposed of in the local sewage treatment system where the criteria established in Column 1 of Table 1 are met, and with the consent of the local municipal government.

All sampling, handling and chemical testing of run-off must be consistent with accepted practices. Composite samples should be obtained where possible and chemical testing procedures undertaken by a CAEAL recognized laboratory.

Conclusion

Industrial, commercial and institutional operations in Nunavut produce a wide variety of wastes that require disposal. Much of this waste can be safely disposed of in landfills (i.e. food and packaging waste) and sewage treatment facilities (i.e. toilet waste) while others are hazardous and require treatment prior to disposal. The *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* establishes limits on industrial waste that can be disposed of into municipal waste facilities in Nunavut.

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

For additional information on the management of industrial waste, or to obtain a listing 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

American Public Health Association, American Water Works Association and Water Environment Federation. Standard Methods for the Examination of Water and Wastewater. Latest Edition.
http://www.standardmethods.org/

Government of Alberta, Department of Environment. Alberta User Guide for Waste Managers.
http://www.environment.gov.ab.ca/info/library/7423.pdf

Government of Canada, Department of Justice. *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.*
http://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=84

Government of Nunavut, Department of Environment. Environmental Guideline for the General Management of Hazardous Waste. 2010.
http://env.gov.nu.ca/node/82#Guideline Documents

Government of Nunavut, Department of Environment. Environmental Guideline for Industrial Waste Discharge in Nunavut. 2002.

Government of the Northwest Territories, Department of Municipal and Community Affairs. Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories. 2003.
http://www.enr.gov.nt.ca/_live/documents/content/solidwaste_guidelines.pdf

United States Environmental Protection Agency. Method 1311 – Toxicity Characteristic Leaching Procedure.
http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/1311.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 – GOVERNMENT AND OTHER 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

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free)
Fax: 1-866-979-8501

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) 975-5774 Fax: (867) 975-5755

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

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

Government of Canada

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

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine
Fax: (204) 983-1734 Air

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

Other Contacts

Nunavut Water Board
P.O. Box 110
Gjoa Haven, Nunavut X0B 1J0
Telephone: (867) 360-6338 Fax: (867) 360-6369

Canadian Association for Environmental Analytical Laboratories
300-265 Carling Avenue
Ottawa, Ontario K1S 2E1
Telephone: (613) 233-5300 Fax: (613) 233-5500

AGNICO EAGLE

MELIADINE GOLD PROJECT

ROADS MANAGEMENT PLAN

MARCH 2019
VERSION 7
6513-MPS-03

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ᐊᑦᓂᓄ ᐃᐃᒍ ᐅᓴᖅᑕᕆᐊᓕᕆᓚᐅᖅᓄᑦ (ᐊᑦᓂᓄᖅᓄᑦ) ᐱᓭᓪᓕᐊᔪᑦ ᑕᓯᔪᐊᖅᑎᑦ ᒍᓗᒍᑦ ᐱᓕᕆᐊᖅᑎᑦ (ᐱᓕᕆᐊᖅ), ᐃᓂᐅᔪᒋᑦᑐᖅ 25 ᑭᓪᓕᑦᑐᓗᐊᓂᑦ ᐅᖓᓱᓂᑎᒋᔪᖅ ᐅᐊᖏᓇᖓᓂᑦ ᑲᖏᖅᓂᓂᐅᑦ, ᐊᑦᒪᓗ 80 ᑭᓪᓕᑦᑐᓂᑦ ᐅᖓᓱᓂᑎᒋᔪᑦᓗᓂ ᓂᒋᖅᓯᓕᔪᓂᑦ ᐅᐊᖏᓇᖅᓯᓕᔪᓂᑦ ᐃᒡᓗᓐᓇᖅᓯᒃᑯᑦ ᑭᓭᓪᓕᑦᑐᑦ ᓄᓇᓕᒪᑦᑐᑦ. ᐱᓕᕆᐊᖅ ᑕᓯᔪᐊᖅᑎᒋᑐᖅ ᐅᐃᐅᓪᓴᑦ ᐃᒪᖅᑎᑦ ᐊᐅᓪᓚᕆᓂᖅᓴᓕᔪᑦᑐᑦ (ᓄᓇᓕᒪᑦᑐᑦ ᐃᒪᖅᑎᒪᑦ ᒪᓕᑐᖃᓕᓂᒃ ᑎᑎᖅᑲ 4).

ᐅᓴᖅᑕᕆᐊᖅ ᐃᓄᖓᓄᑦ ᓇᖓᒥᓂᕆᐅᔪᓂᒃ ᓄᓇᒋᑦᑐᖅ, ᑕᐃᒪᖓᓇᒍᓪᓗᑦ, ᓄᓇᒃ ᐊᓪᓚᓗ ᐊᐊᑎᓕᕆᓂᖅᓴᓪᓕᑦ ᐊᐅᓪᓚᑕᑎᓂᖅ ᐊᐅᓪᓚᑕᐅᔪᖅ ᒪᓕᑎᖓᓴᓄᑦ ᓄᓇᒋᒪᑦ ᓄᓇᑕᖅᓯᓪᓴᑦ ᐊᖏᑎᓕᕆᓂᖅᓴᓪᓕᑦ. ᑕᑦᓇ ᑎᑎᖅᑲᖅ ᐊᑦᓯᔪᑎᓂᒃ ᐊᐅᓪᓚᑕᑎᓂᖅᓴᓪᓕᑦ ᐸᖅᓇᐅᑎᓕᕆᔪᖅ (ᐸᖅᓇᐅᑎᑎ) ᐅᓴᖅᑕᕆᐊᖅᓴᓪᓕᑦ ᐊᓪᓚᓗ ᐊᖅᑭᐱᓪᓚᑐᓄᓂ ᐃᓕᓴᐅᔪᕐᓂᒃ ᑎᑎᖅᑲᖅᓯᓕᐅᔪᖅᓂᒃ Type A ᐃᓚᖅᓴᑦ ᓕᐃᓴᓵᔪᕐᓂᒃ ᑐᓵᔪᐅᑎᓴᑦ. ᑎᑎᕆᖅᓯᒪᔪᑦ >ᒥᑦ-ᖃᔪᑦ, ᓕᐃᓴᓵᔪᓪᓕ, ᐊᖏᓪᖅᑎᑎᔨᑎᑦ, ᐱᔪᖅᓇᖅᑎᑕᐅᓂᑦ, ᐊᓪᓚᓗ ᐃᓚᒋᓕᕆᔪᐅᔪᑦ ᑕᑦᓯᔪᑐᓄᓗᒍ <ᖅᓇᐅᑎᓴᑦ ᑕᐃᒪᐅᔪᑦ.

ᐊᑦᓯᔪᑎᓂᓵ ᐊᐅᓕᑦᑎᓂᖅ

<ᖅᓇᐅᑎᒥᑦ ᐃᓕᐅᔪᑦ ᐱᔨᐅᔪᖅᓇᖅᓂᖏᑦ, ᐱᔨᑦᑎᕆᐃᓂᖅ, ᐊᓪᓚᓗ ᐅᔪᒃᑕᒃᓂᖅᓴᓪᓕᑦ ᐊᑦᓯᔪᑎᑦ ᐱᓕᕆᐊᖅᑎᑦ, ᐊᓪᓚᓗ ᐱᑦᔪᑎᖏᖅᑐᖅ ᓴᓇᔨᐅᓂᖏᑦ, ᐊᐅᓪᓚᖅᑎᑦᑎᓂᓵᑦ, ᐅᓵᔪᖅᓯᐊᓂᖅᑐᓂᓗᒍ ᐱᓕᕆᐊᖅᑎᑦ, ᐊᓪᓚᓗ ᓄᓇᕗᑦ ᐊᐊᑎᖏᓐᓂᓵᑦ ᐊᐅᓪᓚᑕᑎᓂᖅ ᐊᓪᓚᓗ ᖃᐅᔨᓴᓕᕆᔨᖅᑐᖅ ᐅᓴᖅᑕᕆᐊᖅᓴᓪᓕᑦ <ᖅᓇᐅᑎᓗᒍ (ᐊᑦᓂᓄᖅᓄᑦ 2014a). ᐊᑦᓯᔪᑎᑦ ᐊᑐᖅᑕᐅᖅᑕᖅᑐᑦ ᐊᑦᓂᓄᖅᓄᓇᓕᑦ ᑭᓯᐊᓂ ᑭᓴᖅᑐᖅᑐᓄᑦ ᐊᑐᖅᑕᐅᑎᑎᓂᖅᑕᖅᑕᕐᓂᑦ ᐃᓄᐃᑦᑑᓂᑦ, ᐅᓗᓚᐊᓇᖅᓯᒪᑦᑐᓂᒃ <ᖅᓇᐅᑎᓗᒍ (ᐊᑦᓂᓄᖅᓄᑦ 2014a). ᐊᑦᓯᔪᑎᑦ ᐊᑐᖅᑕᐅᖅᑕᖅᑐᑦ ᐊᑦᓂᓄᖅᓄᓇᓕᑦ ᐃᓄᐃᑦᑑᓂᑦ ᐊᑐᖅᑕᐅᑎᓂᑎᖅᑕᖅᑕᕐᓂᑦ ᐃᓄᐃᑦᑑᓂᑦ ᐊᑐᖅᑕᐅᓂᓂᑎᖅᑕᖅᑕᕐᓂᑦ ᐃᓄᐃᑦᑑᓂᑦ ᐊᑐᖅᑕᐅᑎ

ᐱᓕᕆᐊᖅᐳᓂᖏᑦᓄᓕᓂ ᐊᑦᕿᔪᑎᑦ ᐃᓕᐅᑦᓗᑎᒃ ᓴᐸᖃᑦᖠᓗᐊᖅᑕᐃᓕᓚᐸᑎᑦ ᐊᑐᖅᑕᐅᖅᖃᑦᑕᖅᑐᑦ, ᐊᐳᑕᐃᖅᐃᓂᓕᓂ ᐊᔪᓚᓂ ᐊᐱᐸᓂ ᐊᐳᑎᒥᒃ ᐊᐅᓕᕆᓂᓂᖅᑎᒃ, ᐊᔪᓚᓂ ᐊᐳᑎᒥᒃ ᐊᐅᓕᕆᓂᓂᖅ ᐃᑲᔾᑎᓂᓂ ᐊᔪᓚᓂ ᔪᑦᓗᓂ.

ᐊᑐᖅᑕᐅᔪᓴᐃᓕ ᐱᓂᕐᓗᐊᖏᓂᐅᔪᓄᓕ ᐊᔪᓚᓂ ᐊᑐᖅᑕᐅᖅᓀᐊᖅᖅᓯᑕ ᓴᑭᖅᑕᓪᓕ ᑕᐃᒪᐅᔪᑦ ᐊᐃᓵᖅᑐᖅᓭᓂᓂ ᐊᑕᓪᓕ. ᐊᓚᓂᔪᔪᑦ ᐊᖅᑭᔪᓭᓭᓂ ᒪᓕᓚᑕᐅᔪᓴᓂᓚ ᐊᔪᓚᓂ ᐱᖃᐃᐅᖅᑕᖏᓪᓕ ᐅᓯᓗᐊᖅᑕᖏᓪᓕ ᖃᓄᐃᓕᓂᓂᐊᖅᑐᓂ ᐅᓴᓗᐊᖅᑕᐅᖅᓀᐊᖅᖅᓗᓚᓚᑦᑕ ᐅᖃᓗᐊᖅᑕᐅᖅᓀᐊᖅᖅᓗᓚᓚᑦᑕ ᖃᓄᐃᓕᓂᓂᐊᖅᑐᓂ ᑐᓴᐃᓀᖅᑐᓂ ᐊᑦᕿᔪᑎᑦ. ᐊᓚᓂᔪᔪᑦ ᐅᖃᓗᐊᖅᑕᐅᖅᓀᐊᖅᖅᓗᓚᓚᑦᑕ ᖃᓄᐃᓕᓂᓂᐊᖅᑐᓂ ᑐᓴᐃᓀᖅᑐᓂ ᐊᑦᕿᔪᑎᑦ ᐊᔪᓚᓂ ᐱᖃᐃᐅᖅᑕᖏᓪᓕ ᐅᓯᓗᐊᖅᑕᖏᓪᓕ

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine is located on Inuit Owned Lands and, as such, land and environmental management are generally governed by the provisions of the Nunavut Land Claims Agreement. This document presents the Roads Management Plan (the Plan) for the mine and forms a component of the documentation series produced for the Type A Water Licence Application. A list of permits, licenses, agreements, authorizations, and approvals applicable to this Plan are provided.

Roads Management

The Plan includes access, service, and haul roads within the Project area, and covers construction, operations, closure and post-closure phases of the Project. This Plan is linked to the Spill Contingency Plan and the Terrestrial Environment Management and Monitoring Plan (Agnico Eagle 2014a). Access roads are used by Agnico Eagle but they also provide unrestricted access to the public, if it is safe to do so. Roads outside the mine area include:

1. A 30 km All-weather Access Road (AWAR) from Rankin Inlet to the mine site. The AWAR is used to transport the building materials, construction/mining equipment, fuel, reagents, supplies, workers, and contractors to the mine site. The road is also used to transport saline water from the mine site to Itivia where it is discharged into Melvin Bay. This road has unrestricted public access providing rules of the road are observed.
2. A 5.9 km bypass road around the Hamlet of Rankin Inlet from the Rankin Inlet Itivia land-based facilities (Itivia) to the AWAR. This road is closed to public use.

A manned gate is located on the south side of the AWAR at km 7 to prevent public access to the mine site. There is also an unmanned gate at Meliadine Camp's entrance, kilometer 30 of the AWAR. The road is closed during periods of bad weather, in the event of a road accident, during periods of major road maintenance, and, during caribou migration.

A sign is installed near Rankin Inlet giving the daily status of the AWAR, stating whether it is open or closed to the public that day. Monitoring the average daily traffic on the AWAR including the type and numbers of vehicles depending on the season, is included in the Plan.

This Plan presents mitigation measures and protocols to be implemented during operations to preserve wildlife, to prevent permafrost degradation, to control surface runoff and sedimentation, and to mitigate dust. Agnico Eagle has put in place operational procedures for daily operation and maintenance of the roads including dust suppression methods, snow removal, de-icing and snow drifts/banks management, and snow management at bridges and culverts.

Protocols for accidents and anticipated use of police services are presented in the sections below. Agnico Eagle has procedures in place and will keep resources close-at-hand to respond to emergencies on the roads in a timely manner. Agnico Eagle also reports all reportable incidents to the appropriate Government authorities.

Reclamation of the access, service and haul roads will follow the completion of all mining. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowner (the Kivalliq Inuit Association and/or the Hamlet) and then complete its own environmental assessment and permitting process covering future use.

Dust Management

Agnico Eagle uses best management practices to minimize dust generation from becoming airborne at the mine site, Itivia, AWAR, Bypass road, service roads, and haul roads. This includes identification of major sources of dust, implementation of dust mitigation measures, inspections for unacceptable levels of dust, and recording dust monitoring data to document Agnico Eagle's success in controlling and reducing dust at the Project. The Dust Management Plan focuses primarily on dust generated from roads, with some reference to other mining activities such as the tailings storage facility which are addressed in other plans, including the Mine Waste Management Plan.

Dust could potentially be generated by such activities as road use, drilling, blasting, crushing, conveying, loading, hauling, unloading, stockpiling, and by wind erosion of dry, exposed mine areas. Dust emissions are prevalent during late spring and summer, while being much reduced in fall and winter.

Mitigation measures to control dust include mine design and operational procedures. Operational practices, such as speed limits and road maintenance, assist in reducing dust. Water and the addition of Calcium Chloride ($CaCl_2$) is used to control and reduce dust on roads and other mine areas when airborne dust becomes a safety hazard or impacts sensitive natural areas.

Dust suppression measures are in place during operations and closure.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	September 2012			First draft of the Roads Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			Additions made throughout the Plan	John Witteman, Env. Consultant, Agnico Eagle
		6.4	17	Addition of Section 6.4	
3	April 2014	1.2.1	4	Added IQ box	Larry Connell, Corp. Dir. Reg. Affairs, Agnico Eagle
		1.2.5	6-7	Details on snowmobile trails	
			8	Added new Figure 1-2 (Itivia)	
		2.2	12-14	Update including *Navigation Protection Act*	
		4	17	Added details on consultation wrt road mgmt. and use	
		6.1	20	Details on emergency reporting	
		6.5	23	Territorial Park	
		6.6	24	Periodic survey of road use	
		7.1	25-26	Section on sedimentation control	
		7.2.1	28	Protection of archaeological sites	
		7.3	29	Meadowbank experience wrt winter maintenance	
		8.2	34	Role of the Royal Canadian Mounted Police (RCMP)	
		App. C		New Appendix: Dust Management Plan	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			Complete plan update based on Feasibility Study and NIRB Conditions for the Water Licence Application	John Witteman, Env. Consultant, Agnico Eagle
5	March 2017			General review of the plan	Environment Department, Agnico Eagle Mines
6	March 2018			Update plan based on NIRB requests	Environment and E&I Departments, Agnico Eagle Mines

7	March 2019			-General review/update of the plan reflecting production phase. -Updated Appendix A	Terry Ternes, Sean Arruda, Bethany Hodgins, Environment Department, Agnico Eagle Mines
		1.2.3, 6.4	3 23, 24	-Added information about trucking of treated saline water to Itivia.	
		6.1	20,21	Traffic Management update	
		10	42	Updated information on bypass road	
		1.1	1	Removed mine plan from introduction as it is non-essential to the Roads Management Plan	
		10.1	39-40	Updated with AWAR closure during Caribou migration	

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ARD/ML	Acid Rock Drainage/Metal Leaching
ATV	All-Terrain Vehicle
AWAR	All-weather Access Road
CGS	Department of Community and Government Services, Government of Nunavut
DFO	Department of Fisheries and Oceans Canada
ERT	Emergency Response Team
GN	Government of Nunavut
HTO	Hunters and Trappers' Organization
INAC	Indigenous and Northern Affairs Canada
IOL	Inuit Owned Lands
IQ	Inuit Qaujimajatuqangit
KIA	Kivalliq Inuit Association
MDAG	Multidisciplinary Advisory Group
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NTI	Nunavut Tunngavik Incorporated
NU	Nunavut
NWB	Nunavut Water Board
RCMP	Royal Canadian Mounted Police

UNITS

km	kilometre
m	metre

SECTION 1 • INTRODUCTION

1.1 Project Description

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands (IOL). The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

Figure 1-1 provides an overview of the Project access road network. There is presently a controlled access, Phase 1 All-weather Access Road (AWAR) between the mine site and Rankin Inlet[1] (constructed in 2013/2014). A bypass road that was built around the Itivia site and links to the AWAR outside of Rankin Inlet. The remote location of the Project necessitates that access, service, and haul roads be built to support the development of the mine.

The following structures and facilities located near the Tiriganiaq gold deposit include:

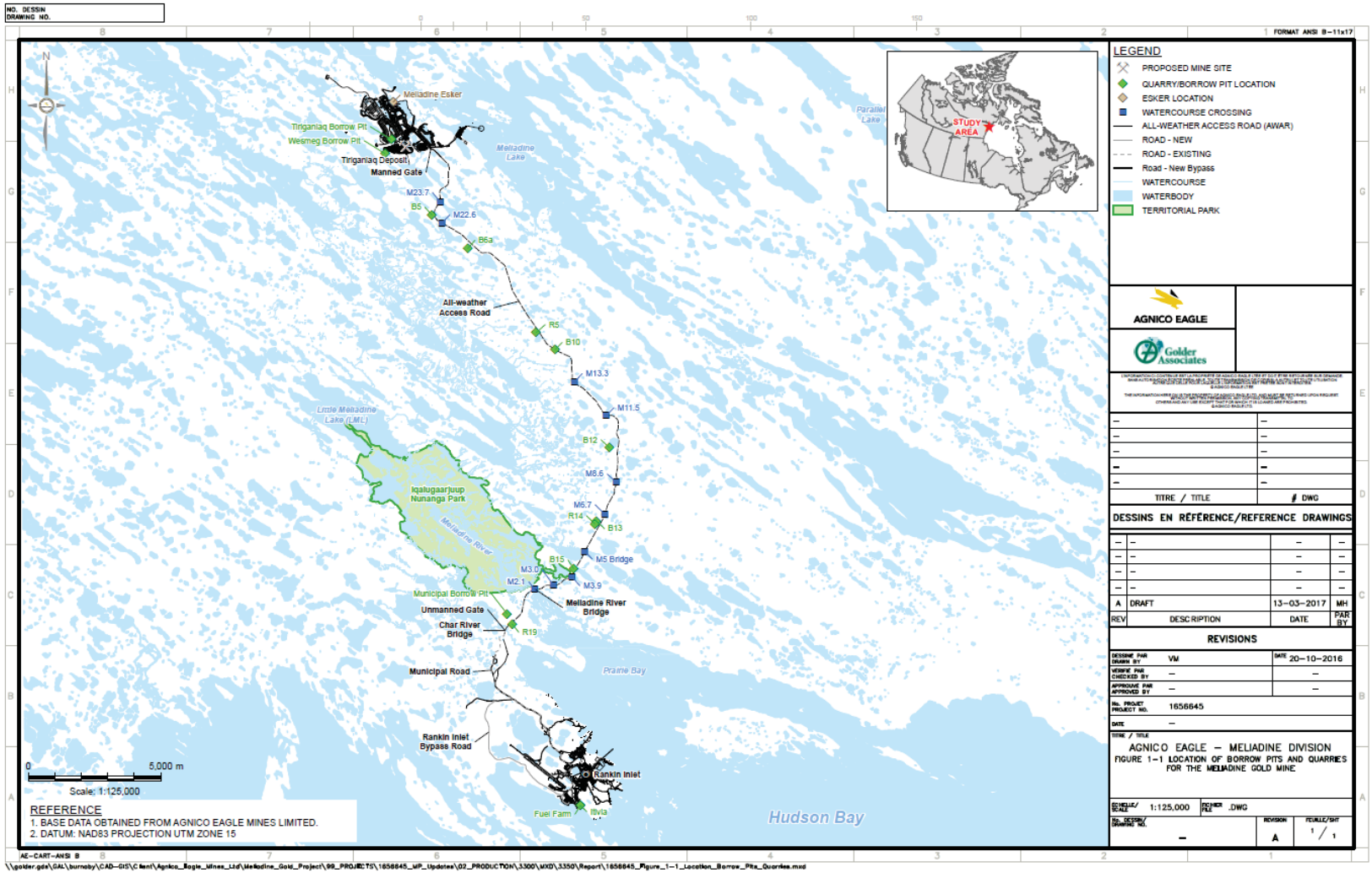
- Two open pits for the Tiriganiaq gold deposit and ancillary facilities;
- Underground and ancillary facilities;
- Tailings storage facility consisting of dry stack tailings;
- Overburden/waste rock/ore storage facilities;
- Plant site and ancillary facilities;
- Storage areas;
- Fuel tanks holding up to 9 million litres;
- Quarries and granular borrow pits;
- Water management facilities;
- All-weather access, bypass, service and haul roads;
- Incinerator building;
- Landfarm for petroleum hydrocarbon contaminated soils and snow/ice; and
- Industrial waste landfill.

The following structures and facilities located in Rankin Inlet include:

[1] The Meliadine Phase 1 AWAR was authorized under a separate process (Golder Associates 2010, 2011a, 2011b) and subject to separate monitoring and management plans (Agnico Eagle 2011, 2012). The concepts and monitoring and management plans are being merged with the current Project.

- Spud barge located at Itivia and serving as a dock;
- Oil Handling Facility at Itivia holding up to 38 million litres of diesel;
- Laydown yard at Itivia;
- 5.9 km bypass road around the community;
- Two kilometres of the AWAR located on municipal land;
- Bridges over the Char and Meliadine Rivers on municipal land; and
- Reclaimed rock quarry (R19) on unicipal land.

Figure 1-1 Meliadine Access Road Network with Quarries and Drainage



AGNICO EAGLE

1.2 Access Roads, Service Roads, and Haul Roads

What is the difference between access roads, service roads and haul roads?

Access Roads have public access. The public can use small vehicles such as All-Terrain Vehicle (ATVs), skidoos, and pick-up trucks on these roads, providing the use is in a safe manner. Small mine and contractor vehicles frequently use access roads. Large vehicles such as fuel tankers, buses, transport trucks, graders, and snow plows can also be expected. If oversized vehicles were to use an access road, they are be accompanied by escort vehicles. Access roads have two-way traffic, are 6.5 metres (m) wide with pull offs approximately every 400 ± 50 m.

Service Roads do not have public access. These roads are restricted to mine and Agnico Eagle contractor vehicles. All mine and contractor drivers using service roads are trained to do so. Large equipment occasionally makes use of service roads but normally use haul roads. Service roads have two-way traffic and are 6.5 m wide.

Haul Roads do not have public access. All mine and contractor drivers using haul roads are trained to do so. Haul roads are essentially reserved for haul trucks transporting waste rock and ore from open pits. Haul roads are approximatively 17 m wide, and have safety berms where required.

Access, service, and haul roads are needed in the operation of the Project. Access roads are used by Agnico Eagle but also have unrestricted access by the public, if it is safe to do so. The only access road is the 30 kilometer AWAR between Rankin Inlet and the mine site as shown on Figure 1-1. The bypass road around Rankin Inlet is closed to public use. It is used by Agnico Eagle and its contractors to transport fuel, supplies, and reagents from Itivia to the AWAR. The AWAR and the Bypass road is also used to carry saline water from the mine site to Itivia for discharge to Melvin Bay.

A gate is installed on the AWAR near the mine site to prevent public entry. There is a manned gate at km 7 at the south end of the AWAR. The road is closed during periods of bad weather, in the event of a serious road accident, during periods of major road maintenance, and during migration. A chronological record of consultation on the AWAR to date is provided in Appendix A.

Service roads are exclusively for Agnico Eagle and its contractors use; the public does not have right of entry to these roads that service mine areas. They are found in and around open pits, leading to waste rock storage facilities, around the mill site, to the landfill and Emulsion Plant to mention a few. Service vehicles, trucks carrying explosives, and small trucks with mine personnel use the service roads. All Agnico Eagle workers and its contractors using service roads receive training before doing so.

Haul roads are primarily restricted to haul trucks, loaders, and other heavy machinery. Small vehicles operated by Agnico Eagle and its contractors can also use haul roads, but only after driver training and when it is safe to do so.

The Plan applies equally to access, service, and haul roads. Operations and maintenance of all types of roads will largely be the same. While public safety is emphasized in the use of the access roads, the safety of its workers and contractors is of no less importance to Agnico Eagle in their use of all roads.

1.2.1 Road Routes

The routing of the AWAR and service roads were selected to minimize possible effects of construction and operation on the environment, and to facilitate maintenance of the road, particularly during winter. Prior to future road construction, Agnico Eagle conducts a survey along road routes to verify that dens of foxes, bears or wolverines are not destroyed or damaged. Other considerations include the overall length of the road, the route's proximity to satellite ore bodies, the number of stream crossings, the availability of quarries along the route, acid rock drainage/metal leaching (ARD/ML) potential of borrow materials, geomorphology, avoidance of archaeological resources, avoidance of the Iqalugaarjuup Nunanga Territorial Park, Inuit Qaujimajatuqangit (IQ), and avoidance of raptor nesting sites. An additional design consideration for roads is to remain on the height of land as much as possible to allow for drainage in the summer and for wind to assist in clearing snow in the winter.

> The location of the Meliadine Bridge was in part determined by IQ. Inuit Elders spoke of graves on an esker downstream of the present bridge location, which ruled out crossing at this location.
>
> The elevation of the bridge above the Meliadine River was based on IQ as Elders spoke of significant overflow at the selected location, which could impinge on the bridge. This caused Agnico Eagle to raise the elevation of the bridge more than first described in the engineering design.

Wildlife concerns also factor into road routes. Their design takes into account measures that roads do not prevent or unduly limit the movement of wildlife. This includes limiting the height of the road above the surrounding topography and limiting safety berms on haul roads where possible. Ore from the underground mine is transported by conveyor underground to the primary crusher. This design feature eliminates the surface transport of underground ore and mitigates possible interactions with wildlife.

Haul roads will be proximal to open pits and used year round; they connect open pits to Waste Rock Storage Facilities, ore storage pads and the primary crusher. Haul roads will be kept as short as possible and, where feasible, follow routes that limit the need for safety berms, which can block the movement of wildlife.

The routing of the bypass road, as shown on Figure 1-1, avoids the built-up part of the Hamlet thereby ensuring homes, businesses, recreation centres, schools, and healing centre are not disturbed by mine traffic. It does not interfere with the operation of the airport, potential runway expansion, community's water intake source (i.e. Nipissar Lake) or the new Hamlet landfill, and joins the municipal road leading to the AWAR, Iqalugaarjuup Nunanga Territorial Park, and a community borrow pit.

1.2.2 All-weather Access Road

The AWAR, as shown on Figure 1-1, connects Rankin Inlet to the mine site. The route was selected following consultation with the Inuit. The AWAR is a 30 km private road built with a 6.5 m running surface between the Char River bridge turn-off and the mine site, and has passing turnouts approximately every 400 ± 50 m (9.5 m total road width at passing turnouts[2]).

There is controlled access to the mine area by a seasonally manned gate located on the AWAR just south of the mine area (kilometer 30). There is also a year-round manned gate at kilometer 7 at the south end of the AWAR. The road is closed during periods of bad weather, in the event of a road accident, during periods of major road maintenance and, during caribou migration. Finally, a sign will be installed near Rankin Inlet giving the daily status of the AWAR stating whether it is open or closed to the public.

1.2.3 Hamlet Bypass Road

A bypass road was completed in 2018 and is built around the south of the airstrip to Itivia as shown on Figure 1-1. Its design and width is identical to the AWAR (6.5 m). The bypass road is approximately 5.9 km long and allows traffic from Itivia to bypass the Hamlet in delivering materials and fuel to the

Why a bypass road is preferable to using existing roads in the Hamlet?

Thirty million litres of fuel are required annually for mine operations and it is stored in the Itivia tank farm. All this fuel needs to be transported to the mine site where two tank farms, each having 2 tanks are located. The total fuel that can be stored on site is approximately 9 million litres. If each fuel tanker carries 45,000 litres, it results in a total of approximately 667 trips annually or, on average, 1.8 trips per day. Added to this would be moving 20,000 to 40,000 tonnes of dry cargo from Itivia to the site annually, and up to 350 workers to and from the airport for each two-week work rotation. It is estimated that approximately 1,800 trips per year will occur when the mine hauls saline water to Itivia for discharge to the sea.

[2] Passing turnouts allow vehicles to pass each other when travelling in opposite directions.

mine site or saline water to Itivia from the mine. By building the bypass road, use of municipal roads by Agnico Eagle is kept to a minimum. The bypass road is closed to the public.

A small amount of material is also transported from the mine site to Itivia for transport south by sea, including hazardous materials and other wastes that require shipment to the south.

In 2019 Agnico Eagle will begin transporting treated saline water from the underground mine, to the Itivia area for discharge to sea. This will result in an increased amount of traffic on both the AWAR and the Bypass road. It is estimated that approximately 1,800 trips per year will be made from the mine to Itivia for the discharge of saline water.

1.2.4 Traditional ATV and Snowmobile Trails

The building of roads and the infrastructure at Itivia impacts existing ATV and snowmobile trails. Where these trails cross a road, a ramp has been constructed to ease road crossing, and signage is in place to alert road users of the crossing. Similarly, there are signs alerting ATVs and snowmobiles when approaching a road. Maintenance of the roads would ensure the snowmobile crossings are kept clear of snow.

Rankin Inlet residents, the Rankin Inlet and Kangiqliniq Hunters' and Trappers' Organization (HTO) have identified that there is an existing snowmobile trail in the area of the Itivia laydown yard that local residents use in winter months to access the sea ice at Melvin Bay. Agnico Eagle is aware of this trail and has accommodated the trail to allow continued unfettered snowmobile access along the east side of the laydown yard to the sea ice at Melvin Bay. The location of this trail in relation to the laydown yard is shown in Figure 1-2.

While the laydown area is fenced, this snowmobile trail is not hampered or blocked by any fencing.

1.2.5 Haul Roads

The building of additional haul roads will be governed by the sequence of the two open pits to be mined, Tiriganiaq 1 and 2, and their width determined by the size of the haul trucks and other equipment using the roads. Haul roads are kept separate from access and service roads to ensure road safety. The layout of haul roads in the vicinity of the mine site is presented in Figure 1-3.

Haul roads outside the open pits are 26 m wide to allow for two way traffic, or 17 m for single lane traffic with passing zones spaced accordingly. A two-lane 17 m wide haul road designed for 70-t trucks in dual lanes is required for access to the TSF and Paste Plant. Safety berms are installed where necessary along the haul roads.

The ramps and haul roads were designed for the largest equipment (70 payload tonne class haul trucks), with an operational width not exceeding 5.7 m, in accordance with Nunavut mine regulations. For double lane traffic, the ramp width will be 21.5 m decreasing to 15.8 m for single

lane traffic at the pit bottom (last three benches) to reduce waste stripping. The ramp's width will include a protection berm and a drainage ditch. The safety berm on the outside edge will be constructed of crushed rock to a height equal to 3/4 of the rolling radius of the largest tire using the ramp. To facilitate drainage, ramp gradients will be established at 10% and will increase to 12% for the last three benches at the bottom of the open pit.

Figure 1-2 Itivia General Arrangement and Access

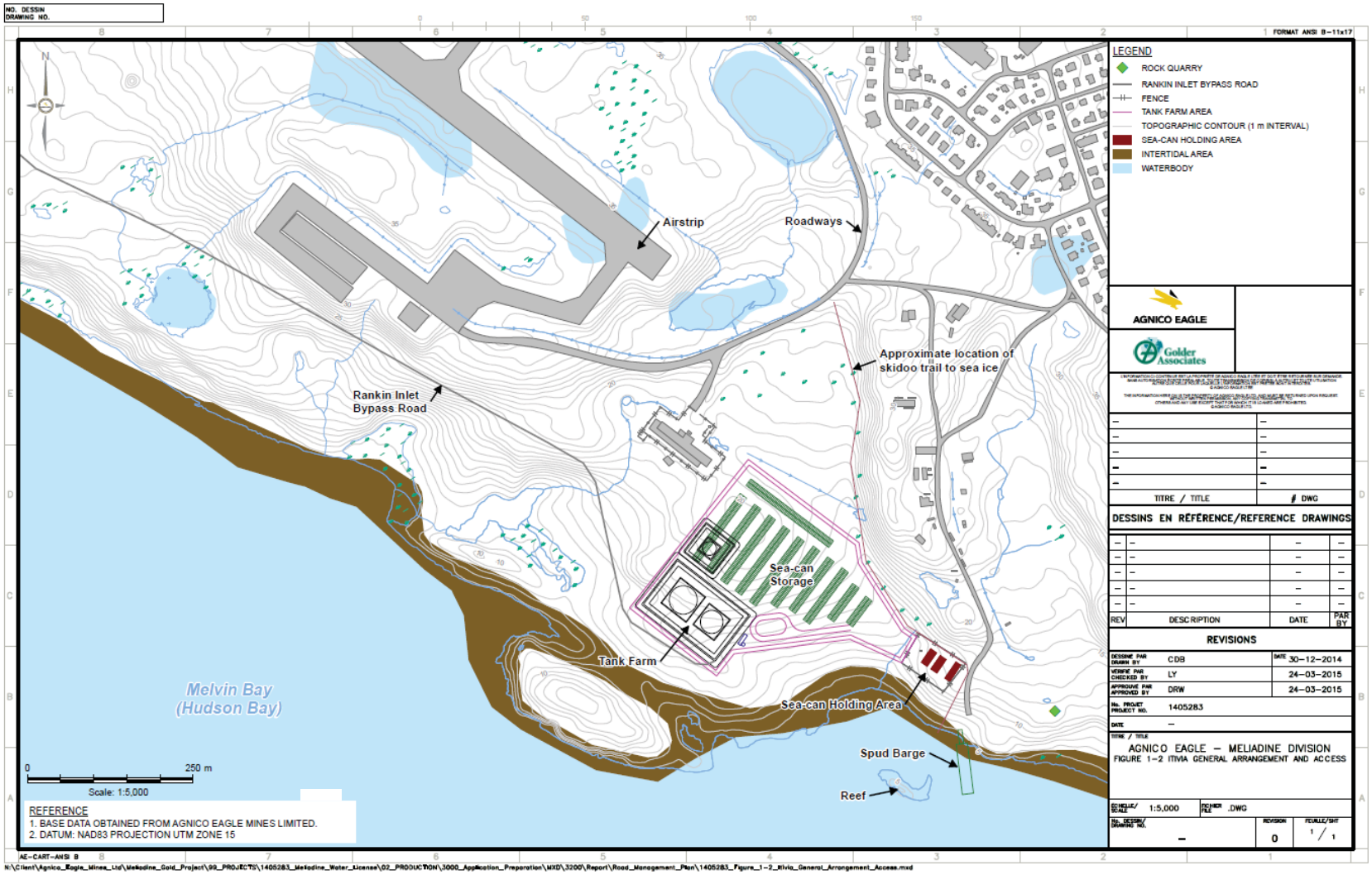
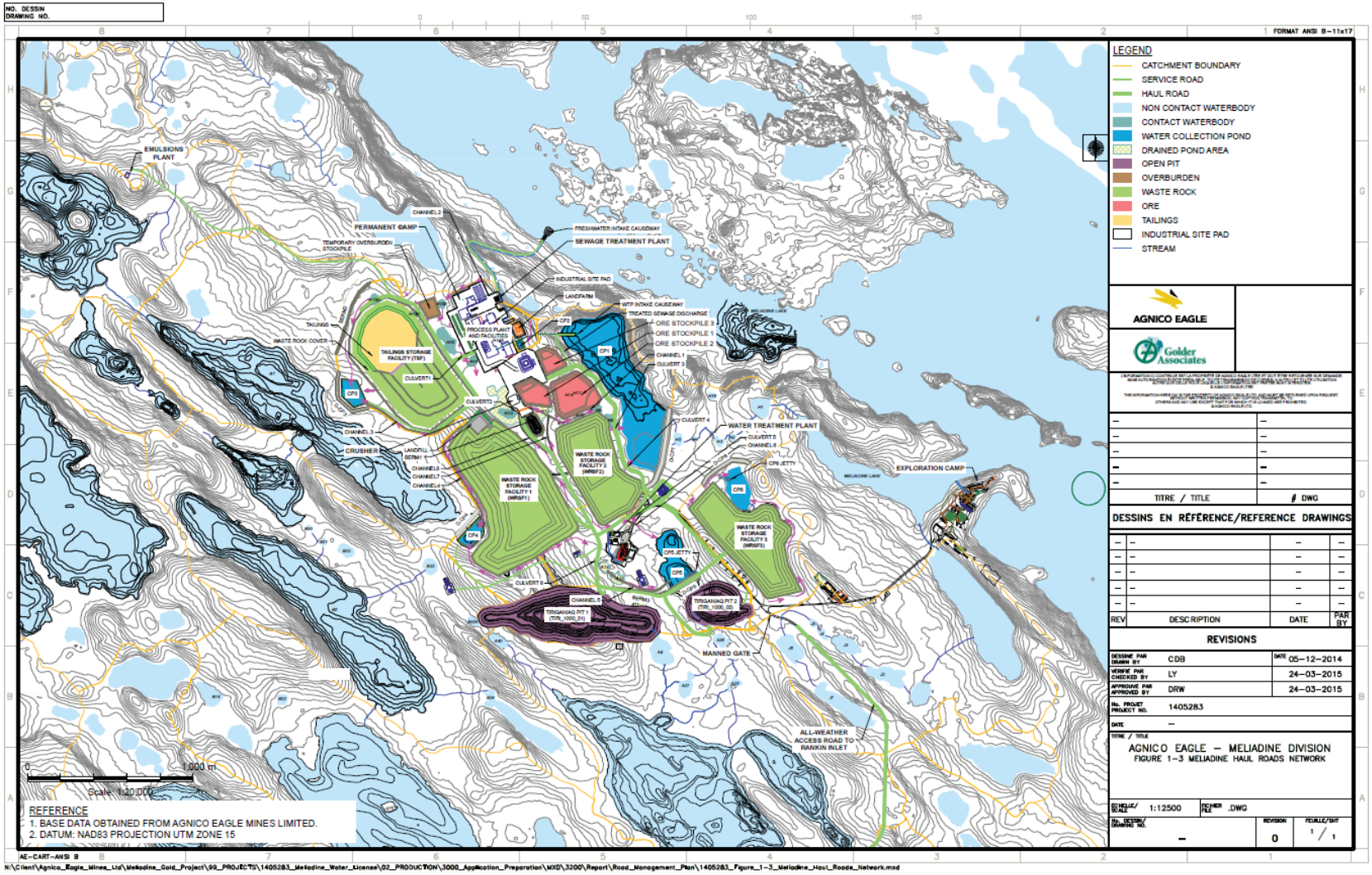


Figure 1-3 Meliadine Haul Roads Network



SECTION 2 • REGULATORY SETTING

2.1 Land Tenure

The majority of all access, service and haul roads are located on IOL administered by the Kivalliq Inuit Association (KIA). The surface ownership of the land encompassing the roads right-of-ways was transferred to the KIA when the Nunavut Land Claims Agreement came into effect. Land and environmental management in this area are generally governed by the provisions of the Nunavut Land Claims Agreement.

Closer to Rankin Inlet, 2.3 km of the AWAR and the complete bypass road are on Commissioner's land held by the Department of Community and Government Services (CGS) for the benefit of the Hamlet of Rankin Inlet.

The Phase 1 AWAR was constructed under land use permits issued by CGS on municipal land, and the KIA on IOL. Leases followed the completion of construction and a legal survey of the road right-of-way. The width of the land leases is 20 m for the length of the roads, wide enough to accommodate their 6.5 m width.

Service and haul roads will exclusively be constructed on IOL under the mine lease(s) issued by the KIA.

2.2 Permitting Regime

Federal, territorial, and municipal laws and regulations that apply to the construction, operation and closure of all access, service, and haul roads are itemized in Appendix B. No land use permit, operating permit, authorization, or license can be issued by any regulatory agency that would allow Agnico Eagle to undertake construction on any other road until the Nunavut Impact Review Board (NIRB) has completed its environmental assessment and issued a Project Certificate Amendment of No. 006.

Table 2-1 outlines the current licences and permits held by Agnico Eagle in relation to the Phase 1 AWAR and for advanced exploration. Most winter roads right-of-way permits are being allowed to expire because the AWAR is complete, but are included for sake of completeness. After receiving a Project Certificate and all necessary authorizations, land use permits were issued by CGS on behalf of the Hamlet for the construction of the bypass road. This permit has subsequently been taken to lease.

A list of anticipated permits, licenses, agreements, authorizations, and approvals for all roads is presented in Table 2-2.

Table 2-1 Licenses and Permits held by Agnico Eagle – Roads

License Number	Explanation	Issued By	NIRB File	Remarks
KVL100B195	Meliadine Prospecting – Land Use	KIA		general land use permit applying to exploration and drilling
KVL302C268	NTI RI-01 Parcel Drilling	KIA		drilling on RI-01 Inuit Owned Lands
KVL308C07	Mel E Exploration RI-01	KIA		drilling on RI-01 Inuit Owned Lands
N2010C0002	PB1, Drilling Permit	INAC	10EN006	
N2013-C002	Exploration, drilling claims CWM	AANDC		
KVCL102J168	Commercial Lease	KIA	07EN044	commercial lease for exploration and underground activities
KVRW98F149	Meliadine Right-of-Way	KIA		amended to allow access to old Discovery camp (renewed annually)
KVRW07F02	Overland Right-of-Way	KIA	07AN063	winter road along all-weather road route(will be allowed to expire)
KVRW11F02	Permanent Road Right-of-Way	KIA	11RN017	
KVCA07Q08	Mainland Esker Quarry Permit	KIA		Tiriganiaq Esker quarry
KVCA11Q01	Permanent Road Quarries	KIA	11RN017	
	WCB Program Authorization	WCB		annual renewal
2BB-MEL1424	Bulk Sampling - Water License	NWB	07EN044, 11RN017	
2BE-MEP1318	Exploration – Water License	NWB	08EN043	
2AM-MEL1631	Meliadine Mine	NWB	11MN034	

Table 2-2 Approvals and Authorizations for All Roads

Authorization	Authority	Basis
Conformity determination with Keewatin Regional Land Use Plan	Nunavut Planning Commission	allows Project to proceed to screening
Article 12, Part 5 Environmental Assessment	Nunavut Impact Review Board	allows Project to proceed to authorizations to build and operate roads
Type A Water License	Nunavut Water Board	allows for construction of the mine and related roads
Navigation Protection Act evaluation	Transport Canada	Agnico Eagle provided a list of water crossings for the Phase 1 AWAR and requested a navigability determination for each from Transport Canada. Subsequently, a navigation evaluation was prepared for small streams, lakes, and ponds impacted by the Project
Inuit Impact and Benefits Agreement	Kivalliq Inuit Association	impacts are compensated and benefits provided to Inuit
Water Compensation Agreement	Kivalliq Inuit Association	compensation for Inuit Water Rights under NLCA Section 20
Right-of-way Lease	Kivalliq Inuit Association	allows right-of-way for AWAR across Inuit lands
Land Use Permit	Rankin Inlet and Community and Government Services	allows construction of the bypass road on municipal land
Right-of-way Lease	Rankin Inlet and Community and Government Services	allows right-of-way for AWAR and bypass road located on municipal lands
Quarry License	Kivalliq Inuit Association	various quarry and borrow pit sites on Inuit Owned Land along the right-of-way for building the road to the mine site and infrastructure pad.
Explosive Magazine Permit Renewal	Workers' Safety and Compensation Commission	permits an explosive magazine on-site and at other approved locations
Class 2 Permit for Heritage Sites (obtained by qualified professional archaeologist)	Department of Culture, Language, Elders and Youth	unavoidable impacts of roads on heritage sites have been mitigated

Amendments to the *Navigable Waters Protection Act* came into force in April 2014 as part of the Federal Government's 2012 Bill C-45. In part, these amendments:

- Changes the name of the *Navigable Waters Protection Act* to the *Navigation Protection Act*;
- Includes a schedule, which clearly lists the major waterways for which regulatory approval is required prior to the placement or construction of work;
- Allows proponents of works in non-scheduled waters to opt-in and seek approval of their proposed work to give them additional legal certainty; and
- Expands the list of low risk works (e.g., minor repairs on bridges) that can be pre-approved because they pose very little impact on safe navigation.

Schedules listing major waterbodies requiring regulatory approval include Schedule 2 Part 1 – Oceans and Lakes, and Schedule 2 Part 2 – Rivers and Riverines. Schedule 2, Parts 1 and 2 do not include any waterbodies found within the Project's footprint. As such, all are non-scheduled waterbodies and Agnico Eagle undertook an assessment to determine navigability.

Using the *Navigation Protection Act*, Agnico Eagle assessed the navigability of the small lakes, ponds and streams within the Project's footprint through the following questions[3]:

- Are the waterbodies within the Project's footprint capable of being navigated by floating vessels for the purpose of transportation/recreational use?
    - If the answer is "no" to this question, the waterbodies are not navigable.
    - If the answer is "yes", then additional questions were asked.

- Is there a public right to travel?
- Is there any historical use of the waterbodies for navigation?
- Is there any proposed future use of the waterbodies for navigation?
- Is the waterbody part of a navigational network or transit route to other waterbodies?
- Is the waterbody a self-contained route for fishing or recreation?
- Will Agnico Eagle's roads offer access to waterbodies within the Project's footprint?

Based on these questions, Agnico Eagle determined that:

- Navigation of streams found within the Project's footprint is not feasible;
- Navigation to and between waterbodies is not feasible;

[3] The questions being asked are in part based on the *Draft Working Framework for determining a Navigable Water under the Navigation Protection Act* prepared by Transport Canada.

- The waterbodies within the Project's footprint do not form part of a navigational network or transit route;
- There is no evidence of historical use of the waterbodies for navigation or recreation; and
- There is no anticipated future use of the waterbodies for navigation.

At this time, Agnico Eagle does not believe that the small lakes, ponds, and streams within the Project's footprint are navigable waterbodies. Agnico Eagle does recognize that Meliadine Lake, Meliadine River, and Melvin Bay[4] as navigable waterbodies.

[4] The port of Itivia is located in Rankin Inlet at Melvin Bay, which is part of Hudson Bay.

SECTION 3 • RELATED DOCUMENTS

Final Environmental Impact Statement documents and documents submitted in support of the Water Licence Application that provided input to the Roads Management Plan include the following:

- Terrestrial Environment Management and Monitoring Plan (Golder 2015);
- Spill Contingency Plan;
- Preliminary Closure and Reclamation Plan;
- Borrow Pits and Quarries Management Plan; and
- Dust Management Plan.

The Plan is part of the Environmental Management and Protection Plan for the Project and will be in effect during the operation and closure of the Project.

SECTION 4 • CONSULTATION

Consultations on the road route with the community of Rankin Inlet, Inuit Elders, Kangiqliniq HTO and KIA were ongoing from as early as 2004. A chronological record of consultation on the AWAR is provided in Appendix A. Extensive details on all consultation for the Project can be found in the Public Engagement and Consultation Baseline Report. In Agnico Eagle's June and August 2014 Kivalliq community consultations, concerns with the AWAR or the bypass road were not raised.

On several occasions in 2013, Agnico Eagle met with the KIA and with the Rankin Inlet HTO to discuss how the Phase 1 AWAR should be managed and to develop a plan on how limited public access would be provided. The HTO told Agnico Eagle that they believe the AWAR should be open to unlimited public access but acknowledged that for Phase 1, the AWAR must be operated with controlled, limited public access until NIRB has the time and opportunity to assess the impact of such open public access. In the interim closure, Agnico Eagle and the HTO discussed how to control and manage limited public access on the Phase 1 AWAR beginning in the summer of 2014. It was agreed that access be limited to ATVs only unless otherwise permitted and be via a pass system where the HTO has involvement over who is granted a pass. Agnico Eagle and the HTO have also been discussing a program that would see the HTO provide wildlife monitoring services for Agnico Eagle along the Phase 1 AWAR. In 2016, 3 meetings were attended by Agnico Eagle personnel at the KHTO meetings. Agnico provided the KHTO with offers and opportunities to assist in the AWAR road surveys. Agreement on this program still remains to be concluded with KTHO. In 2017 and 2018, Agnico continued communicating with KTHO to engage the organization in assisting in these programs. Further meetings are scheduled in 2019 to discuss these items.

Agnico Eagle presented its proposed management procedures for the AWAR, along with options for the development of the Rankin Inlet by-pass road at public meetings held in Rankin Inlet in 2012 (mid-October) and 2013 (mid-February).

There were some elders who would have preferred the AWAR be built using a different alignment that ran west of the Iqalugaarjuup Nunanga Territorial Park and then cut north towards the Project. This would have given them better access to the Diana River and traditional hunting and fishing area to the northwest. Agnico Eagle explained that this was a much longer route as it moved away from the site (i.e. was not a straight line to the Project site) and involved more water crossings and was thus not an acceptable route from Agnico Eagle's needs and perspectives. The community spoke to its preference to the Rankin Inlet by-pass route going along the southwest side of the Rankin Inlet airport and not along the northeast side as proposed in one option by Agnico Eagle. This option placed the by-pass road in conflict with the entry to the airport terminal and future housing development areas.

At the NIRB's technical meeting and pre-hearing conference in early December 2013, road issues were raised by various Kivalliq communities. Unrestricted road accessibility to Inuit, road interactions with

caribou, peregrine nests, dust control, what happens to the roads upon closure, and fuel transport were all raised as concerns.

4.1 Upcoming Consultations Prior to Opening the All-weather Access Road to Public Use

Agnico Eagle wants to meet the expectation of Rankin Inlet residents in opening the AWAR to public use. However, Agnico Eagle shares the concerns of others that all AWAR users need to abide by 'rules of the road' to protect their own safety and that of others. While Agnico Eagle will maintain the AWAR in good operating condition and close it when poor driving conditions prevail, it will be incumbent on all organizations and the public to share in the responsibility in educating AWAR users in safe and responsible road use. This could be as simple as leading by example to participating in developing and endorsing the rules of the road.

Prior to the opening of the All-weather Access Road to public use, Agnico Eagle will:

- Undertake extension consultation with the KIA, HTO, residents of Rankin Inlet, and the Hamlets of Rankin Inlet and Chesterfield Inlet with the purpose of developing rules of the road and safety requirements for public use of the AWAR;
- Update this Plan, with particular emphasis on public safety, and submit it to the Nunavut Impact Review Board, KIA, HTO, the Government of Nunavut (GN), Nunavut Water Board (NWB), Hamlet of Rankin Inlet and authorizing agencies;
- Prior to opening the AWAR to the public, hold community meetings to go over the rules of the road and impress on all potential AWAR users their responsibility for their own safety and that of others in using the AWAR safely; and
- Place signs emphasising safe use of the AWAR at strategic locations along the AWAR.

The rules of the road will be posted on community bulletin boards; and on a quarterly basis, read over the community radio and placed on the local television station. Agnico Eagle will also post them on its Nunavut web site.

4.2 Road Use by Nunavummiut and Other Developers

The AWAR partly covers existing ATV and snowmobile trails, which were used as access to traditional areas for hunting, fishing, and recreation in the Meliadine Lake, Machum Lake, and Twin Lakes areas. Agnico Eagle is unaware of any possible future developments near the Project that could make use of the access and/or service roads.

It is Agnico Eagle's responsibility to decommission and reclaim the roads once its activities in the area are complete. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowners (the KIA and the Hamlet) and then complete its own environmental assessment and permitting process covering future use. Agnico Eagle does not own the land on which the roads are constructed and, thus, cannot transfer future ownership or use privileges to any third party. Agnico Eagle must complete its obligation to decommission and reclaim

all roads unless directed otherwise by a combination of the landowners and other regulatory agencies who issued permits/authorizations for the roads.

4.3 Use of Inuit Qaujimajatuqangit in the Planning of the Roads Management Plan

Inuit Qaujimajatuqangit (IQ) is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. Information collected through IQ can contribute to mine design and planning, as well as monitoring activities. Agnico Eagle is committed to including IQ and public concerns raised through IQ, where practical, in the design of management and monitoring plans for the Project. Agnico Eagle continues active engagement with communities and Inuit organizations as the Project proceeds through permitting, operations, and closure. Additional IQ collected through consultation and engagement will be included in updates to the design and implementation of environmental programs.

The Road Management Plan considered IQ (including TEK, TLU) and concerns regarding Project effects on traditional resources and traditional land use sites through the following Project design and mitigation measures:

- In allowing public access on the AWAR, Agnico Eagle took into consideration that the area in the vicinity of the Project will continue to be used for traditional purposes during the construction, operation, and closure phases of the Project.
- Access to traditional use sites are being mitigated by constructing ramps and installing signage along Project roads to facilitate road crossings for existing ATV and snowmobile trails. Snow clearing takes into consideration the location of snowmobile trails such that they are not blocked, and snowmobile crossings are identified with signs identifying the location of the trail prior to snow removal.
- The Itivia laydown yard was designed to avoid impacting the existing snowmobile trail so that local residents can continue to access the sea ice at Melvin Bay.
- Elders expressed the greatest concern regarding potential effects of the Project on caribou including road construction and motorized vehicles potentially limiting or altering their movement patterns, and the potential for overhunting to occur as a result of increased access to caribou migration routes and calving grounds. Agnico Eagle consulted with the Government of Nunavut, the KIA, the Kivalliq Wildlife Board, local HTOs, and the public in developing appropriate monitoring and mitigation measures related to the ease of harvesting of caribou afforded by the AWAR. The result of these consultations was a Road Access Management Agreement (see Section 10.2).
- IQ indicated that land mammals including Arctic fox, wolverine, and wolf are important traditional resources for harvesting, and community concerns were raised regarding the potential effects of snowmobiles, and the potential of road construction creating barriers to

wildlife movement. The routing and design of the AWAR and service roads were selected to minimize potential Project effects on the environment, including wildlife movement. Potential adverse effects to wildlife abundance or movement were considered in setting the rules of the road, including setting maximum speed limits and ensuring wildlife has right-of-way on the roads, wildlife will not be harassed and hunting is prohibited within 1 km of the AWAR. Furthermore, locations of large aggregations of animals is reported and all incidents between vehicles and wildlife will be reported and investigated. Finally, a wildlife monitoring program will be implemented with input from the local stakeholders to record the species, numbers and location of wildlife observed along the roads, with particular focus on caribou, muskoxen, bears, wolves, migratory birds and raptors.

- Community concerns were also raised regarding the potential for the Project to change the land and water, subsequently impacting the diet of land animals. There was also concern that road construction could affect environmental stability and contaminate water. IQ also indicated that berry harvesting is an important activity in the area, and community members expressed concerns over dust that could impact the health of both water and vegetation. These concerns were considered in proposing the following mitigation measures and protocols to be implemented during construction and operations to preserve wildlife, prevent permafrost degradation, control surface runoff and sedimentation, and mitigate dust:
    - Sedimentation and erosion control measures were implemented prior to the start of work and maintained until after all disturbed areas have been stabilized; and
    - Regular inspection of the roads are conducted to identify areas of ponding, erosion or sedimentation.

- IQ indicated that the rivers and Meliadine Lake are considered important fish harvesting sites, and community concerns were raised regarding potential contamination of waterbodies in the entire Meliadine watershed, and for potential adverse effects to fish and other traditional resources. Accordingly, to protect fish spawning and nursery periods of local fish populations, no in-water work was taken place from May 1st to July 15th. In addition, areas where dust deposition could impact fish habitat and/or water quality, mitigation measures were implemented, including grading of the road surface, placement of new coarser topping, and/or watering/addition of $CaCl_2$ on the road surface.

- IQ has indicated that the entire Meliadine valley, including Iqalugaarjuup Nunanga Territorial Park, has a long history of traditional use and many important cultural sites. To mitigate the potential for disturbance to cultural sites, all employees or contractors are not allowed to construct any side roads/trails off the west side of the AWAR between Km 1 and Km 8, and regular road inspections occur to ensure that no unauthorized trails or access routes leading from the AWAR into the Park are being created. In addition, Agnico Eagle and GN-DoE Park staff will work together to discuss what other measures can be taken to prevent unauthorized

access into the park, including potential signage, public education and the placement of barriers.

- To prevent potential ice buildup at the lower Meliadine River crossing bridge resulting in flooding of important cultural sites upstream from the bridge, regular inspections and monitoring occurs so that potential risks to cultural sites can be mitigated.

SECTION 5 • MEASURES TO PREVENT PERMAFROST DEGRADATION

Roads have been designed with a minimum fill thickness to maintain permafrost conditions within the subgrade soils. The thermal modelling indicated a minimum road fill thickness of 1 m is required above ice poor subgrade soils to maintain the soil in a frozen condition year round. Similarly, a minimum road fill thickness of at least 1.3 m is required above ice rich subgrade soils.

To the greatest extent possible, roads are constructed in the winter when the subgrade soils are frozen to prevent insulation of thawed subgrade soils. A rough base is advanced at the full road width so that the base of the roads is laid down in winter frozen ground conditions. The stream crossing culverts are also installed in the winter. Once the rough base and stream culverts were installed, the remainder of the construction was completed by building up the rough base primarily under winter conditions, and placing the final topping materials during the spring and early summer.

Mitigation and environmental design features to reduce the potential for permafrost degradation are as follows:

- Road alignments avoid, where possible, fine-grained, poorly drained, ice-rich, frost susceptible soil conditions as noted by geomorphologic mapping, due to their susceptibility to thaw related settlement;
- Regions of high ground relief (higher elevations) are sought to provide better drainage conditions, to minimize the potential for snow drifting on the road and to avoid organic depressions and/or other poor ground conditions, which are more abundant in the low lying areas;
- Road fill material was placed directly over the existing soil layer without cutting, stripping, or grubbing to avoid disturbing the subgrade soils;
- Thick drifted snow was removed before road fills were placed;
- The road fill thickness was a minimum of 1 m in thaw-stable soils, and 1.3 m in thaw-sensitive soils; and
- Construct access, service, and haul roads in the winter when the subgrade soils are frozen to prevent insulation of thawed subgrade soils, to the greatest extent possible.

The road and its shoulders is inspected weekly (at a minimum) during the summer period (June to August) for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment. Such movements are expected and may lead to longitudinal cracking and thaw settlement especially for portions of the road founded on thaw susceptible (ice rich) soils. When such areas are discovered, the affected area is repaired using granular material and/or crushed rock. Agnico Eagle will maintain stockpiles of such material in select borrow/quarry areas along the road.

SECTION 6 • TRAFFIC MANAGEMENT ON ACCESS ROADS

6.1 Management of Agnico Eagle Traffic on the Access Roads

All of the required fuel, supplies, and equipment for the mine will be transported to the mine via the bypass road and AWAR. Saline water delivery from the mine to Itivia occurs on the bypass road and AWAR. All drivers transporting these materials and personnel will either be Agnico Eagle employees or employees of contractors directly hired by Agnico Eagle. They must possess a valid driver's license from a Canadian province or territory, for the appropriate class of vehicle, for them to be allowed to operate vehicles on access roads. Agnico Eagle educates all of its employees and all of its contractor's employees on road safety rules during the safety introduction training that occurs when first starting work at the mine site.

All Agnico Eagle vehicles that routinely travel on the access roads are equipped with a radio set to the requisite road frequency. Similarly, contractor's vehicles that routinely travel on the access roads are also equipped with a radio set to the requisite road frequency. Consequently, Agnico Eagle and contractor traffic on the road always have radio contact with the northern gatehouse, security, Agnico Eagle and contractor traffic. This system is used to report any unusual conditions along the roads such as: location of other vehicles, presence of wildlife on or near the roadway, presence of non-Agnico Eagle traffic such as ATVs, snowmobiles or other vehicles on the access roads, special road conditions, and special weather conditions. All Agnico Eagle drivers and contractors using the road are required to monitor and report to the northern gatehouse by radio any observed unauthorized or unsafe use of the road.

The AWAR is open to restricted public access and as such when there is a scheduled shut down of the road due to weather or special shipments of restricted products Agnico Eagle will notify the Hamlet. It is proposed in the future that Agnico Eagle may be able to establish full cell phone service along the full length of the AWAR during the operation of the mine. When this occurs the prime mechanism for contacting Agnico Eagle in the event of an emergency will be by cell phone. Once such service capability is in place, Agnico Eagle will take the following action to communicate how the public can contact Agnico Eagle to report an emergency on the AWAR. The following guidelines are presently being used to notify the public:

- Signage at the Rankin Inlet end of the road and at the mid-point Emergency Spill Response station(at a minimum) will provide the public with the Agnico Eagle phone contact number (site security) to which the public can report an emergency along the AWAR.
- Signage near Rankin Inlet will provide the current status of the AWAR, stating whether it is open or closed to public use that day.
- Include this information on periodic public information sessions on the rules of the road and road safety procedures delivered in Rankin Inlet.
- Include this information in periodic community radio and TV announcements.

- Information is provided on Agnico Eagle's Nunavut web page.
- AEM webpage indicates road closures and information.
- The gatehouse at the 7 km marked will be closed and the gate house attendant can discuss the closure with interested parties.

6.2 Management of Non-Agnico Eagle Traffic on the All-weather Access Road

Agnico Eagle works with the KIA, HTO, the Government of Nunavut, and the Hamlet of Rankin Inlet to devise a system for unrestricted public access to the AWAR at a future date. Until this system is in place, traffic on the AWAR is controlled by Agnico Eagle through an unmanned gate at its southern end and a manned gatehouse at its northern end.

The rules of the road[5] developed for the roads apply to all users of the road, including Agnico Eagle employees, Agnico Eagle contractor employees, and the public. Agnico Eagle holdsd public information sessions in Rankin Inlet for AWAR users, on a regular basis (minimum of twice per year). The Government of Nunavut will also be consulted prior to opening the AWAR to unrestricted traffic. A copy of the rules of the road, which will have a strong emphasis on road safety, will be presented at these sessions.

Agnico Eagle will also holds public information sessions in Chesterfield Inlet for AWAR users on a regular basis (minimum of once per year). A copy of the rules of the road will be presented at these sessions. This is required because Chesterfield Inlet has now built approximately 17 km of trail/road south from their community towards Rankin Inlet and occasionally drive their ATVs/snowmobiles to Rankin Inlet.

Agnico Eagle will also use other communication tools to get the road access procedures and road safety rules out to the public in Rankin Inlet. These will include community radio, community TV[6], Facebook page, postings around town, through the Project office in Rankin Inlet, and via an Agnico Eagle Project website. The communication will be in both English and Inuktitut. All non-Agnico Eagle road users will also be encouraged to monitor and report any observed unsafe use of the roads to Agnico Eagle.

6.3 Other Access Control Procedures

There will be occasions when access to the AWAR will be restricted for short time periods for special reasons. This includes bad weather, unsafe road conditions, maintenance activity on the roads, heavy project related truck traffic, movement of oversized loads, and/or presence of large numbers of

[5] See Section 8 for complete details on rules of the road measures proposed for the AWAR.

[6] Notices on rules of the road will be placed on community radio and television a minimum of 4 times a year.

caribou on or adjacent to the road. The AWAR could also be temporarily closed in the event of an incident, accident or other event requiring mitigation or response. These short-term closures will be required to ensure safety.

In communicating such short-term closures, Agnico Eagle will take the following actions:

- Agnico Eagle will issue a daily road condition bulletin by means of email to a subscriber list, through an Agnico Eagle website, and through community radio. The bulletin will provide information on current road and weather conditions and on special activity planned for that day on the AWAR.
- Agnico Eagle (with the consent of the Hamlet of Rankin Inlet) will set up and maintain a sign in English and in Inuktitut to be located close to Rankin Inlet on the existing municipal road out to the Char River and the Territorial Park that indicates whether the AWAR is “open” or “closed” at that specific point in time.
- Agnico Eagle will limit access and, in certain conditions, close the roads to all traffic during bad winter weather (blizzard or white out conditions). In the worst weather, the southern gate on the AWAR near the Char River will be closed and signed accordingly;
- Agnico Eagle will limit access to the AWAR when it is not safe as a result of an accident or a road maintenance problem.
- Agnico Eagle will limit access to the AWAR when large numbers of caribou are near to or crossing the road. This will occur in consultation with the Kangiqliniq HTO.
- Agnico Eagle will work with the GN, KIA, and HTO to establish a one kilometre no shooting zone on both sides of the AWAR to ensure that project workers and all other road users are not inadvertently exposed to the risk of accidental shooting.
- Agnico Eagle reserves the right to refuse access to individuals who do not respect the rules of the road on safety, speed and the no shooting zone when using the AWAR.

The GN Department of Environment (GN-DoE) has expressed a valid concern that there is potential for unauthorized trails/access routes to be created from the AWAR into a designated preservation zone within the Iqalugaarjuup Nunanga Territorial Park at an area to the northeast of the Meliadine River just north of the new Meliadine River Bridge. The AWAR is in close proximity to the park boundary in this location. The GN-DoE have pointed out that such an unauthorized use of this designated preservation zone could cause irreparable damage to the natural and cultural features meant to be protected within this territorial park. Agnico Eagle acknowledges this concern and commits to work with the GN-DoE to reduce/prevent this potential unauthorized access from the AWAR to this part of the Iqalugaarjuup Nunanga Territorial Park.

In this respect, Agnico Eagle will take the following actions:

- Agnico Eagle commits that it will not allow any of its employees or contractors to construct any side roads/trails off the west side of the AWAR between Km 1 and Km 7. Agnico Eagle has no intention of constructing any side roads and/or trails off the designated AWAR corridor at

any point along its length, and if so, additional regulatory approval would be needed under the Terms of the Road Use Lease with the KIA and/or Community & Government Services before any side road/trail could be constructed;

- Agnico Eagle will task its Road Supervisor with keeping an eye on this critical section of the AWAR as part of its regular road inspections (as outlined in Section 7 of this Roads Management Plan) with the objective of identifying any signs of unauthorized trails/access routes leading from the AWAR into this area of the Park. If any evidence of unauthorized access trails is discovered, the Road Supervisor will contact GN-DoE Park Staff in Rankin Inlet to inform the GN-DoE Park staff of the discovery and to jointly work on a plan to prevent any further use of such access points. Agnico Eagle would then take the agreed upon measures to implement the plan provided that such measures are reasonable; and
- Agnico Eagle will meet with GN-DoE Park staff to jointly discuss what other measures can be taken to dissuade/prevent such potential unauthorized access into this area of the Park (e.g. possibly signage, public educational measures, placement of barriers, etc.). Agnico Eagle will then implement the agreed upon measures. Agnico Eagle will continue to periodically meet with GN-DoE park staff (at least annually, but more frequently if required) to discuss protection of this designated preservation zone within the Park.

6.4 Projected All-weather Access Road Traffic between Itivia and the Mine

Agnico Eagle and contractor traffic on the AWAR between Itivia and the mine site is not expected to vary as much as public traffic between summer and winter. Table 6-1 provides the projected traffic for the bypass road and AWAR.

Agnico Eagle and contractor vehicles which use the road include, but are not limited to: pick-up trucks, cube vans, buses, fuel trucks, tractor-trailers, snowplows and graders. However, the amount of traffic will be highly dependent on the level of activity on site and the time of year, such as when supplies and materials arrive by sea, as well as on the weather and the traffic as a result of transporting saline water from the mine to Itivia. Also, should flights not be able to get into Rankin Inlet, passenger vans/buses would only transport local employees to the mine site, which would reduce the number of vans/buses by half.

Summer traffic is expected to be moderately higher than winter traffic as more contractual work can be expected over the summer. Fuel deliveries and passenger van/bus traffic are not expected to vary a great deal between winter and summer.

In the summer of 2019 Agnico Eagle will begin trucking treated saline water from the underground mine, to Itivia, where it will be discharged to sea. This process will result in increased traffic along the AWAR and Bypass road.

Table 6-1 Estimated Average Daily Traffic on the All-weather Access Road

Type of vehicle	Winter		Summer	
# of vehicles	Week Days	Weekends	Week Days	Weekends
Mine-Related Traffic				
Pick-up trucks	10-12	4-8	12-14	6-10
Cube vans	4	1	4	1
Passenger vans/buses	2	1	2	1
Fuel trucks[(a)]	2	2	2	2
Transport trucks[(b)]	1	1	6-14	6-14
Saline Trucks[(c)]	0	0	16-20	16-20
Public Road Use				
Pick-up trucks	4-6	2-4	6-8	12-16
ATVs/snowmobiles	4-8	4-10	10-16	10-20

[(a)] Transport of fuel is continuous, year round. A fuel truck carries on average 45,000 litres.

[(b)] Transport of dry goods from Itivia largely takes place over a 4-month period, from August to November.

[(c)] Transport of treated saline water from mine to Itivia is estimated at 800 m3/day over approximately 3-month period (July 1 to October 1)

Projected public traffic on the access roads has greater uncertainty as it will be weather dependent. Agnico Eagle estimates that 25-50% of the anticipated trips will be incremental to current access, which is by ATVs and snowmobiles. During periods of mild weather, more traffic can be expected as those living in Rankin Inlet may travel up the AWAR for a day of fishing, hunting, berry picking, or other leisure activities. During poor weather conditions, public traffic on the road can be expected to drop significantly and it is likely that no public access will occur during such conditions.

During the Phase 1 operation of the AWAR, Agnico Eagle will collect information on traffic volume on the road on a daily basis. The survey information will record the number and types of mine vehicles, and the number and types of public vehicles using the AWAR over a 12-hour period, typically from 8:00 AM to 8:00 PM. The surveys will gauge the accuracy of the predictions contained within Table 6-1. The survey results will form part of Agnico Eagle's annual report.

SECTION 7 • INSPECTION AND MAINTENANCE OF ACCESS, SERVICE, AND HAUL ROADS

Agnico Eagle recognizes that inspection precedes maintenance, and believes that a thorough inspection program leads to the early identification of areas of the roads where improvements are necessary. The early resolution of any deficiencies results in less ongoing maintenance and repair of the driving surface and water crossings.

Agnico Eagle has the sole responsibility for the ongoing inspection and maintenance of all of the components of the access, service, and haul roads, including road beds, bridges, culverts, and borrow/quarry sites used in the construction and maintenance of the roads. Agnico Eagle applies the experience that it has gained from the ongoing operation of the Meadowbank All-Weather Road, which has now been in operation for eight years. This experience is applied in the planning of day-to-day operation, inspection, and maintenance of the Project roads. Agnico Eagle has a road supervisor who is responsible for the ongoing road inspection and maintenance of the access, service and haul roads. The operation and maintenance of all roads applies the same principles.

The road supervisor conducts periodic inspections (minimally on a weekly basis) of the roads to ensure that the roads are maintained for safe travel of personnel, equipment, and supplies. These inspections are recorded, including deficiencies which are followed up by a corrective plan. These periodic inspections include an inspection of the bridge abutments and a visual observation of the road surfaces to assess the status of road foundation.

During the summer period (June to August), the road surface is maintained with fresh gravel being spread as required and regular grading of the road. By September, the road starts to freeze; therefore, gravel is added for safety reasons. Snow clearing and road sanding along the road are done to operate vehicles on the roads safely. The manner in which the snow is cleared will also take into account the road configuration to avoid snow accumulation that could cause problems during the freshet or block snowmobile trails.

All roads are inspected for signs of accumulation of ponded water either on the road surface or along the sides of the road. Where noticed, the Agnico Eagle road supervisor evaluates and monitors the accumulation to determine why water is accumulating in these areas. Based on these evaluations, the road supervisor takes remedial action where and when necessary to correct the cause of such ponding, such as grading of the road surface to remove areas of ponding or installation of additional culverts if the road is causing excessive water ponding.

7.1 Sedimentation Control

7.1.1 Construction

Various mitigations and best practices that were followed during the bypass road construction to control sedimentation and these are as follows:

- No in-water works took place from May 1st to July 15th, to protect fish spawning and nursery periods of local fish populations; this would apply to all stream crossings;
- Sediment and erosion control measures were implemented prior to the start of work and maintained during the work phase to prevent entry of sediment into water or the movement of re-suspended sediment into the stream crossings;
- Sediment and erosion control measures were left in place until all disturbed areas were stabilized;
- All disturbed areas were physically stabilized as soon as possible following construction using rock and/or vegetation;
- Machinery used near stream crossings or working within the drainage of Nipissar Lake arrived on-site in a clean condition and be maintained free of fluid leaks to keep contaminants out of the drainage basin;
- The equipment was re-fueled, serviced, and washed away from the stream crossings to prevent deleterious substances from entering the water. Fuel, lubricants, hydraulic fluids, etc., were not stored within 31 m of the high water mark of any waterbody, and were kept in an area where spillage can be contained, and in a manner inaccessible to all wildlife; and
- An emergency spill kit was kept at the work site in case of fluid leaks or spills from machinery.

In addition to those listed above, the following mitigation measures will be used to minimize potential effects on water resources should road construction activities occur in non-winter months:

- Regular inspection of the road to identify areas of ponding, erosion, or sedimentation, will be conducted;
- Construction runoff will be captured and managed to minimize suspended solids in the watercourses, where applicable; and
- In-stream construction work will be avoided, or limited, to the minimum extent possible.

7.1.2 Operation

During the operational phase, routine periodic inspections of the AWAR and bypass road continue to be conducted as discussed previously in this Section. These inspections will include looking to identify areas of ponding, erosion, or sedimentation. If identified, any such areas will be addressed using the same mitigation measures described in this section for the construction phase.

7.2 Watercourse Crossings Inspections and Maintenance

The watercourse crossing inspection and maintenance program has three main components:

- A regular inspection program to identify issues relating to watercourse crossings, such as structural integrity and hydraulic function;

- An inspection program to track the impacts of large storm events on watercourse crossings, such as structural integrity and hydraulic function; and
- A culvert location inspection program to ensure that culverts have been installed in the right locations with respect to the watercourse and that culvert capacity is adequate to ensure that the culvert(s) pass the water under all hydraulic conditions. In most cases there will be multiple culverts installed at different elevations at each stream crossing to ensure that these culverts can adequately pass normal summer flows as well as spring freshet and heavy rainfall flows.

7.2.1 Regular Crossing Inspection and Maintenance

Just prior to spring freshet, all culverts and stream crossings (including the bridge crossings at the Char River, lower Meliadine River and at the M5 Bridge (see Figure 1-1) will be inspected to confirm that they are in a state that will allow them to accommodate the rapid spring thaw that is seen in the north. During the freshet period, crossings inspections will be performed twice a week (mid-May through June) and weekly during the remainder of the ice-free period prior to fall freeze-up (July through October).

These inspection activities for each watercourse crossing will consist of:

- Visual inspection of its infrastructure to identify defects, cracks or any other risks to structural integrity. Particular attention will be paid to the inlet and outlet structures of culverts, and to bridge abutments and their foundations, as required;
- Visual inspection to identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damages as soon as possible; and
- Visual inspection of upstream and downstream channel to identify bed erosion or scour around the watercourse crossing structure. Particular attention will be paid to bridge abutments and abutment foundations as they will be vulnerable to scouring and erosion during flood events. Particular attention will also be paid to potential sources of sediment transport at the crossing.

Inspection results will be recorded by Agnico Eagle to help track changes in conditions over time. Maintenance operations will consist of undertaking remediation of any detected problems and repairing damage as soon as possible.

7.2.2 Archaeological Sites and Ice Buildup

Agnico Eagle acknowledges that the GN Territorial Archaeologist has concerns that potential ice buildup at the site of the lower Meliadine River bridge crossing can cause water to back up and flood important archaeological sites upstream from the bridge in the Iqalugaarjuup Nunanga Territorial Park. Agnico Eagle has committed to work with the GN to inspect and mitigate where possible such

risks. To this effect, Agnico Eagle has committed to provide copies of its twice weekly inspections at the lower Meliadine River Bridge to the GN Territorial Archaeologist in the spring/early summer freshet period via email or fax. The intention is to allow both Agnico Eagle and the GN Territorial archaeologist to monitor for this potential risk, specifically for the purpose of taking appropriate action in a timely manner should ice buildup reach the point where these sites are at risk of flooding. The intent is for action to be taken prior to harm being done. The action plan would be developed and implemented by Agnico Eagle in consultation with the GN.

Agnico Eagle has agreed to work with the GN to develop other protective measures to protect important archaeological sites upstream of the Meliadine River Bridge within the Iqalugaarjuup Nunanga Territorial Park if it is shown that these sites continue to be damaged by flooding caused by ice and snow accumulation at the bridge.

7.2.3 Event Crossing Inspection and Maintenance

Inspection frequency will increase just after heavy or prolonged rainfall storm events. Visual inspection of each watercourse crossing will be completed to identify potential risks to the crossing's structural integrity, debris accumulation, and whether erosion and scouring have occurred. Water accumulation along the road will also be monitored. Results will be recorded by Agnico Eagle to help track changes in condition over time. The remediation of any detected problem and any necessary damage repairs will be undertaken as soon as possible, under the direction of Agnico Eagle's road supervisor.

7.2.4 Culvert Location Inspection

Following their installation, the culvert crossings were visually inspected to confirm they have been properly executed and installed. These culverts were installed during winter conditions and thus it is possible that a culvert will not be sited correctly to pass all ponding of water through the road. The road supervisor or designate checks for such conditions during the first snow melt and after rain events so that adjustments can be made accordingly. Additional culverts will be installed, if necessary, should the inspection indicate that the culverts were installed in a location that does not optimally route water flows.

7.3 Snow Removal and Snow Management – Winter Maintenance

Sections of the Meliadine roads are expected to experience snow drifts because of strong winds over the winter period[7]. As much as possible, this snow will be cleared to the downwind side of the road

[7] This has been the experience along the AWAR where significant snow accumulation occurs at one location on municipal land known as Apache Pass.

to limit the wind re-depositing the same snow on the cleared road. Routine spring snow management will include the removal of any snow that accumulates at bridges and culverts so that water at freshet can move freely through the culverts and under bridges. In the case of culverts, snow will be removed from both ends but not from the inside.

Where snowmobile trails cross the road, snow clearing will be mindful of not placing snow on the trails thereby making crossing the roads easy.

The report, "Preliminary Snow Drift Assessment of the Meliadine All-Weather Road from Rankin Inlet to the mine site, Nunavut" (Golder Associates 2011c) provides an assessment where snow drifts can be expected. It states:

> *"Observations seem to indicate that snow drifts can be expected on the lee of short, steep slopes and along lake shores."* and
>
> *"Maintenance will be required during operations to manage snow accumulation along the road alignment; however, most of the alignment appears to be located along the windward slopes and ridge crests where there should be a limited tendency for snow to build up."*

The design of the AWAR between the mine site and Rankin Inlet factored in snow accumulation and this is one of the reasons the road is located along the height of land as much as possible and has a northerly alignment.

Dangerous ice formation on road surfaces, including the AWAR, is expected to occur periodically leading to their temporary closure until the roads can be graded and/or sanded. These procedures are employed at Meadowbank and were adopted for the Project. Road sanding and grading equipment is available at Meliadine to address icy road conditions.

7.4 Dust Suppression

The Dust Management Plan addresses in detail the actions that Agnico Eagle takes to suppress dust generated by road traffic during the non-winter months when dust becomes an issue. Particular attention is paid to the dryness of the bypass road surface, the number of vehicles, weight and speed, and maintenance road near Nipissar Lake where dust suppression is a priority.

In general, the amount of dust generated along a road is dependent on the driving surface. Regular grading of the roads combined with the addition of granular material to the driving surface is needed. This improves road safety and reduces the amount of dust generated. Dust is also mitigated by maintaining posted speed limits.

In areas or times identified by the Agnico Eagle road supervisor as being prone to high dust levels, where safe road visibility is impaired, or in areas where dust deposition could impact fish habitat and/or water quality, the road supervisor arranges mitigation measures as appropriate. This could

involve actions such as grading of the road surface, placement of new coarser topping, and/or watering of the road surface. Use of chemical dust suppressants, such as Calcium Chloride,is only used as a last resort and only in accordance with the Guideline for Dust Suppression on Unpaved Roads published by the Government of Nunavut Department of Environment (GN 2014).

Dust control measures along the AWAR, service and haul roads, and travel surfaces such as yards at the mine site have been identified by the community of Rankin Inlet as an important health concern important health concern[8].

[8] Following the technical review and community roundtable sessions held by the NIRB on the Draft EIS, NIRB directed Agnico Eagle to prepare a Dust Management Plan for inclusion with the Final EIS. This plan was prepared and was updated following receipt of Final Hearing Report.

SECTION 8 • ROAD SAFETY

Agnico Eagle security personnel along with Agnico Eagle's road supervisor monitor activity on all roads through radio contact with both staff at the gatehouse and drivers on the roads, and through periodic patrols of the roads. All Agnico Eagle and contractor vehicles that routinely travel on the roads are equipped with a radio set to the requisite road frequency (Section 6). This radio system is used to report any unusual conditions along the roads such as:

- Location of other Agnico Eagle vehicles;
- Presence of wildlife on the roadway;
- Presence of non-Agnico Eagle traffic such as ATVs, snowmobiles, or other vehicles;
- Non-Agnico Eagle vehicles broken down on the roads;
- Any unsafe practices noticed;
- Any special road conditions; and
- Any special weather conditions; etc.

Agnico Eagle works to develop partnerships with the residents of Rankin Inlet, community organizations, and government departments in developing rules of the road, and educating the non-Project related users on road safety, on good driving practices, and on influencing people's behaviour on the roads. Emphasis is directed to the use of helmets, seat belts, observing the posted speed limits, improving one's visibility by wearing reflective clothing when on a snowmobile or ATV, not drinking and driving, dealing with driver inexperience, etc.

These are the same safety rules that apply to all users of the roads, including Agnico Eagle employees, Agnico Eagle contractor employees, and public users of the roads. The rules of the road include but not limited to the following:

- Maximum speed limits:
    - on AWAR: 50 km/h;
    - on the bypass road: 30 km/h;
- Use of seat belts by all drivers and passengers is mandatory;
- Driving under the influence of alcohol or intoxicating drugs is prohibited;
- Wildlife has right-of-way on the roads, and no harassment of wildlife is allowed;
- All hunting activity must avoid shooting across the road and should respect a safe shooting distance from the road (suggested at 1 km);
- Hunting is prohibited within 1 km of the AWAR and the Project;
- Vehicles are not to park on the travelling surface of the roads but pull off the road at a safe location such as passing turnouts to prevent accidents (passing turnouts are spaced approximately every 400 ± 50 m along AWAR length); and

- No public traffic is allowed within mining areas; these are industrial work sites and, thus, non-Project related vehicles are stopped at the gate when in operation. Signs are posted warning of an upcoming gate[9].

Agnico Eagle holds public information sessions in Rankin Inlet for users of the roads prior to the roads opening and on a regular basis thereafter (minimum of twice per year). The rules of the road and safety considerations are presented at these sessions, and modified if necessary based on broad and frequent consultation.

Agnico Eagle also uses other communication tools to get the road access procedures and rules of the road and safety considerations out to the public in Rankin Inlet. These include community radio, community TV, Facebook/Internet, postings around town, signage near Rankin Inlet indicating whether the AWAR is open, through the Project office in Rankin Inlet and via the Agnico Eagle Project website. The communication is in English, Inuktitut, and French.

Agnico Eagle has placed an emergency spill response sea can at km 7 and km 18 along the AWAR. The station has the necessary spill response supplies to address any spills that occur along the road in an emergency situation.

8.1 Road Signage

Agnico Eagle has posted appropriate road signs along the roads in both English and Inuktitut. Typically, signs advise drivers of the posted speed limit, of approaching bridges, of approaching curves, and/or areas of lower visibility (blind hills or obstructed curves).

English and Inuktitut signs are posted at the southern and northern ends of the AWAR, and at an appropriate mid-point to advise any public travelling by snowmobile or ATV that they are entering an area that may be potentially hazardous due to the presence of heavy vehicle traffic. This recognizes that snowmobiles and ATVs can enter and leave the road from any point along the roads. Signs are also posted to advise the public that they are approaching the gate at the northern end of the AWAR where public access is not allowed. This is just before entering the mine site, where heavy industrial activity and large vehicles can be expected. Both ends of the bypass road have automatic manually operated gate with signs indicating it is not open to public access.

Signs are also located at the bypass road, where it enters the AWAR, indicating that the bypass road is a private and restricted road for Agnico Eagle employees and contractors only. A sign also occurs at the start of the bypass road located at Itivia indicating that the bypass road is a private road.

[9] A gate was installed on the AWAR near the mine site.

Speed limit signs are posted at intervals of approximately every 5 km along the roads. Reflective flags are installed along one side of the roads to help drivers identify the road shoulder during blizzard, white-out conditions or dense fog. Typically, these flags are black in colour to help them stand out in white-out conditions, and are nominally set at intervals of 100 to 200 m apart. Kilometer markers are posted at intervals of at least 1 km along the roads.

A list of road signage on roads is presented in Table 8-1.

Table 8-1 Road Signage

Element	Location
Safety precautions and users advice	at the southern and northern ends of the AWAR, and at an appropriate mid-point
Stop signs	where required at road junctions
Give way	at haul and service road junctions
Blind hill	200 m ahead of the beginning of a blind hill
Speed limit	nominally at 5 km intervals
Curve	200 m ahead of a curve
Bridge announcement	200 m ahead of a bridge
Bridge side sign	On each side of the bridge
Flexible delineators (flags)	nominally at 100 to 200 m intervals
Kilometres markers	nominally at 1 km intervals
Private Road	Bypass road at Itivia and where the bypass road intersects AWAR

8.2 Policing of Rules of the Road

For privately operated roads, responsibility for “policing” will not fall to the RCMP. Responsibility for all operating and maintenance activity on roads rests solely with Agnico Eagle. For the access roads, Agnico Eagle concentrates on raising public awareness and commitment to road safety, and improving communication, cooperation and collaboration among all stakeholders on the safe use of the roads. For all roads, all Agnico Eagle employees and its contractors who use the roads are required to take road safety training before being allowed to access the roads.

Agnico Eagle uses its road supervisor and site security to monitor what is occurring on the roads. They monitor activity on the roads through radio contact with the staff at the gatehouse, through periodic patrols of the roads, and in conversation with drivers on the roads at the time. Agnico Eagle monitors speed limit infractions by direct observation of drivers seen driving too fast and by recording the time taken to drive between the Project and the Hamlet. Agnico Eagle also relies on radio contact with all Agnico Eagle and Agnico Eagle contractor vehicles on the roads to monitor unsafe conditions or

activity. Agnico Eagle records unsafe practices, warns the person causing the infraction, and in severe or repeated cases of violation, removes all privileges for future access to the roads by an offending driver. In the case when Agnico Eagle is aware of unsafe or illegal activity on the road, the RCMP will be informed.

Regulatory inspectors can inspect the roads and any associated infrastructure at will. Agnico Eagle abides with the recommendations and directives provided by the inspectors.

However, the *Criminal Code* of Canada applies to private roads. For example, if an accident were to occur on a road and alcohol was involved, that person could be charged by the RCMP. Under their current mandate, while the RCMP is not responsible for policing of the AWAR as it is a privately operated road, the RCMP will have the right to access the AWAR at any time to investigate any accident or incident where they believe there is a need.

8.3 Public Use of Private Roads in Other Jurisdictions

The AWAR is a private road constructed, operated, and maintained by Agnico Eagle. The AWAR covers traditional trails that were openly and continuously used by Inuit for many years. As well, most of the AWAR is on Inuit Owned Land. Agnico Eagle had to obtain land use permits from the KIA. After completion of the AWAR, these land use permits were taken to lease. Agnico Eagle is subject to the terms and conditions of the leases.

Before the construction of the bypass road was completed, Agnico Eagle met with all regulatory agencies and the public to finalize the rules of the road and this Plan.

SECTION 9 • ACCIDENTS, SPILLS, MALFUNCTIONS, AND EMERGENCY RESPONSE

Emergency response is reactive whereas prevention lowers the frequency of incidents occurring requiring emergency response. Agnico Eagle's emphasis will be on the latter, while at the same time keeping resources nearby to respond to emergencies on the roads in a timely manner.

Three possible causes of road emergencies are the road, vehicle, and people. It is the interplay of these three elements that lead to either safe use of the roads or emergency response. Agnico Eagle is fully responsible for the design, construction, and maintenance of the roads for Project related use, and public use of the access roads. This includes regular inspection and maintenance of transportation infrastructure, including access roads, service roads, haul roads, road crossings, water crossings, signage and the two emergency spill response stations.

Agnico Eagle verifies its vehicles are in good working order prior to use. Agnico Eagle, however, has little influence on the condition of the non-Agnico Eagle owned vehicles that will use the AWAR. Vehicles could be poorly maintained and individuals could also make poor decisions such as using an ATV in winter when a snowmobile would be more appropriate. Nonetheless, Agnico Eagle will provide emergency assistance where the health or safety of people is at risk when travelling on the AWAR or on the land near Project facilities. Additionally, Agnico Eagle trains its employees and contractors on road safety and emergency response (first aid, firefighting, spill response, etc.). By educating and protecting its workers, they lead by example in road safety.

While Agnico Eagle feels it can successfully manage the condition of the AWAR and influence what vehicles use it, shaping an individual's responsible driving habits and attitudes to safety could prove more difficult. As a result, Agnico Eagle, in cooperation with Inuit organizations, authorizing agencies and others, will, to the best of its ability, implement all such measures necessary to protect public and mine traffic on all roads open to unrestricted public use. Responsibility and risk comes with driving on the AWAR and Agnico Eagle will:

- Impress on AWAR users that they should always remain aware of what is happening around them as they drive and make responsible decisions about hazards and problems;
- Highlight the environmental and human costs of irresponsible driving habits, and a driver's accountability for his/her decisions; and
- Repeatedly inform AWAR users of the rules of the road.

In 2018, Agnico Eagle educated the public on road safety, shaping good driving practices and influencing people's behaviour on the roads. Emphasis was directed to the use of helmets, seat belts, observing the posted speed limits, improving one's visibility by wearing reflective clothing when on a snowmobile or ATV, not drinking and driving, dealing with driver inexperience, etc. This also included encouraging all drivers to abide by the rules of the road to control speeds and advance considerate

driving. Vests and buggy whips will be available for borrow at the gatehouse (km 7) when accessing the AWAR.

An Agnico Eagle trained site-based emergency response and spill clean-up team[10] are available on site with appropriate equipment to respond to all spills and road accidents. The Emergency Response Team (ERT) are trained in emergency response (firefighting, first aid, mine rescue, spill response, vehicle accidents, etc.). In addition, emergency response equipment and spill kits are carried in all Agnico Eagle vehicles using the roads to improve response in the event of an incident or accident. This equipment includes emergency first aid equipment, and initial spill response equipment. Spill response is implemented by environmental staff who advise, document, and report on initial response and clean-up actions. The Spill Contingency Plan is activated in responding to a major spill. Minor spills are handled safely without the assistance of the ERT using initial spill response equipment carried in the vehicle. Major spills[11] require the ERT, who use spill response equipment and supplies maintained by Agnico Eagle at the mine site or from the two emergency spill response stations on the AWAR and/or at Itivia.

In urgent circumstances, where appropriate, Agnico Eagle may request assistance from other parties in Rankin Inlet. However, based on Agnico Eagle's experience with the Meadowbank access, service, and haul roads, Agnico Eagle does not believe that its Project roads will result in any increased demand on local public service providers (i.e., fire, police, ambulance, medical, and maintenance) in Rankin Inlet.

9.1 Accidents and Malfunctions

Agnico Eagle understands that accidents can occur, but the prevention and mitigation measures along the roads, emergency response planning, training, and preparation will substantially reduce the risk, frequency, and severity of such incidents. Agnico Eagle emergency response personnel are tasked with responding to any vehicle accident resulting in personal injury or spillage of harmful material. Agnico Eagle will initiate response and transport to medical assistance at the mine's health centre or Rankin Inlet's medical center. Agnico Eagle staff will follow the procedures in place in Risk Management and Emergency Response Plan. The types of accidents and malfunctions that may occur are as follows:

[10] For more details on emergency and spill response, please refer to the Risk Management and Emergency Response Plan and the Spill Contingency Plan, respectively.

[11] A major spill is defined as an event that cannot be handled safely without the assistance of Emergency Response Team, including all events where a person is injured or contaminated.

- Vehicle collisions that may result in personal injury and spillage of potentially harmful materials such as fuel, lubricating fluids, saline water, and antifreeze;
- Contact between vehicles and wildlife that may result in harm to wildlife, personal injury and spillage of potentially harmful materials;
- Single vehicle accidents that may result in personal injury and spillage of potentially harmful materials;
- Risk of people getting stuck on the roads in bad weather such as in blizzard, white out or dense fog conditions, or due to mechanical breakdown;
- Risk of accident due to an intoxicated or impaired driver on the roads; and
- Spills of harmful materials onto the land or into water through a vehicle rollover or tipping over.

Agnico Eagle reports all reportable incidents to the appropriate Government authority (e.g., Mines Inspector, RCMP, NWB, NU Spill Line, Environment Canada, GN Department of Environment, Fisheries and Oceans Canada (DFO), KIA, and Hamlet of Rankin Inlet).

The following actions are to be taken in the event of an accident on the roads involving other vehicles (including ATVs), or in the event of an accident involving contact with wildlife such as caribou, muskox, bear, and wolf, the ERT will:

- Check the condition of people involved in the accident and provide immediate first aid if appropriate;
- Call the Meliadine road dispatch by radio and report the location and nature of the accident and indicate the type of assistance required (medical help, environmental cleanup, fire and/or mechanical help);
- Secure the accident site so that the vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident, or blocking off the road in both directions in the event of a more serious accident; and
- If safe to do so, secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, the road dispatch will initiate the emergency response procedure passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been removed to medical care, the emergency coordinator will turn the scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife, the road dispatch will notify the site security personnel and the environmental representatives. Security and the site environmental team will then

initiate an appropriate accident investigation. The Environmental Department will ensure that appropriate reporting of such incidents is done in a timely manner to the KIA, the Rankin Inlet HTO, and the GN Conservation Officer in Rankin Inlet.

In the event of a serious accident, the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

SECTION 10 • WILDLIFE MANAGEMENT

Wildlife is occasionally expected to be observed on or near the AWAR, service, and haul roads. Caribou and other wildlife will have the right-of-way at all times. In case of problems (e.g., aggregations of caribou), the environmental personnel on-site will be in charge of managing the situation and, with the collaboration of the security department, will advise road users by patrolling the roads. The Project personnel will be notified by dispatch radio if any wildlife is observed on the roads.

The following protocol is implemented on the roads for the protection of wildlife:

- Vehicle traffic speeds on the access, service and haul roads will be limited to 50 km/h and 30 km/hr on the bypass road;
- Where small to moderate aggregations of caribou (i.e., 1 to 50 animals) are observed within 100 m of a road, travel speeds are reduced to 30 km/h;
- Where large aggregations of caribou (i.e., 50 or more) are observed within 100 m of a road, the protocol outlined in section 10.2 is followed;
- Caribou and all wildlife are given right-of-way on the road: vehicles must stop until the animal is off the road;
- Locations of large aggregations of animals are reported to the road supervisor who will inform all potentially affected employees and the environmental representative, and put the protocol in Section 10.2 into effect. Agnico Eagle's environmental coordinator will then inform the KIA, the Hamlet, HTO, and the GN Conservation Officer in Rankin Inlet;
- All incidents between vehicles and wildlife are reported to the Agnico Eagle road supervisor and the environmental representative whether they are:
    - Near-miss;
    - Collision with injury to the wildlife; or
    - Accidental death.
- Each incident is investigated by the road supervisor and the Environment Department, and measures taken to avoid re-occurrence are put in place. Disciplinary measures will be taken against any employee if the investigation concludes that the accident is the result of negligence; and
- In the case of accidental death of an animal, the Environmental Coordinator will contact the GN Conservation Officer in Rankin Inlet. The carcass will be removed from the road and incinerated to avoid attracting scavengers such as Arctic foxes, wolves, grizzly bears, and/or wolverines.

10.1 Wildlife Monitoring Program

Agnico Eagle has implemented a monitoring program to record on a systematic basis the prevalence of wildlife seen along the roads. This program will be developed further with the input of the local

HTO and the KIA as needs change. The program will focus on caribou, muskoxen, bears, wolves, migratory birds, and raptors. Agnico Eagle and the HTO have also been discussing a program that would see the HTO provide wildlife monitoring services.

The current program consists of year-round weekly ground surveys of wildlife observed along the roads. The survey is logged and includes type of wildlife observed, estimate of numbers, and nearest kilometre marking along the roads. The data is aggregated and presented in the annual report for the mine. Complete details on wildlife monitoring can be found in the Terrestrial Environment Management and Monitoring Plan (TEMPP) (Golder 2015).

During caribou migration daily AWAR surveys are completed. If more than 50 caribou are detected within 100 m of the AWAR the Road Utilisation Work Suspension Protocol as per the TEMMP (Golder 2015) is implemented.

10.2 Road Management Agreement

Agnico Eagle has consulted with the Government of Nunavut, the KIA, the Kivalliq Wildlife Board, local HTOs, and the public in developing appropriate monitoring and mitigation measures related to the ease in harvesting of caribou afforded by the AWAR. The result of these consultations are known as the Road Access Management Agreement that endorses the following measures:

- During periods when large aggregations of caribou (greater than 50 individuals) are detected within 1 km of the AWAR, the southern gate is closed to public cars and trucks. Public access using ATVs will still be allowed.
- In consultation with the Kivalliq Wildlife Board (KWB), as required under the Nunavut Wildlife Act, Agnico Eagle will seek the establishment of a no-shooting zone (1 km wide) on either side of the road. If the KWB, other agencies and the public are in agreement, AWAR use by hunters will be conditional on observing the 1 km no-shooting zone.
- Dedicated ‘road monitors’ patrol the road to ensure compliance relating to public safety and wildlife. Monitoring is increased during periods of road closure when large aggregations of caribou are present;
- All incidents of hunting involving shooting along or across the AWAR are reported by the Agnico Eagle to the GN.
- During periods when large aggregations of caribou are detected near the Project, harvest monitoring intensity is increased to properly document harvesting levels of caribou.

The roads supervisor, in consultation with the environment coordinator, or designate is responsible for ordering the southern gate shut and preventing the use of bridges by ATVs while large numbers of caribou remain on or near the AWAR. Similarly, the roads supervisor, in consultation with the environment coordinator, would open the southern gate and bridges to all traffic once the caribou have moved on.

SECTION 11 • RECLAMATION

Reclamation of the access, service, and haul roads will follow the completion of all mining. Progressive reclamation will, in some instances, lead to roads being reclaimed after they are no longer needed. As described in the Preliminary Closure and Reclamation Plan, the access roads should be one of the last mining components to be reclaimed.

In most circumstances, the AWAR will continue to be open to public access during any temporary closure of the mine. The status of the road during such periods would be assessed by Agnico Eagle on a case-by-case basis. For short duration temporary shutdowns (short-term temporary closure), the AWAR would remain open and be maintained in the same manner as proposed during the operational phase. While each case would be assessed separately, temporary shutdowns of less than 6 months duration would not change the way the access road is operated or maintained. For temporary shutdowns of greater than six months and less than 12 months in duration, and/or for indefinite shutdowns (period of time greater than one year: long-term temporary closure), Agnico Eagle would have to change the way it operates and maintains the road. In such an instance, Agnico Eagle would evaluate what level of activity was expected to continue at the site during the shutdown period and adjust its care and maintenance of the access road accordingly. For example, here are two possible scenarios:

Case 1: Long-term Temporary Closure of the Mine due to a low Gold Price

Under an indefinite shutdown of the mine due to a low gold price, in this case the duration of the event would be unknown and beyond the control of Agnico Eagle. Agnico Eagle would likely shutdown all mining and milling operations in a progressive manner and put the facilities into a care and maintenance mode with a minimal site presence to protect the integrity of the facilities at the site. In this event, Agnico Eagle would likely suspend winter snow clearing along the AWAR and would significantly reduce summer maintenance. Winter use of the AWAR by public would stop; summer access would still be open but likely limited to ATVs as the road would no longer be maintained to its normal standard.

Case 2: Short-term Temporary Closure of the Mine

Short-term Temporary Closure is defined as the shutdown of the mine with a defined timeline, less than 1 year mill shutdown. The duration of the event would be known and would be within the control of Agnico Eagle. Agnico Eagle would reduce activity at the site while the mill is rebuilt and/or repaired. In this case, there would be a continued presence on site and thus regular road access would still be required. In this event, Agnico Eagle would likely maintain the road in the same manner as during normal operations with potential extended shut downs during the worst winter conditions. In this event, continued public access to the road would continue as normal except for periods when the road is closed due to severe winter conditions or some other eventuality.

There are a number of scenarios that could fall between those presented above and each would be considered on a case-by-case basis. In general, if during the short-term or long-term shutdown period there is ongoing activity planned at the site, the AWAR would for the most part remain open to public access. However, if during the shutdown period there is no ongoing activity planned at the site, the road would not be maintained, thereby limiting public access to snowmobiles or tracked vehicles during winter and to ATVs during summer months.

The question as to how public use of the AWAR will be monitored and how road use rules and procedures will continue to be enforced during any short-term or long-term temporary closure of the mine has been raised as a valid concern.

- For short-term temporary closures (up to 12 months in duration), the AWAR would continue to be monitored, maintained and operated (enforcement of rules and procedures) in the same manner as those laid out in Sections 6 through 10 of this Plan for normal operations; and

- For long-term temporary closures or for indefinite shutdowns (greater than 12 months in duration) where further site activity is being curtailed and the intention is that the mine will resume operations as soon as possible after the cause for the indefinite shutdown has been addressed, then AWAR monitoring, maintenance and enforcement activities would be significantly reduced. A decision on the estimated length of the indefinite shutdown would be made after the initial one year period. Decisions on possible extensions to the indefinite shutdown would be made every 6 months thereafter and would be based on the conditions at that time. At present, the maximum length of time or number of extensions for interim shutdown before moving to final closure has not been defined.

When further site activity is curtailed, a physical barrier would be established on the AWAR before the Meliadine River Bridge that prevents open public access by cars, trucks or other motorized vehicles larger than an ATV. This would likely be a rockfill barrier with appropriate signage. During winter months, the road would not be kept open thus curtailing travel other than by snowmobile or tracked snow vehicle. In summer months, Agnico Eagle would continue to carry out environmental monitoring both along the AWAR and at the mine site but at a reduced frequency in accordance with its license/permit requirements. During these inspections, Agnico Eagle personnel would continue to monitor for inappropriate use of the AWAR and for conditions along the AWAR that could result in risk to public safety or to the environment (e.g., wash outs, erosion, plugged culverts, etc.). This would include monitoring and addressing any unauthorized trails/access into the designated preservation zone of the Iqalugaarjuup Nunanga Territorial Park as discussed in Section 6.3 of this Plan.

For the permanent closure scenario and as outlined in the Preliminary Closure and Reclamation Plan, the AWAR will remain available for use during closure as access to the mining areas is required until post-closure and reclamation activities have been completed. The road surface will at this point

be rehabilitated to promote natural re-vegetation, water crossings removed, and natural drainages re-established.

Agnico Eagle would like to emphasis that it has the responsibility of decommissioning and reclaiming all roads once construction, operations, closure, and post-closure activities are complete. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowners (the KIA and the Hamlet) and then complete its own environmental assessment and permitting process covering future use. Agnico Eagle does not own the land on which the roads are constructed and, thus, cannot transfer future ownership or use privileges to any third party. Agnico Eagle must complete its obligation to decommission and reclaim all roads unless directed otherwise by a combination of the landowners and other regulatory agencies who issued permits/authorizations for the roads.

Decommissioning of the roads will be accomplished by loosening compacted surfaces, flattening side slopes, and removing all culverts, bridges (not including the Char River bridge as this would become the property of the Hamlet of Rankin Inlet), and other potential obstructions to drainage paths. The objective will be to make the road surface impassable by vehicle traffic by ripping the entire road bed and removing all bridges and culverts along the route.

The loosening of compacted surfaces will be accomplished by ripping of the road bed using a dozer with a “ripper” attachment on the back. Successive passes with the dozer longitudinally along the road bed will eliminate the level road surface and make travel difficult (Figure 11-1). It is anticipated that, in this way, the abandoned roads will not be useable by wheeled vehicles (i.e., cars, trucks, and pick-up trucks). The road bed would still be useable by ATV or snowmobile and, thus, even after final reclamation, the reclaimed roadbed would offer similar passage to the existing set of trails that currently exist and are used by the residents of Rankin Inlet for traditional use purposes.

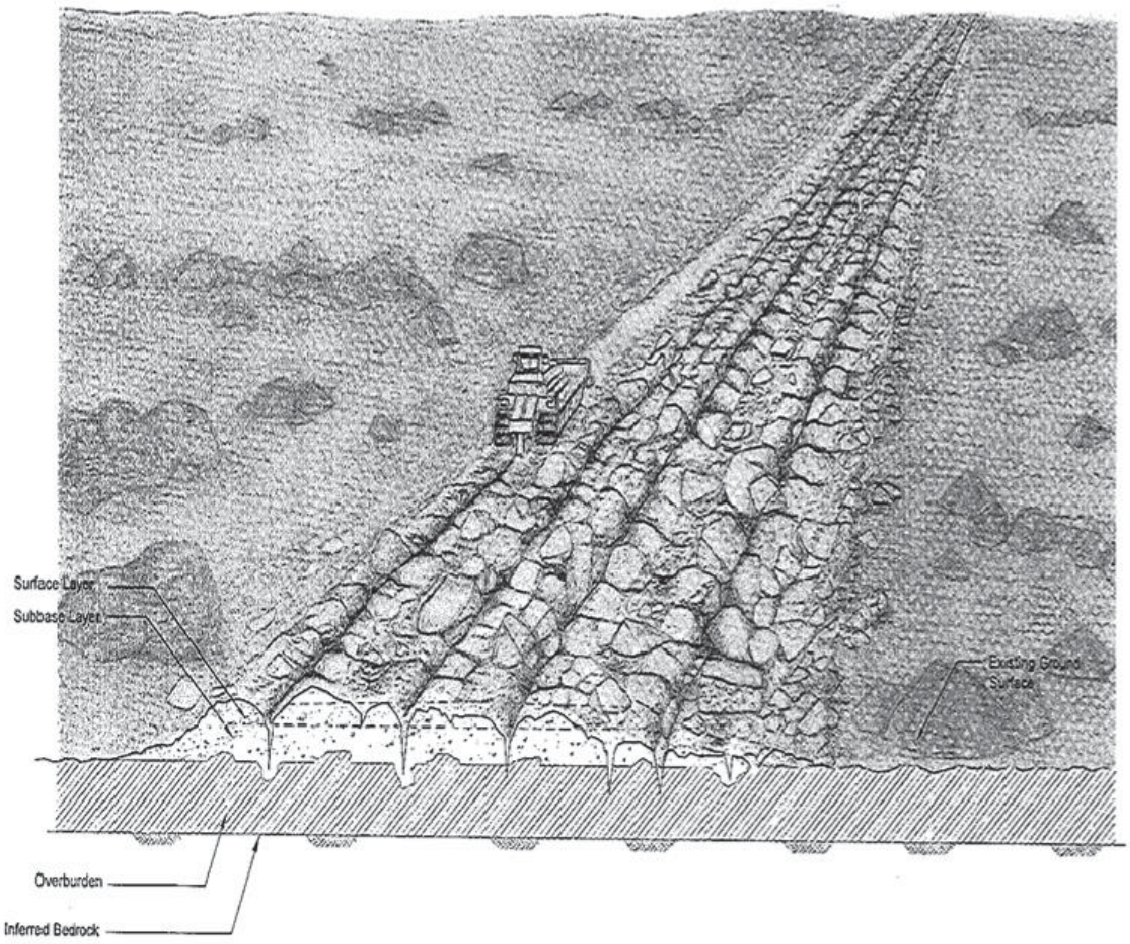


Figure 11-1 Schematic Showing the Ripping of the Road upon Closure

The road deactivation works will be carried out as necessary to stabilize any slopes where potential for slope erosion may exist. Stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened out slopes using non-acid generating material.

These measures would also be applicable to borrow pits/quarries that remained open following construction and are located adjacent to the roadway. As much as practical, deactivated surfaces will be graded to blend with the existing topography.

To the extent practical, the reclamation would also restore the natural pre-road hydrology. Natural drainage courses would be restored primarily through the removal of all culverts and bridges (excluding the Char River bridge, which will belong to the Hamlet of Rankin Inlet), and through rehabilitation of channels and banks at the crossing sites. Cross-drain structures (cross-ditches) will also be installed where necessary between culvert sites. Where armouring rock (rip-rap) is required, this rock will be non ARD/ML for the protection of aquatic life. Where affected watercourses are fish

bearing, the timing of work will have to be restricted to within the designated DFO fisheries work window (July 16th to April 30th). For these sites, appropriate fish exclusion measures will be undertaken prior to the in-stream works. All in-stream works will be carried out using best management practices for erosion and sediment control.

Decommissioning of the roads will start from the Project site and progress south towards Rankin Inlet and will include reclamation of the bypass road. Stream crossings will be rehabilitated as they are encountered during the progression of the work. The culverts and bridges, as previously mentioned, will be removed from the crossings using a backhoe and crane, and then removed materials (i.e., culvert steel, bridge decks, abutment steel, etc.) will be transported to Rankin Inlet using a semi-tractor and a low-boy trailer, for disposal and salvage.

11.1 Reclamation of Quarries and Borrow Pits Sites

All quarry sites and borrow sources developed during the construction of the roads have been selected to generate only non-acid generating/low metal leaching materials (see Borrow Pits and Quarries Management Plan). Water quality monitoring and testing will be undertaken periodically during the construction and operational period of the roads to measure the quality of water draining from the open quarry/borrow sites and from the road base materials.

The quarries and borrow pits have gently sloping walls and are designed for positive drainage wherever possible. Reclamation and closure of quarries and borrow pits will depend on the individual site conditions. With a conservative initial design, the quarries should require little reclamation following completion of the roads. Loose rock will be pulled to the floor of the quarry and the entrance blocked with large boulders. Reclamation should lead to natural re-vegetation establishing on disturbed areas.

During reclamation of the roads, should acid-generating bedrock be exposed along the roadway or in borrow pit/quarries, these areas will be covered with a minimum 2m thick layer of non-acid generating soil or rock to direct water away from the surface.

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APPENDIX A • AGNICO EAGLE CONSULTATION ON THE ALL-WEATHER ACCESS ROAD

A chronological record is provided of the consultation undertaken on the routing of the AWAR between Rankin Inlet and the mine site.

Date	Location	Parties involved and purpose of meeting
2004/10/21	Rankin inlet	Presentation on Project status to KIA Board of Directors with a request for a proposal of motion to support a future road from Rankin Inlet to the site.
2007/03/26	Chesterfield Inlet	Presentation to the KIA Board of Directors on the proposed underground Program and 2007 Meliadine West exploration plans. Verbal Motion of Support from the Board
2007/03/27	Rankin Inlet	Presentation of the proposed 2007 Meliadine West exploration program to the Rankin Inlet Community Lands and Resources Committee.
2007/03/28	Rankin Inlet	Presentation of the proposed 2007 Meliadine West exploration program to the Kivalliq Chamber of Commerce.
2007/03/28	Rankin Inlet	Town hall meeting - presentation of the proposed 2007 Meliadine West exploration program.
2007/07/04	Rankin Inlet	Briefing on Project status to Hamlet Council with specific discussions on road alignment and overwinter fuel storage in barge.
2007/07/04	Rankin Inlet	Elders Luncheon at Nunavut Arctic College. Project overview and immediate project plans for underground exploration was presented by Mark Balog with a slide show. Issues that were raised: – employment opportunities for young people; – all-season road location and utility for other projects; – Soapstone from Newfoundland. Attendees: Hamlet Elders including Mr/Mrs Tatty, Mr/Mrs. Itinuar, Mr/Mrs Kabvitok, Mrs. Pissuk, others: Comaplex Minerals: Mark Balog, Ben Hubert. Arranged by John Hickes.
2009/05/06-08	Rankin Inlet	Multidisciplinary Advisory Group (MDAG), chaired by Bernie MacIssac, INAC: all regulatory groups in attendance. Presented the Project and All- weather Road to regulators. Met regulators who will work on Project, including Jackson Lindell and Stephen Hartman, KIA, and Keith Morrison and Jorgan Aitaok, NTI.
2009/06/17	Rankin Inlet	Meeting with Manager CED (Robert Connelly) and Nunavut Transport (Alan Johnson) regarding proposal to access federal infrastructure money

		for the Meliadine River bridge and Comaplex fund the road. Visit to the bridge site.
2009/06/18	Rankin Inlet	Discussion with Rankin Inlet Mayor John Hickes, the SAO, and several council members. Project update and proposed application for road and bridge funding.
2010/06/01	Chesterfield Inlet	Mark Balog and John Witteman, Comaplex sponsored a town hall meeting providing an update on the Project and the building of an All-weather Road. The road would link to the planned road to Chesterfield Inlet.
2010/06/02	Rankin Inlet	Mark Balog and John Witteman, Comaplex sponsored a town hall meeting providing an update on the Project and the building of an All-weather Road. The meeting was particularly well attended and there were no objections to the routing to the All-weather Road. There were no objections to the proposed road alignment.
2010/01/09	Meliadine site	John Witteman and Jacek Patalas (Golder Associates) met with Gary Cooper and Nicola Johnson of DFO to discuss fisheries habitat and compensation issues relating to the development of the Meliadine Gold Project. Discussions regarding compensation for road crossings were also discussed.
2011/01/06	Cambridge Bay	Eric Lamontange, Denis Gourde and John Witteman met with Ryan Barry, Kelli Gillard and one more staff member, NIRB, to describe the status of the Project and in particular the AWAR. Agnico Eagle described what had been done in regards to gathering baseline information for the road, regulatory permits required and use of the road (having it open access).
2011/02/07-09	Rankin Inlet	Larry Connell and John Witteman met with the Lands Division of KIA to discuss the road and other matters. A meeting with the HTO was cancelled due to a blizzard.
2011/03/01	Rankin Inlet	John Witteman, Bertho Caron and Selma Eccles of Agnico Eagle attended a meeting with the HTO, Rankin Inlet. The HTO raised a number of concerns with the route of the road, bridge location over the Meliadine River, wildlife monitoring along the road, plans for the Itivia port area, fish concerns with the bridge. Agnico Eagle talked to each of the concerns raised and were subsequently informed that the HTO Board was satisfied with the responses received
2011/03/23	Rankin Inlet	Denis Gourde, Eric Lamontagne, Larry Connell, Selma Eccles, John Witteman met with the Hamlet Council to describe the AWAR and ongoing activities at the Meliadine site. The Hamlet Council supports the All- weather Access Road and a letter of support can be expected. The

		underground program was explained and what is hoped to be gained from carrying out this work - getting needed information on the deep ore. The question of dust control was raised and lands available in town for development. The underground development was discussed.
2011/03/23	Rankin Inlet	Denis Gourde, Eric Lamontagne, Larry Connell, Selma Eccles, John Witteman hosted a town hall meeting with the community to discuss the All-weather Access Road and the proposed mine. A PowerPoint presentation in English and Inuktitut was presented. The meeting was well attended with over 100 persons present. The road is widely supported by the community as it offers access to Meliadine Lake and also is expected to lead to more economic activity. The question of jobs and careers was frequently raised and what must be done to get jobs such as supervisors and managers. Education was emphasized by Agnico Eagle as well as on-the-job training. Support was voiced for the road and the proposed mine.
2011/04/07	Iqaluit	Meeting with NIRB and NWB in Iqaluit during the Nunavut Mining Symposium. PowerPoint presentation was made on the proposed Meliadine AWAR and our application to amend our Type B water license to allow for construction of this road. Good exchange with NIRB an NWB pointing out omissions in what was presented.
2011/05/06	Geovector, consultant to KIA	AWAR – quarry locations and need to check for ground ice, geochemistry of the waste rock and potential quarries, snow drifting along road, design of culverts, lessons learned from Meadowbank.
2011/06/06	Cambridge Bay, Gjoa Haven Iqaluit	Presentation to NIRB, NWB, Regulatory Agencies in Iqaluit. Discussions on next steps in EA process, possible predevelopment activities, class A water licence, Agnico Eagle's use of municipal infrastructure, need to submit a land use permit for crown land to be crossed by the AWAR, quarries along road.
2011/06/14	KIA, Mayor of Rankin Inlet	Possible predevelopment, Hamlet motion to approve AWAR, build only 1 lane at this time.
2011/10/31	Rankin Inlet	Larry Connell and John Witteman met with the HTO. A PowerPoint presentation was made on the All-weather Access Road and developments at the Meliadine site. The HTO wanted to discuss the alignment of the AWAR to the Meliadine site and the arrangement of Agnico Eagle facilities at Itivia. A more southerly route was proposed by the HTO but Agnico Eagle indicated it was too long and had too many water crossings. The HTO want a role and contract in monitoring wildlife along the AWAR. The arrangement at Itivia was raised but Agnico Eagle did not have maps of the area. Discussion was deferred to the next meeting when Agnico Eagle would bring maps of Itivia and

		surrounding area. Agreement was reached on a ski-doo trail along the east side of the laydown area.
2012/02/29	Rankin Inlet	A public meeting with the community. The meeting covered the status of the Meliadine Project with emphasis on the planned construction of the Phase 1 AWAR between Rankin Inlet and the Meliadine Project site. Options for a bypass road around the Hamlet were presented with support for keeping Agnico Eagle traffic outside the community. Other topics touched on the fate of the existing Char River Bridge, the formation of a Liaison Committee for Rankin Inlet, plans for the Itivia area and employment opportunities in the building of the road.
2012/04/18	Iqaluit	Presentation made to the NIRB and the NWB on the proposed Meliadine All-weather Access Road and update on the exploration project.
2012/08/16	Rankin Inlet	Site visit of the Phase 1 AWAR by two representatives of the Hunters and Trappers' Organization. Progress on the bridges and road was viewed.
2012/09/11	Rankin Inlet	Site visit of the Phase 1 AWAR by KIA and CLARC representatives. Progress on the bridges and road was viewed.
2013/06/21	Rankin Inlet	Meeting was held with the hamlet and Government Services (GN) concerning the removal of the Char River Bridge, the Apache Pass, and the airport by-pass road.
2013/06/27	Rankin Inlet	Presentation on Agnico Eagle exploration activities, Phase 1 AWAR and road access made to town council, community, Land and Resources, Hunters and Trappers' Organization, Kivalliq Inuit Association, NTI.
2013/07/10	Rankin Inlet	Discussions were held with the Airport Manager and Government Services (GN) concerning the airport by-pass road.
2013/08/08	Rankin Inlet	Meeting with town council, community, Land and Resources, Hunters and Trappers' Organization, Kivalliq Inuit Association, NTI on the Phase 1 AWAR and Road Access Policy – minutes are available.
2013/11/06	Rankin Inlet	Meeting with HTO Board explaining the status of the Project, Phase 1 All-weather Access Road, caribou migration, sewage treatment – minutes available.
2014/05/29	Rankin Inlet	Rankin Inlet Public consultation on the road access by ATV.
2016/05/05	Rankin Inlet	Meeting with the KHTO to discuss the proposed joint Wildlife Monitoring Program to be conducted along the AWAR.

2016/06/09	Rankin Inlet	Meeting with Nunavut Airports, Government Services (GN) and the Hamlet to present the updated road route for the bypass road. The permitting process was also discussed.
2016/07/07	Rankin Inlet	Meeting with the KHTO to discuss the proposed joint Wildlife Monitoring Program to be conducted along the AWAR.
2016/08/25	Rankin Inlet	Meeting with Nunavut Airports, Government Services (GN) and the Hamlet to provide an update on the bypass road design process and hear concerns. The permitting process was also discussed.
2016/09/20	Rankin Inlet	Meeting with KHTO to discuss signage erected on AWAR.
2016/11/28	Rankin Inlet	Pre-Hamlet Council meeting with Nunavut Airports, Government Services (GN) and the Hamlet to discuss the bypass road project. Pre-Council concerns were also shared by all parties.
2016/11/28	Rankin Inlet	Hamlet Council Meeting. Bypass road project presented to request support for the project by the Hamlet.
2016/12/13	Rankin Inlet	Hamlet Council Meeting. Bypass road project receives support from the Hamlet.
2017/02/27	Rankin Inlet	Hamlet Council Meeting. Bypass road project application for lease presented for approval by Council. Outstanding concerns discussed. Vote postponed.
2017/03/13	Rankin Inlet	Hamlet Council Meeting. Bypass road project application for lease discussed. Agnico Eagle is requested to provide design for road extension.
2017/07/17	Rankin Inlet	Meeting with SAO on dust control measures.
2017/07/18	Rankin Inlet	Public meeting on Itivia, including bypass road.
2017/07/27	Rankin Inlet	Information and consultation on Itivia Boat Launch and Johnson's Cove Boat Launch, dust control, road maintenance, bypass road, snowmobile trail, shooting range relocation, caribou migration and gravel pits.
2017/11/24	Rankin Inlet	Visit of bypass road area with HTO and Elder representative. Discussed access for ski-doos and hunters.
2018/06/05	Rankin Inlet	Meeting regarding Cyanide attended by: Rankin Inlet Emergency Services, HTO, Health Centre, RCMP and Gun Club, Nunavut Parks, Airports and Government. Topics covered included: International Cyanide Management Code, Cyanide transportation to Meliadine, Health and

		Safety regarding Cyanide storage and community sharing of the draft Emergency Response Plan. Main outcomes: Department of defence will restrict access to their site during transportation, Agnico Eagle will provide shipping window and mock drill dates and Agnico Eagle will reach out to other Stakeholders.
2018/06/13	Rankin Inlet	Public meeting on Meliadine and Itivia project update, AWAR health and safety procedures and Caribou Management on the AWAR.
2019/07/31	Rankin Inlet	Rankin Inlet Emergency Services, HTO and Government meeting regarding cyanide. Topics covered included: International Cyanide Management Code, Cyanide transportation to Meliadine, Health and Safety regarding Cyanide storage and community sharing of the draft Emergency Response Plan.
2019/08/18	Rankin Inlet	Rankin Inlet Public meeting regarding cyanide. Topics covered included: International Cyanide Management Code, Cyanide transportation to Meliadine, Health and Safety regarding Cyanide storage and community sharing of the draft Emergency Response Plan.

APPENDIX B • APPLICABLE ACTS, REGULATIONS, AND GUIDELINES FOR THE ACCESS, SERVICE AND HAUL ROADS

Applicable Acts, Regulations, and Guidelines for the Access, Service and Haul Roads

Act	Regulation	Guideline
Federal		
Canadian Environmental Protection Act (1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Release and Environmental Emergency Notification Regulations (SOR/2011-90)	CCME - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory (threshold for hydrochloric acid 6.8 tonnes) Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Canada Wildlife Act (1985 w9)		
Species at Risk Act (2002 c.29)		Species at Risk Policies
Migratory Birds Convention Act (1994 c.22)	Migratory Birds Regulations (C.R.C., c. 1035)	
Canada Water Act (1985 c.11)		
Oceans Act (S.C. 1996, c. 31)		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	Arctic Waters Pollution Prevention Regulations (C.R.C., c. 354) Arctic Shipping Pollution Prevention Regulations (C.R.C., c. 353)	
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	Transportation Safety Board Regulations (SOR/92-446)	
Canada Shipping Act, 2001 (S.C. 2001, c. 26)	Response Organizations and Oil Handling Facilities Regulations (SOR/95-405) Pollutant Discharge Reporting Regulations, 1995 (SOR/95-351) Environmental Response Arrangements Regulations (SOR/2008-275) Ballast Water Control and Management Regulations (SOR/2006-129) Vessel Pollution and Dangerous Chemicals Regulations (SOR/2012-69)	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995 Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)

Act	Regulation	Guideline
Navigation Protection Act		
Marine Liability Act (A.C. 2001, c.6)	Marine Liability Regulations (SOR/2002-307)	
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222) Marine Mammal Regulations (SOR/93-56)	The Policy for the Management of Fish Habitat Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Transport of Dangerous Goods Act (1992, c. 34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	
Explosives Act (1985 c.E-17)	Explosives Regulations (C.R.C., c. 599) Ammonium Nitrate and Fuel Oil Order (C.R.C., c. 598)	
National Fire Code of Canada (2010)		
Nuclear Safety and Control Act (s.c. 1997, c.9)	General Nuclear Safety and Control Regulations (SOR/2000-202)	
Canadian Human Rights Act (R.S.C., 1985, c. H-6)	Canadian Charter of Rights and Freedom	
Canada Labour Code (R.S.C., 1985, c. L-2)	Canada Labour Standards Regulations (C.R.C., c. 986) Canada Occupational Health and Safety Regulations (SOR/86 304)	
Territorial Lands Act (R.S. 1985, c. T-7)	Northwest Territories and Nunavut Mining Regulations (C.R.C., c. 1516) Territorial Land Use Regulations (C.R.C. 1524) Territorial Quarrying Regulations (C.R.C. c. 1527)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c.10)	Northwest Territories Waters Regulations (SOR/93/303)	
Nunavut Act (1993 c.28)	Nunavut Archaeological and Paleontological Sites Regulations (SOR/2001-220)	

Act	Regulation	Guideline
*Nunavut Land Claims Agreement Ac*t (1993, c.29)		
Territorial - Nunavut		
Environmental Protection Act (RSNWT (nu) 1988, c E-7)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003) [The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport.]	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guidelines on Mercury-Containing Products and Waste Mercury Environmental Guideline for Waste Asbestos Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's land Environmental Guideline for Ozone Depleting Substances
Scientists Act (RSNWT (Nu) 1988, c S-4)	Scientists Act Administration Regulations (NWT Reg (Nu) 174-96)	
Historical Resources Act (RSNWT (Nu) 1988, c. H-3)		
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	Territorial Parks Regulations (RRNWT (Nu) 1990 c T-13)	
Wildlife Act (RSNWT (Nu) 1988, c W-4)	Wildlife General Regulations (NWT Reg (Nu) 026-92) Wildlife Licences And Permits Regulations (NWT Reg (Nu) 027-92) Wildlife Management Barren-Ground Caribou Areas Regulations (NWT Reg (Nu) 099-98) Wildlife Management Grizzly Bear Areas Regulations (NWT Reg (Nu) 155-96)	

Act	Regulation	Guideline
	Wildlife Management Zones Regulations (RRNWT (Nu) 1990 c W-17)	
	Wildlife Regions Regulations (NWT Reg (Nu) 108-98)	
Commissioner's Land Act (RSNWT 1988, c C-11)	Commissioner's Airport Lands Regulations (NWT Reg (Nu) 067-97)	
	Commissioner's Land Regulations (RRNWT 1990, c C-13)	
Safety Act (RSNWT 1988, c.S-1)	General Safety Regulations (RRNWT (Nu) 1990 c S-1)	
	Work Site Hazardous Materials Information System Regulations (RSNWT 1988, C 81 (Supp))	
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	Mine Health And Safety Regulations (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	Workers' Compensation General Regulations (Nu Reg 017-2010)	
Apprenticeship, Trade And Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	Apprenticeship, Trade And Occupations Certification Regulations (RRNWT (Nu) 1990 c A-8)	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	Annual Vacations Regulations (RRNWT 1990, c.L-1)	
	Educational Work Experience Regulations (RRNWT 1990, c.L-2)	
	Employment of Young Persons Regulations (RRNWT 1990, c.L-3)	
	Labour Standards Meal Regulations (RRNWT 1990, c.L-4)	
	Notice of Termination Exemption Regulations (RRNWT 1990 c.L-5)	
	Pregnancy and Parental Leave Regulations (RRNWT 1990, c.8(Supp.))	
	Reciprocating Jurisdiction Order (RRNWT 1990, c.L-6)	
	Wages Regulations (RRNWT 1990, c.L-7)	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	Electrical Protection Regulations (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	Explosives Regulations (RRNWT (Nu) 1990 c E-27)	
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	Petroleum Products Tax Regulations (RRNWT (Nu) 1990 c P-3)	

Act	Regulation	Guideline
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990 c F-12)	
Hospital Insurance And Health And Social Services Administration Act (RSNWT 1988, c T-3)	Territorial Hospital Insurance Services Regulations (RRNWT (Nu) 1990 c T-12)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	Camp Sanitation Regulations (RRNWT (Nu) 1990 c P-12) General Sanitation Regulations (RRNWT (Nu) 1990 c P-16)	
All-Terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	All-Terrain Vehicles Regulations (RRNWT (Nu) 1990 c A-1)	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	Large Vehicle Control Regulations (RRNWT (Nu) 1990 c M-30) Motor Vehicle Registration And Licence Plate Regulations (RWT Reg (Nu) 054-94)	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	Highway Designation And Classification Regulations (NWT Reg (Nu) 047-92)	
Transportation of Dangerous Goods Act (1990. RSNWT (Nu) 1988, c 81 (Supp))	Transportation Of Dangerous Goods Regulations (1991, NWT Reg (Nu) 095-91)	

AGNICO EAGLE

MELIADINE PROJECT

PROJECT CERTIFICATE NO. 006

Analysis of the Risk of Temporary Mine Closure

February 1, 2019

Presented to: Nunavut Impact Review Board

AGNICO EAGLE

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AGNICO EAGLE

1. Introduction

As part of the Meliadine Project Certificate No. 006, term and condition No. 90, Agnico Eagle has been asked to "*identify risks and potential effects of temporary mine closures on communities and to develop appropriate offsetting measures*" (Nunavut Impact Review Board, 2015). More specifically:

> *"Prior to the commencement of operations, the Proponent is required to undertake an analysis of the risk of temporary mine closure, giving consideration to how communities in the Kivalliq region may be affected by temporary and permanent closure of the mine, including economic, social and cultural effects. The results of this analysis are to be provided to the NIRB upon completion."* (Nunavut Impact Review Board, 2015).

2. Temporary Closure

A temporary closure occurs when Agnico Eagle ceases to operate the Meliadine Project with the intent to resume mining activities in the future, and maintains activities relating to the facilities necessary to protect humans, wildlife and the environment. Temporary closure could last for a period depending on economic, environmental and social factors (Agnico Eagle Mines Ltd and Kivalliq Inuit Association, 2017, p. 28).

The Meliadine Operation is planned to be continuous for the entire proposed operating period, however, temporary closure could occur if, for any reason, the Project became uneconomic and was expected to remain so for an extended period of time (Agnico Eagle Mines Ltd, 2014, p. 20). Examples of situations that could contribute to the Project becoming uneconomic include labour disputes, unfavorable gold prices, critical breakdowns, or shipping delays.

Notification of temporary closure would be presented to the staff and the local population with at least 30 days' notice; a longer notice period will be provided where possible. The staff maintained at site would be sufficient in number and expertise to successfully carry out care, maintenance and monitoring duties, and to address and remediate any potential problems that may arise (Agnico Eagle Mines Ltd, 2015, p. 142).

As per the Meliadine Inuit Impact and Benefit Agreement (IIBA), written notice of a temporary closure decision would be given immediately to the Kivalliq Inuit Association (KIA) and the Parties would "*enter into good faith negotiations and use commercially reasonable efforts to conclude an agreement on appropriate implementation measures which shall be in keeping with the purpose and the objectives of*" the IIBA (Agnico Eagle Mines Ltd and Kivalliq Inuit Association, 2017, p. 17).

3. Effects of Temporary Closure on Kivalliq Communities

Any potential temporary closure scenario would likely be unplanned and therefore would have more potential for negative effects (Agnico Eagle Mines Ltd, 2014, p. 20). However, if a temporary closure were to occur early in the Project's life cycle, many of the anticipated socio-economic impacts described in the Meliadine Project Final Environmental Impact Statement (FEIS) may not have fully developed (Golder Associates, 2014, p. 186) and may thus attenuate any negative impacts of a temporary closure.

The extent to which mine closure affects Kivalliq communities will vary depending on the size of the Agnico Eagle and contractor labour force from each community that is employed at the Meliadine Project. The impacts will likely be higher in the community of Rankin Inlet as this community currently provides over 60% of Agnico Eagle's Inuit labour force (Aglu Consulting and Training Inc and Stratos Inc, 2018, p. 17).

3.1 Anticipated Socio-Economic Impacts

Anticipated socio-economic impacts of the Meliadine project have been detailed in Volume 9 – Social Environment of the FEIS through pathway and effects analysis. A primary pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VSEC relative to baseline values (Golder Associates, 2014, p. 12) The table below summarizes the primary pathways by valued socio-economic components (VSEC):

Valued Component	Primary Pathway topics
Population Demographics	• Population stability
Traditional Activity and Knowledge	• Traditional and commercial harvesting • Land use and mobility • Food security
Economic Development and Opportunities	• Employment • GDP and Economic Growth • Inflation and Consumer Price Index • Trade Balance • Investment • Government Fiscal Situation • Business Opportunities and Contracting • Economic Development • Income

Education and Training	• Education achievement, dropout rates, school attendance • Available training in existing education system • Capacities of existing education system • Funding of existing education system • Education and skill levels of local labour force
Individual, family and community wellbeing	• Physical and Mental Health • Safety • Savings
Community infrastructure and Public Services	• Population stability (effects of migration on housing, police, and health/social services, financial services, communication services, school services and community/infrastructure services) • Local and regional transportation
Governance and Leadership	• Fiscal performance of government • Operational capacity of government • Regulatory and monitoring capacity of government
Non-Traditional Land Use and Resource Use	• Hunting and fishing • Tourism, recreation, parks and protected areas
Worker and Public Health and Safety	• Health and safety performance for the Project (Project Activities) • General Public, Workers
Cultural, Archaeological and Paleontological Resources	• Site specific

Table 1: Summary of VSECs with primary pathway analysis 9.2-9.10 (Golder Associates, 2014)

Of the identified impacts with primary pathway analysis in the FEIS, those that would be most affected by a temporary closure are listed below:

- **Employment:** Temporary closure would have a significant impact on employment. As per the FEIS, during operations, the Meliadine project is expected to directly employ 700 people per year (Golder Associates, 2014, p. 182). Although the Meliadine Project FEIS makes no specific predictions regarding Kivalliq community's resident employment rates, Agnico Eagle is committed to maximizing employment opportunities for the greatest number of Inuit (Agnico Eagle Mines Ltd and Kivalliq Inuit Association, 2017, pp. 7,56).

- **Income:** Employment income paid by Agnico Eagle at the Meliadine Project will result in competitive wages for people working on the Project, including for unspecialized workers (Golder Associates, 2014, p. 185). In the event of a temporary closure, incomes may be negatively affected as employees shift to employment insurance (in the case of a layoff) or work reduced hours in the case of work sharing or other mitigation measures that Agnico may implement.
- **Business Development:** A temporary closure will have direct impacts on project expenditures, GDP, government revenues including IIBA-related royalties and business development as Agnico spending is reduced. The most significant anticipated impact would be on Kivalliq businesses, particularly in Rankin Inlet and Baker Lake, where 70% of the Kivalliq's NTI-registered businesses are located (Golder Associates, 2014, p. 118).

It is not expected that a temporary closure would greatly impact workforce training and community education. As per the Meliadine Inuit Impact and Benefit agreement, Agnico Eagle is required to maintain Inuit training expenditures at around $3.6 million in addition to spending an additional $1 million (half of which is spent by Agnico and half is paid to the KIA) on initiatives that serve to assist in obtaining at least 50% Inuit employment for all Nunavut Projects (Agnico Eagle Mines Ltd and Kivalliq Inuit Association, 2017, p. 66).

While IIBA provisions may be suspended during a temporary closure, if other Agnico projects are still operating normally in Nunavut (e.g. Whale Tail), then these general requirements would likely still be in effect. Given this, while the types of workforce training and community education may shift in order to attenuate employment effects of a temporary closure, the overall dollar amount spent would likely not be affected unless temporary closure occurred at all Agnico sites in Nunavut. In the case of a temporary closure at all Agnico sites in Nunavut, training expenditures would be impacted, however these impacts cannot be assessed since changes to IIBA provisions would need to be negotiated with the KIA.

3.2 Mitigation Measures

3.2.1 Building Capacity

Agnico Eagle is committed to not only enhancing access to economic opportunities during the Meliadine Project's life, but to also give consideration to an eventual final closure. It is Agnico's intent to, by Project final closure, have increased the capacity of Kivalliq labour and business to engage in economic activities independent of the Project. The principles below contribute to achieving this goal and could help mitigate effects of a temporary closure (Agnico Eagle Mines Ltd, 2014, pp. 19-20):

- **Employment**: Preferential employment, training and culturally sensitive employment practices that contribute to job performance, satisfaction, retention and advancement for people in the Kivalliq Region.
    - This, and the inclusion of targeted Inuit employment as a criterion for evaluating bids from contractors, will build the capacity of Inuit employees to participate in a

wage economy. These measures will provide the work experience that will give people a competitive edge in competing for jobs elsewhere in the economy.

- **Education and training**: Programs that emphasize not only preparation of adults for work at the Project (e.g. work readiness training), but that encourage youth to value education with a view to either Agnico Eagle employment or other participation in the formal wage economy has implications for long-term employability. In addition, the expectation is that such programs will provide motivation to higher education in areas such as health, education, public security, and business administration.
- **Contracting**: Preferential contracting, assistance with the development of business expertise and including the use of Kivalliq region businesses as a criterion for evaluation of bids from businesses supplying to the Project, will contribute to building experience and capacity in the Kivalliq. In addition, Agnico Eagle will support local suppliers to enhance their service offering with a view to diversify their client base and be less dependent on Agnico as a primary client.
- **Support of traditional culture**: The consideration and support for individual decisions to combine formal wage employment with traditional activities and practices in employment and education and training programs contributes to resilience in face of economic dislocation.
- **IIBA and community contributions**: Continued implementation of the IIBA will contribute to economic growth, but also to the social and cultural wellbeing that underlies the ability of people to create and take up life opportunities.

3.2.1 Workforce and Contract Transition Plan

As per the Meliadine IIBA, Agnico "*will use its Best Efforts to ensure that Inuit workers shall be the last to be laid off, with preference given to Inuit of the Affected Communities*" (Rankin Inlet and Chesterfield Inlet) (Agnico Eagle Mines Ltd and Kivalliq Inuit Association, 2017, p. 59). This provision as well as the hiring priority outlined in the IIBA are the main drivers behind the workforce transition plan.

One of Agnico Eagle's guiding principles in a temporary closure scenario is the minimize layoffs and job losses, however, depending on the nature and duration of the temporary closure, impacts would likely still be felt by Kivalliq communities.

Agnico Eagle intends to work with communities and government to agree on appropriate measures, including schedules, to ensure that effects of any temporary closure are managed as best as possible (Agnico Eagle Mines Ltd, 2014).

In the event of a temporary closure of the Meliadine Project, specific mitigation measures have been considered to reduce potential negative effects on Kivalliq communities (Agnico Eagle Mines Ltd, 2016, pp. 4-5):

- Secure full time jobs and income and whenever possible, minimize the length of the transition for employees affected.
- Encourage the use of vacations to cover lack of work period.
- Promote opportunities for Agnico Eagle employees to transfer to other Agnico mine site locations, including temporary assignments.
- Explore opportunities to progress projects or maintenance programs in order to maintain jobs and income.
- Offer training to employees to acquire the necessary skills to be able to take advantage of mitigation measures (e.g. transfers, maintenance programs). Training offered will be focused on enhancing acquired skills in same or equivalent position based on current and future operational needs.
- Introduce temporary unpaid leave of absence for those who would like to pursue other training or personal opportunities during a temporary closure.
- Exploring opportunities for Work-Sharing. Work-Sharing is an adjustment program with Services Canada designed to help employers and employees avoid layoffs when there is a temporary reduction in the normal level of business activity that is beyond the control of the employer. The measure provides income support to employees eligible for Employment Insurance benefits who work a temporarily reduced work week while their employer recovers. Employees on a Work-Sharing agreement agree to a reduced schedule of work and to share the available work over a specified period of time.
- Promote early retirement options for those who are eligible.
- Provide counselling to employees that are being laid-off to help them prepare for the effects of losing their jobs by reviewing their options and plan their next steps.
- Provide financial information and counselling to employees (such as any lay-off packages, RRSP management, stocks management, budgeting, information on government employment benefit programs, etc.)
- Maintain access to Agnico's Employee Family Assistance Program by laid-off employees during temporary mine closure.
- Meet with Inuit business contractors to discuss impacts of temporary closure to contracts and opportunities for care and maintenance contracts. Agnico Eagle will place emphasis on such opportunities for Rankin Inlet-based contractors.

It is noted that the economic effects of a temporary closure will to a large extent depend on whether or not there are economic alternatives available at the time of closure to replace the

Project. This in turn is expected to largely depend on progress in developing the mining sector in the Kivalliq Region, and Nunavut more generally (Agnico Eagle Mines Ltd, 2014, p. 20).

4. Conclusion

Ultimately, the depth of the effects of a temporary closure on Kivalliq communities will depend on the duration and scope of the closure. The capacity building integrated into the overall Project as well as the workforce and contract transition plan have been designed to minimize and mitigate any potential effects.

In the event of premature (temporary or final) closure of the Project, Agnico will consult with the Socio-Economic Monitoring Working Group and the Kivalliq Socio-Economic Monitoring Committee to update the Socio-Economic Management Plan (Agnico Eagle Mines Limited, Government of Nunavut, Government of Canada, 2017). Additionally, this analysis will be updated as necessary to reflect significant changes to the Project or the socio-economic conditions in the region that may increase the risks and potential effects of temporary mine closures (Nunavut Impact Review Board, 2015). Updates will be submitted to the Nunavut Impact Review Board.

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AGNICO EAGLE

MELIADINE GOLD PROJECT

Dust Management Plan

MARCH 2019

VERSION 5

Executive Summary

Agnico Eagle Mines Limited (Agnico Eagle) will use best management practices to minimise dust generation from becoming airborne at the mine site, Itivia, and all access, service, and haul roads. This includes identification of major sources of dust, implementation of dust mitigation measures, inspections for unacceptable levels of dust, and recording dust monitoring data to document Agnico Eagle's success in controlling and reducing dust at the Meliadine Project. The Dust Management Plan focuses primarily on dust generated from roads, with some reference to other mining activities. Dust generated from other mining activities, such as the Tailings Storage Facility (TSF), are addressed in other plans, including the Mine Waste Management Plan and the Tailings Storage Facility Deposition Plan .

Dust could potentially be generated by such activities as road use, drilling, blasting, crushing, conveying, loading, hauling, unloading, stockpiling, and by wind erosion of dry, exposed mine areas. Dust emissions will be prevalent during late spring and summer, while being much reduced in fall and winter.

Mitigation measures to control dust include mine design and operational procedures. Operational practices, such as speed limits and road maintenance, will assist in reducing dust. Water and, if necessary, chemical dust suppressants such as calcium chloride, or another acceptable chemical, will be used to control and reduce dust on roads and other mine areas when airborne dust becomes a safety hazard or impacts on sensitive natural areas. The Itivia bypass road will not have any chemical dust suppressants applied. Only water will be applied on this portion of the road for dust suppression. Dust suppression measures will be in place during construction, operations, and closure.

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Document Control

Version	Date	Section	Page	Revision	Author
1	April 2014			Version 1 of the Dust Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	April 2015	7.2	11	Update plan for Water Licence application - Added EK-35 and DUST-STOP to chemical dust suppressants approved for use in Nunavut	John Witteman, Env. Consultant, Agnico Eagle
3	April 2017			General review of the plan	Environment Department, Agnico Eagle Mines
4	March 2018			Minor modifications	Environment Department, Agnico Eagle Mines
5	March 2019			General update of the document to reflect going into production	Terry Ternes, Sean Arruda, Environment Department, Agnico Eagle Mines
		5	7	Saline water trucked to Itivia	
		6.2	8	Removed sentence indicating transport on bypass road would be maximized in late summer and fall.	
		7	9-14	Calcium Chloride as dust suppressant	

1. Introduction

The Dust Management Plan (the Plan) is a framework for the management and control of dust[1] (airborne particulate matter) arising from traffic related to mine activities. Best management practices are identified to minimize and reduce the impact of dust on the natural and human environment.

The Plan identifies the sources of dust along with measures for their control during operation and closure.

2. Climate

The Meliadine Gold Project (Project) is located in the low Arctic eco-climate characterized by long cold winters and short cool summers. The frost-free period can be as short as 90 days and have prolonged periods with no precipitation. The 30-year climate normals for Rankin Inlet (1971 to 2000) indicate that wind speeds are relatively high, averaging more than 19 km/h every month.

Dust can be a problem at certain times of the year. During the winter and early spring, dust does not pose a significant problem as snow and ice cover most surfaces. However, surfaces that are exposed to the wind can result in dust, especially if ice resulting from fall rains is not present to bond fine particles together. However, in the late spring and summer, and under the right conditions, dust generation could present an issue at the mine site and along its roads. In late spring when temperatures remain below freezing, sublimation tends to cause mine surfaces, including roads, to be dry leading to a potential for dust generation. In summer, when evaporation is high and with little rain, mine surfaces and roads can be dry. The combination of low precipitation and drying winds promote dust generation from developed areas where work is underway and where vehicle traffic is present, especially if mitigation measures are not employed. High winds by themselves can also erode dust from exposed mine surfaces.

3. Related Documents

3.1 Environment Management and Protection Plan

The Environmental Management and Protection Plan (EMPP) provides Agnico Eagle with overarching direction to environmental and socio-economic management for the Project throughout its life (i.e., across all Project phases). It is a site-specific plan that describes the systematic means by which Agnico Eagle will consistently manage and control potentially adverse impacts, and enhance potential project benefits identified through the Environmental Assessment process and the subsequent licensing and permitting of the Project.

The EMPP offers enough flexibility to respond to changes, for example, in the mining development plan, the regulatory regime, the biophysical and socio-economic environments, technology, research results, best management practices, and the understanding of traditional knowledge. Thresholds and indicators

to trigger management actions are provided in the sub plans embedded in the EMPP, along with a system of accountability.

3.2 Air Quality Monitoring Plan

In the Air Quality Monitoring Plan (Agnico Eagle 2015), dust monitoring is expected to occur throughout all phases of the mine, during all seasons, at various locations on the mine site, along the All-weather Access Road (AWAR), the bypass road, and at the Rankin Inlet Itivia land-based facilities area (Itivia). The principle monitoring means are to be particulate fallout measurements.

The Air Quality Monitoring Plan outlines how dust monitoring data helps in verifying if the actual effects from air emissions are less than those predicted in the Final Environmental Impact Statement (FEIS). The data collected provides feedback for continuous improvement in dust mitigation measures. If the dust monitored indicates more dust than expected, adaptive management will be used to understand the reason for the elevated levels and recommend mitigation measures to reduce it.

4. Environmental, Safety and Operational Effects of Dust

The Project is anticipated to generate dust representative of local overburden and rock type. There should not be enrichment of any metal in the dust. Agnico Eagle will use all reasonable and practicable measures to minimise dust generated from the Project.

4.1 Environmental Concern

Physical and chemical stresses on the tundra environment are commonly associated with unpaved roads. Dust generated by vehicle traffic along the roads is carried by the prevailing wind onto the surrounding tundra where it is deposited onto the vegetation and waterbodies.

Chemically inert dust can have negative effects on sensitive receptors such as vegetation. It can accumulate on leaf surfaces and negatively affect leaf physiology. Dust has a shading effect, which reduces the amount of photosynthesis and increases the leaf temperature through incident solar radiation being absorbed by the dust, thus increasing the transpiration rate (Agnico Eagle 2008). Adverse impacts might occur on the wildlife that depend upon the vegetation as a food source. Dust carried off the roads can eventually wash into the local waterbodies adding suspended solids to the water, which can adversely affect water quality and possibly the health of aquatic species.

4.2 Safety Concern

Dust generated by vehicle traffic along roads and other mine surfaces is typically fine, inorganic particulate matter. It reduces visibility along roads, thereby increasing the risk of vehicle accidents. Inhalation of fine particulate matter can potentially cause adverse health effects, especially in persons with pre-existing respiratory problems.

4.3 Operational Cost Concern

Excessive dust when drawn into a vehicle's engine can result in rapid clogging of vehicle air filters, diminishing engine performance and increasing maintenance costs. While the engines are equipped with air filters, the finer sized particulate matter can pass through these filters, getting into the engine where it can cause premature scouring and wear on the pistons and other moving components, thereby leading to a need for more frequent maintenance and shortening the life of the engine.

5. Sources of Dust

The greatest source of dust at mine sites is vehicle traffic on unpaved roads (Thompson and Visser 2001). Dust emissions will vary by the time of week, as well as the time of year. Dust will be more prevalent during the late spring and summer than during winter. Dust emissions are anticipated to be greatest during the operation of the AWAR, when traffic along the road will be at its peak (e.g., on days when additional road traffic is required due to barge unloading, saline water transport to Itivia, and transport to the mine site).

The most significant sources of dust during operations, and closure include the following:

- Preparation of ground surface for construction through stripping, excavating, covering, and/or stockpiling;
- Wind erosion of exposed mine surfaces – e.g., roads, ore stockpiles, waste rock storage facilities, and dry stack tailings;
- Vehicle traffic on unpaved roads and other mine surfaces – haul, service and access roads, pit ramps, other vehicle travel areas (e.g. waste rock storage facilities, storage pads, laydown pads, parking lots);
- Material handling and transfer – loading, hauling, unloading, crushing, conveying;
- Open pit mining activities – drilling, blasting; and
- Closure activities such as covering the tailings, decommissioning of other mine areas, and scarification of roads.

Dust from buildings where people are working such as the mill, maintenance shop and warehouse is expected to be minimal due to the use of bag houses or equivalent means to control dust.

6. Dust Suppression

Dust suppression measures, which are considered to be typical of current mine practices and consistent with best management practices, are expected to achieve desired results through design, operations, and closure.

6.1 Design-Based Dust Suppression Measures

In assessing dust emissions associated with the Project, consideration was given to those mitigation measures that were considered integral in the mine design. Design-based means of dust suppression include:

- The mine site is compact thereby reducing the area where dust generation can occur;
- Dry stack tailings were selected as the preferred form of tailings. These will be trucked from the mill to a tailings storage area northwest of the mill[2];
- Roads were designed as narrow and short as possible while maintaining safe construction and operation practices. This reduces the surface area of roads and the potential to generate dust;
- To minimize dust during construction and operations, coarse sized rock is be used as much as possible in building roads, pads, and laydown areas;
- If possible, road construction will largely occur during the winter when the generation of dust is at its lowest;
- Sheds, enclosures, covers, and/or bag houses will be used on most crushing and processing equipment to limit dust emissions; and
- Most outside conveyer belts will have covers.

6.2 Operation-Based Dust Suppression Measures

Best management practices will be used to control and suppress dust emissions from the Project. Dust suppression during operations include:

- Overburden stripped in opening the open pits is anticipated to be prone to wind erosion, and will be stored within the core of the waste rock storage facilities;
- During landfill activities such as topping and capping, visual monitoring will occur and if necessary, water will be applied
- Roads will be regularly graded to mix excessive silt found on the road surface with the coarser materials located deeper in the roadbed. This will reduce the percentage of silt in the road surface with the benefit of reducing related dust;
- As needed, roads and travel areas will be topped with aggregate and stabilized, which will minimize erosion and dust emissions;
- Where appropriate, larger sized aggregate will be used on the road surface to replace material lost due to wind and water erosion;
- Water, Calcium Chloride, or an equivalent approved dust suppressant, will be applied as needed to reduce airborne dust and improve visibility on access, service, haul roads, pit ramps and other travel areas. This will remove a safety hazard;
- Communication with Rankin hamlet will occur every year to ensure the entire length of the AWAR is treated with dust suppression;
- The Itivia bypass road will not have any chemical dust suppressants applied. Only water will be applied on this portion of the road for dust suppression;
- Dust aprons will be used on open pit, production drills, where practical during all open pit drilling to control dust emissions;
- Should further rock crushing occur in the quarries along the access roads, the crushers location will be best shielded from the prevailing wind, preferably behind a high wall in the quarry so as to

[2] Details on the use of dry stack tailings and how dust arising from them will be mitigated can be found in Mine Waste Management Plan

reduce the quantity of wind-blown dust, and to have as much dust as possible fall within the bounds of the quarry;

- The maximum speed limit on the AWAR will be 50 km/hr but will be lower where required for safety reasons (e.g., approaches to bridges, intersections, etc.);
- The number of mine vehicles on the AWAR will be kept to a minimum (e.g., vans and buses are to be used to transport employees to and from the Rankin Inlet airport);
- Maximize the transport of materials from Itivia to the mine site in late summer when rain events are more common, and in the fall when the road surface is frozen and less susceptible to dust generation;
- Regularly inspect the road and undertake timely repairs to minimize the silt loading on the road surface;
- Avoid multiple handling of materials that have the potential to generate dust, where possible;
- Conveyor loads will be kept within designated load limits, and conveyor covers used, where practical;
- Stockpiles will be of a suitable height, width and slope to minimise wind effects;
- Employees and contractors will be encouraged to report excessive dust to their supervisor; and
- Contractors for activities that have the highest potential for dust generation are required to submit detailed work plans that indicate dust mitigating practices and procedures. This may include the modification of activities to reduce the dust created by their activities.

6.3 Closure-Based Dust Suppression Measures

Closure will include the following dust suppression measures:

- The tailings storage facility will be covered progressively, with an engineered cover, thereby isolating it from the environment and preventing dust generation;
- Other exposed mine areas subject to wind erosion will also be covered with waste rock;
- Open pits will be flooded;
- All roads will be scarified and bridges and culverts removed thereby making the roads impassable to large vehicles and associated dust generation. Scarification will also allow plants to establish on the former roads and, in doing so, prevent wind and water erosion; and
- During operations, obsolete roads will be closed and scarified.

7. Access, Service and Haul Roads

For the Phase 1 AWAR, Agnico Eagle committed to apply active controls on the road surfaces to reduce dust. These controls could include actions such as using water or applying chemical dust suppressants such as Calcium Chloride. Although literature does not provide a control efficiency for regular maintenance of the road surfaces, the commitment by Agnico Eagle to maintain the road surface is expected to have benefits with respect to the amount of dust generated (Agnico Eagle 2011b).

The nature of the road surface and the size distribution of the material, in particular the percentage content of silt and fine sand (2 µm to 75 µm), directly influences the potential to generate dust (Thompson

and Visser 2001). The greatest sources of dust on a mine site are the disturbance of granular surfaces, and this normally occurs when materials are handled or when vehicles pass over an unpaved surface[3]. Of the two, by far the largest source of dust is vehicle traffic on unpaved roads; this has been estimated to reach 70 percent in some instances (*Cecala 2012*). The mechanical grinding of surface materials on the road and their breakdown under the weight of vehicle wheels creates dust, while the air turbulence created by the vehicle causes dust to become airborne. The amount of dust generated along a road is dependent on the dryness of the road surface, the percentage of silt on the road surface, the number of vehicles, weight and vehicle speed, weather conditions[4], and maintenance of the driving surface.

The composition of the road surface will be analysed to determine what dust suppression measures will work best. Different types of road surfaces dictate different approaches to dust control. Kissel (*2003*) makes the following recommendations based on the particle size distribution of material on the road surface:

- *Gravel with few fines.* In gravel road surfaces with not enough fines, only watering will be effective. Chemical dust suppressants can neither compact the surface (because of the poor size gradation) nor form a new surface, and water soluble suppressants will thus leach.
- *Sand.* In compact sandy soils, bitumens, which are not water-soluble, are the most effective dust suppressant. Water-soluble suppressants such as salts, lignins, and acrylics will leach from the upper road surface. However, in loose, medium, and fine sands, bearing capacity will not be adequate for the bitumen to maintain a new surface.
- *Good size gradation.* In road surfaces with a good surface particle gradation, all chemical suppressant types offer potential for equally effective control.
- *Silt.* In road surfaces with too much silt (greater than about 20 to 25%), no dust suppression program is effective, and the road should be rebuilt. In high-silt locations, chemical suppressants can make the road slippery, and there is an inability to compact the surface or maintain a new road surface because of poor bearing capacity. Further, rutting under wet conditions requires that the road be graded, which destroys chemical dust suppressant effectiveness. If the road cannot be rebuilt, watering is the best option.

Optimally designed and maintained roads offer the best means of controlling dust but it does not remove the potential for dust generation completely. The potential for dust generation decreases significantly when road design and maintenance are combined with the application of water and/or chemical dust suppressants such as Calcium Chloride.

[3] Volume 5 of the Final Environmental Impact Statement Atmospheric, Environment and Impact Assessment, section 1.4 Emissions Estimation provides details on how dust emissions can be calculated for various mine sources (*Golder Associate 2013*).

[4]Humidity, frequency of days with rain, mean daily evaporation rates, and the prevailing wind speed and direction. Wind erosion contributes to road dust emissions, especially when strong winds combined with vehicle traffic moves the dust generated far afield.

7.1 Dust Suppression Using Water

Water remains the most readily available means of controlling dust in Nunavut. It is common at mine sites worldwide to apply water through fantail sprayers or spray bars attached to a haul truck or equivalent fitted with a large tank. Agnico Eagle recognises that water is only a temporary measure, and reapplications could be necessary to achieve the desired dust control efficiency[5]. The control efficiency of water applications is dependent on the amount of water applied, the time between re-applications, penetration depth of the water into the road surface, the traffic volume, prevailing weather conditions, and the state of the road surface (e.g., excessive fines over coarse material). All these variables need to be considered before selecting water to control dust from roads and other mine areas. If water is selected to suppress dust, Agnico Eagle will use it with a greater frequency near critical areas along the roads.

Watering the roads is only possible during frost-free days. In late spring, significant sublimation can be expected when the temperatures remain below freezing, which can lead to dry roads and significant dust potential. If water is applied while the temperature is below freezing, it will turn to ice on the road and pose a safety hazard for travel. Dust suppression using water or chemicals will not be possible at this time of the year.

7.2 Chemical Dust Suppression

Chemical dust suppressants offer advantages over water under the right conditions. They tend to have the benefit of a reduced treatment frequency over water. However, use of chemical suppressants under all conditions does not necessarily lead to improved dust suppression over that of water. Presently, only fresh water, seawater, DL10, calcium chloride, EK-35 and DUST-STOP are approved for use in Nunavut. Other chemical dust suppressants can be approved for use in Nunavut following their assessment by the Government of Nunavut's Environmental Protection Service.

Numerous types of chemical suppressants are available; broad categories that encompass those approved for use in Nunavut are as follows:

- Wetting agents are designed to increase the ability of water to adhere to and spread over the dust particle. This increases the bulk density of the particle and leads to agglomeration. Calcium chloride ($CaCl_2$) is one such wetting agent.
- Binders hold particulates together and can provide long-term dust suppression on roads. DL10, EK-35, and DUST-STOP are examples of binders approved for use in Nunavut (*GN 2014*).
- Crusting agents work best on inactive storage piles. They are reasonably long lasting, rain resistant, and wind proof. None are approved for use in Nunavut.

[5] Regular light watering is more effective than infrequent heavy watering (Thompson and Visser 2007).

Table C.1 provides a comparison of the advantages and disadvantages of using water, wetting agents, and binders for dust suppression.

Analysis of the road surface is considered when the decision on whether to use chemical dust suppressants , such as Calcium Chloride, is made. Agnico Eagle usage of calcium chloride is kept to a minimum to prevent damage to vegetation adjacent to the road and to mitigate the risk of creating an attractant to wildlife (salt lick effect). It is used selectively where it's more effective than water alone, and where it doesn't adversely affect the environment immediately next to the road. As calcium chloride is susceptible to leaching, Agnico Eagle is not using it within 30 metres of waterbodies or sensitive plant communities.

Table C.1. Comparison of Dust Suppressants

Dust Suppressant	Advantages	Disadvantages
Water	- no environmental impacts - readily available	- short term dust suppression, requires frequent re-application - works better than chemical dust suppressants on roads having greater than 20 – 25 % silt on the driving service or having a majority of sand - can cause water erosion if too much is applied
Calcium chloride	-effective in climatic areas when relative humidity greater than 30% -less frequent applications required than water	- possible impact on water and aquatic species when washed from the road and into the environment - soil salinization and impact on plant life; attractant for wildlife - not effective when road surface has greater than 20 – 25 % silt or has a majority of sand on the driving surface
Oil based binders (DL10)	- effective and long lasting	- may have adverse impacts on vegetation, soil, water and aquatic life
Organic binders (EK-35, DUST-STOP)	- effective and applied directly to road surfaces- Less frequent applications than water	- significantly more expensive to use than water - limited effectiveness if road has greater than 20 to 25 % silt on the driving surface, it is better to use water under this condition -Requires specialize equipment

Adapted from Alberta Environment 2012

As part of its Meliadine Update Technical Study Phase 2, 2015 Agnico Eagle plans to use saline groundwater as dust suppressant (Agnico Eagle 2015) beginning in summer of 2019. If this proves not to be sufficiently efficient, Agnico Eagle will continue to use calcium chloride as the product is considered to work best at the Project. If another non-approved product is considered, AEM will request that the Department of Environment carry out an assessment.

7.3 Planned Dust Suppression

During the peak season where dust suppression is required, Agnico Eagle will complete daily inspections of the road and, on an as-needed basis, will apply water and a mix of $CaCl_2$ and water along the entire length of the AWAR. At the present time only water can be used on the Bypass Road.

Another chemical suppressant (Dust Stop) was tested to evaluate the performance in terms of dust suppression but it did not show to be as effective as calcium chloride. It is Agnico Eagle's intention to use best management practices concerning dust suppression along all of its roads.

7.4 Maintenance of the Road Surface for Dust Suppression

Agnico Eagle recognizes that inspection precedes maintenance and a good inspection program will lead to the early identification of areas of the roads where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the driving surface (Agnico Eagle 2011a). It will also lead to less dust generation.

The amount of dust generated is a function of the composition of the road surface. If there is a significant percentage of silt size particles on the road surface, one can expect greater dust generation. Likewise, any reduction in the percentage of silt on the road surface leads to an equivalent reduction in dust. Grading roads provides relief from excessive dust by mixing silt sized material on the road surface with coarser road materials found deeper in the roadbed.

Unpaved roads and travel areas are topped with new aggregate and graded on an ongoing basis, with the goal of improving safety, minimizing erosion, and reducing dust emissions. This is required as unpaved road constantly lose surface material through wind and water erosion, and from vehicles throwing material off the road.

8. Thresholds for Initiating Dust Suppression

Table C.2 outlines the thresholds Agnico Eagle uses at the Project to initiate mitigation measures.

Dustfall measurements are regularly collected along the roads and other parts of the mine site using passive sampling methods to record the quantity of dust collected over time, and to allow the success of mitigation measures to be quantified. The monitoring data is used to adjust mitigation measures to improve dust management strategy

Table C.2. Thresholds and Mitigation Measures

Location	Frequency	Indicator	Threshold	Mitigation Measure
Itivia laydown and Oil Handling Facility	routine inspection by Itivia supervisor during summer period.	- measured dustfall. - deterioration of visibility along road.	- deterioration of visibility. - safety concern. - dust reaching Hamlet.	- use water and/or calcium chloride to control the dust.
AWAR and bypass road	regular weekly or more frequent inspection by road supervisor during the late spring and summer periods.	- measured dustfall. - deterioration of visibility along road.	- deterioration of visibility. - safety concern. - high dust levels evident near significant waterbodies.	- use water and/or calcium chloride (AWAR road only) in areas requiring attention. - grade the road surface. - add new granular material to the road surface.
Mine site, including travel areas, haul and service roads	regular weekly or more frequent inspection by site services supervisor during the late spring and summer periods.	- measured dustfall.	- deterioration of visibility. - safety concern. - dust reaching Meliadine Lake.	- use water and/or dust suppressant on exposed surfaces such as parking areas, pads, haul, access and service roads, dry stack tailings. - review mitigation measures in place. - add new granular material to surface, - if applicable, grade the surface. - temporarily lower speed limit on site.
Ramps in the open pits	regular inspection by pit supervisor during summer period.	- deterioration of visibility.	- deterioration of visibility. - safety concern.	- use water as a dust suppressant.

Table adapted from Baffinlands 2010

8.1 The Role of the Road Supervisor

The road supervisor[6] conducts periodic inspections (minimum weekly) of roads to ensure that they are maintained for safe travel of personnel, equipment, and supplies. These inspections are recorded and any deficiency recorded and followed up by a corrective plan.

In areas or times identified by the Agnico Eagle road supervisor as being prone to high dust levels, where safe road visibility is impaired, or in areas where dust deposition could impact waterbodies or the Hamlet, the road supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, addition of aggregate to the road surface, watering of the road surface and/or using calcium chloride. The bypass road will receive special attention and extra dust suppression measures may be taken to avoid dust impinging on Nipissar Lake.

Adaptive management will be used when inspections or monitoring shows the generation of dust to be greater than anticipated and that additional mitigation measures are required. As well, if dust is unexpectedly generated where it was not anticipated, adaptive management will be used to understand the source and find ways to reduce or eliminate the same.

9. Dust Management Plan Update

The Plan will be reviewed annually and updated if there are changes in operations and/or technology.

[6] The open pit supervisor will do the same for the open pit ramps.

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AGNICO EAGLE

OIL HANDLING FACILITY

OIL POLLUTION EMERGENCY PLAN

For
Meliadine Mine Fuel Farm in Rankin Inlet

JANUARY 2019
Version 2

EXECUTIVE SUMMARY

This document presents the Oil Pollution Emergency Plan for Agnico Eagle Mines Limited (Agnico) Meliadine Division. This plan is pursuant to the Canada Shipping Act 2001; and all the subtending regulations.

Oil Pollution Emergency Plan (OPEP) designates lines of authority, responsibility, establishes proper reporting and details plans of action in the event of a spill. This plan applies to the operational phase of the fuel transfer which takes place at Agnico Eagle Ltd.'s Itivia Site Fuel Storage and Containment Facilities and Oil Handling Facility located at latitude 62°48'16.66" N and longitude 92°05'5.32" W.

A hard copy of the OPEP is available at the Rankin Inlet Marshalling facility during the transfer operations.

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ᐊᓕᓪᓴᔨᓗᓂ ᐊᐱᔭᖓ OPEP ᒪᓂᒪᔪᖅ ᑲᖏᖅᓂᓂᒍᑦ ᐅᓯᓕᖅᑐᐃᓐᓇᖅᑎᑦ ᑲᑎᓂᓂᒍᑦ ᐊᐅᓪᓚᕆᑎᑎᓂᓂᖅᖅᑎᓪᓗᑎᑦ.

ACRONYMS

Agnico	Agnico Eagle Mines Limited
DFO	Department of Fisheries and Oceans Canada
ECC	Emergency Control Center
ECCC	Environment and Climate Change Canada
ERT	Emergency Response Team
ERP	Emergency Response Plan
Fuel	P50 Arctic Grade diesel fuel
IMO	International Maritime Organization
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
KIA	Kivalliq Inuit Association
MARPOL	*The International Convention for the Prevention of Pollution from Ships,* 1973, and
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
SOPEP	Ship Oil Pollution Emergency Plan
SMP	Spill Management Plan
TC	Transport Canada
TCMSS	Transport Canada Marine Safety & Security
TEU	Twenty-foot equivalent unit

DISTRIBUTION LIST

Agnico - Environmental Superintendent

Agnico – General Mine Manager

Agnico – Health and Safety Superintendent

Agnico – Energy and Infrastructures Superintendent

Agnico – General Services Superintendent

Agnico – ERT Emergency Measures Councilor

Rankin Inlet – Rankin Inlet Hamlet Office

Rankin Inlet – Fire Department

Coastal Shipping Limited – General Manager

Transport Canada – Marine Pollution Officer

Canadian Coast Guard Environmental Response

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
0	17/07/17	All	All	Comprehensive plan for Agnico's Rankin Inlet Fuel Farm Facilities
1.1	18/09/17	5.3, 10.2, Appendix H	11, 33, 217	Additions and revisions in response to the comments by Transport Canada officer
1.2	18/02/07	All Document control 3.2.1 4.2.1 5.4 Figure 3 Table 5	All 5 4 8 12 13 24	-Version and date updated, general review and revision -Environment general supervisor updated -Added reference to spill response seacans located along the AWAR -Removed "A fuel dispensing pad area completed with a dispensing unit will be located in a lined facility with a provision to capture any and all spills at the fueling area and direct them to a containment area provided at the tank farm." – to be implemented through future planning -Added "or equivalent, ie. Plastic tote" to options for spill containment at OHF manifold -Added environment department to list of security contacts -Updated Agnico contact list
1.3	18/07/20	All	All	Fuel Handler
2	19/01/03	All Appendix I	All	-Version and date updated, general review and revision -added mock spill training in the summer of 2018

Prepared By: Agnico Eagle Mines Limited - Meliadine Division

Approved By:

Kevin Buck
Environment General Supervisor

AGNICO EAGLE

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SECTION 1. OIL HANDLING FACILITY DECLARATION

Pursuant to paragraph 168(1) (b) (i) of the Canada Shipping Act 2001, Agnico Eagle Mines Ltd. (Agnico) has signed an Oil Handling Facility Declaration. This Declaration can be found posted at the Oil Handling Facility (OHF).

SECTION 2. GENERAL INTRODUCTION

The Oil Pollution Emergency Plan (OPEP) outlines the necessary actions to stop or minimize the potential loss of fuel at Agnico Eagle Mines Limited's Itivia Site Fuel Storage and Containment Facility located in Rankin Inlet, Nunavut during the ship-to-shore fuel transfer. Additionally, it provides direction to Agnico personnel and/or contractors at the laydown and tank farm areas, and to Agnico's Emergency Response Team (ERT) for emergency spill response situations, describes oil pollution scenarios, defines the roles and responsibilities of management and responders; and outlines the measures taken to prevent spills. The purpose of the OPEP is to minimize potential health and safety hazards, environmental damage and cleanup costs.

2.1 Fundamental Principles

The following OPEP is submitted to comply with the Canada Shipping Act 2001 and all the subtending regulations and to outline the appropriate spill response protocol during fuel transfer operations at the Rankin Inlet OHF. A hard copy of the OPEP is located on site for reference and review during transfer operations. This OPEP is reviewed annually and updates are provided to Transport Canada Marine Safety & Security (TCMSS) for compliance prior to every shipping season. The following priorities shall be taken into account when responding to an oil pollution incident and in the following order:

1. Safety of the workers;
2. Safety of the OHF;
3. Safety of the community of Rankin Inlet;
4. Prevention of fire and explosion;
5. Minimize of the oil spill;
6. Notify and report the oil pollution incident to associated Governing bodies;
7. Minimize the environmental impact of the spill;
8. Complete clean-up from the oil pollution incident.

2.2 Legislative Requirements

This plan was prepared in accordance with federal legislation listed below, which lists legislative instruments applicable to Agnico's Itivia Site Fuel Storage and Containment Facility. All requirements found in the Canada *Shipping Act*, *2001*, ss. 168 are laid out in the Meliadine Mine site OHF Concordance Table which will be submitted to Transport Canada (TC) as a stand-alone document.

The OPEP complies with the requirements for procedures, equipment and resources as set out in the *Canada Shipping Act* (s.s. 660.2(4)) specific to a fuel handling facility - the bulk incoming transfer of fuel from ship-to-shore and spill scenarios directly relating to this operation.

The following standards and regulatory requirements have been reviewed in preparation of this document:

- Canada Shipping Act;
- Response Organizations and OHFs Regulations;
- Vessel Pollution and Dangerous Chemical Regulation;
- Environmental Response Arrangements Regulations;
- OHFs Standards (TP 12402E);

- Response Organization Standards (TP 12401);
- Arctic Waters Oil Transfer Guidelines (TP 10783);
- Environmental Prevention and Response National Preparedness Plan (TP 13585);
- Release and Environmental Emergency Notification Regulations;
- Guidelines for reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants;
- Requirements of the Central & Arctic Regional Response Plan; and
- Storage tank System Regulations

2.3 Related Documents

Management and monitoring plans for the Meliadine Project and that provided input to the Oil Pollution Emergency Plan include the following:

1. Spill Contingency Plan;
2. Emergency Response Plan; and
3. Shipboard Oil Pollution Emergency Plan[1].
4. Shipping Management Plan

The cornerstones of contingency planning for Agnico are the Spill Contingency Plan and the Oil Pollution Emergency Plan. These, coupled with the Emergency Response Plan and the Shipping Management Plan, describe the processes to be followed in responding to a spill. The OPEP on its own provides the necessary information in the event of a mishap where fuel is lost during the transfer of fuel from a tanker vessel to the Fuel Tank Facility.

The OPEP complements the Spill Contingency Plan and it should not be construed as superseding it. The Spill Contingency Plan addresses a wider scope of operations stretching 35 kilometers from the Meliadine mine site in the north to the infrastructure at the Itivia Site Fuel Storage and Containment Facilities. The OPEP strictly covers the transfers of fuel from ship to OHF.

2.4 Meliadine Mine Oil Pollution Emergency Plan

This Plan is a working document that will be reviewed annually and updates will be provided to TCMSS for compliance prior to every shipping season.

This plan specifically centers on the activities in ship-to-shore transfer of fuel from a small tanker delivering fuel to Agnico's Itivia Site Fuel Storage and Containment Facility constructed in Rankin Inlet. On site personnel at the Facility are expected to respond to spill incidents (generally smaller than 1 m^3) that can be contained and cleaned up without assistance, while the Emergency Response Team will respond to larger spills.

Fuel is being delivered to Agnico's Itivia Site Fuel Storage and Containment Facility by Coastal Shipping Limited, a Division of the Desgagnes Group. Fuel is stored within the existing tank farm owned and operated by Agnico. The Shipboard Oil Pollution Emergency Plan (SOPEP) is the responsibility of the shipping company. The outline of the SOPEP prepared by Coastal Shipping Limited can be found in Appendix A – 1.1.

[1] *The Shipboard Oil Pollution Emergency Plan (SOPEP) contains all information and operational instructions as required by the "Guidelines for the development of the Shipboard Marine Pollution Emergency Plan" as developed by*

the International Marine Organization. Desgagnes, the shipping company, is responsible for this Plan.

SECTION 3. PLANNING STANDARDS

3.1 Facility Category

OHFs are categorized according to their maximum oil transfer rate in cubic meters per hour, in respect of the oil product loaded or unloaded to or from a ship, as follows (Table 1):

Table 1 - Category of OHF

Category of OHF	Maximum Oil Transfer Rate (cubic meters/hour)
Level 1	150
Level 2	750
Level 3	2 000
Level 4	More than 2 000

The product transfer rate (Diesel) for the Agnico's Itivia Site Fuel Storage and Containment Facility OHF at Rankin Inlet is 400 m^3/hr. As indicated in the OHF Standards TP 12402, this flow rate requires the onsite spill response capacity to meet a Level 2. To do this, the OHF will have the equipment and resources to respond to a 5 m^3 spill within the required timelines specified in the Response Organization and OHF Regulations:

1. Contain and control in one hour of spill detection; and
2. Commence cleanup within six hours after spill detection.

3.2 General Planning Guidelines

3.2.1 Response Time Standards

Agnico and contractor personnel at Itivia Site Fuel Storage and Containment Facility have appropriate training to respond to spills, if it is safe to do so (see Table 8). The material onsite can be deployed within one hour to contain a spill of 5 m^3 or less, unless deployment within one hour will be unsafe. Generally, for a spill greater than 1 m^3, the OPEP and the Emergency Response Plan (ERP) will be activated and the Emergency Response Team (ERT) located at Meliadine Mine site will come in Rankin Inlet to help. Realistically, the ERT can be on site within 60 minutes (or less) ready to help for the clean-up activity. If the spill is greater than 5 m^3, material from the spill response seacans along the AWAR (km 7 and 18) and the Meliadine Mine site will be required and will be brought to the Itivia OHF within 60 minutes to finalize the containment (if not complete) and recovery of the oil pollution incident.

3.2.2 On-Water Recovery

Agnico has a boat in a sea can at the Itivia Site Fuel Storage and Containment Facility that is ready to be deployed in case of an emergency situation.. All personnel involved in a response situation need to have or complete the pleasure craft operator's certification.

If additional water crafts are required to help with the containment of a spill from the OHF local resources

such as Sarliaq Holdings Ltd and Inuksuk Contracting. Contact info for these companies can be found in Table 6.

3.2.3 Dedicated Facility Spill Response Equipment

Agnico has a sea can with spill response equipment at the Rankin Inlet shore within Agnico's Marshalling area and includes booms that can rapidly be deployed to limit the spread of any spill on water. The list of equipment can be found in Table 2. The spill supplies and resources are in place to respond to a 5 m^3 spill within the required timelines as specified in the Response Organizations and OHF Regulations. These sea cans are inspected before each transfer season to ensure that all the spill response material and PPE are there and stored in a manner that is organized and accessible in order to comply with regulatory requirements and allow an efficient spill response.

3.2.4 Transfer Conduit

The transfer conduit or hose that is used to transfer fuel from Coastal Shipping Vessels to the Agnico Rankin Inlet Fuel Farm OHF are pressure tested annually by Coastal Shipping according to the regulation prior to it being placed into service. A copy of the annual pressure tests conducted can be found in Appendix B. The transfer conduit will always have a bursting pressure of at least 4 times its maximum design pressure and the design pressure will be clearly marked on the conduit.

3.2.5 MEL-ENV-0029: OHF / Ship to Shore Fuel Discharge Procedure

Agnico has created an internal procedure to ensure all planning and precautions are in place prior to the transfer of any fuel from the vessels to the OHF. This procedure can be found in Appendix C along with the Pre-discharge and Spill Response Sea Can checklist.

SECTION 4. RANKIN INLET MARSHALLING AREA AND FUEL STORAGE FACILITY

4.1 General Overview and Site Description

Agnico Eagle's proposed tank farm and laydown area is located at Itivia in Rankin Inlet on Melvin Bay at latitude 62°48'16.66" N and longitude 92°05'5.32" W, map sheet 055/K16. Its location is shown on Figure 1-1. Two (2) fuel storage tanks are installed at the Rankin Inlet Itivia fuel farm. The site location of the 20 million and 13.5 million liter tanks (tank #1 and #2 respectively) is shown on Figure 2 below. Tank #1 was completed in 2018; Tank #2 was erected in 2017.

Figure 1 - Location of the Community of Rankin Inlet

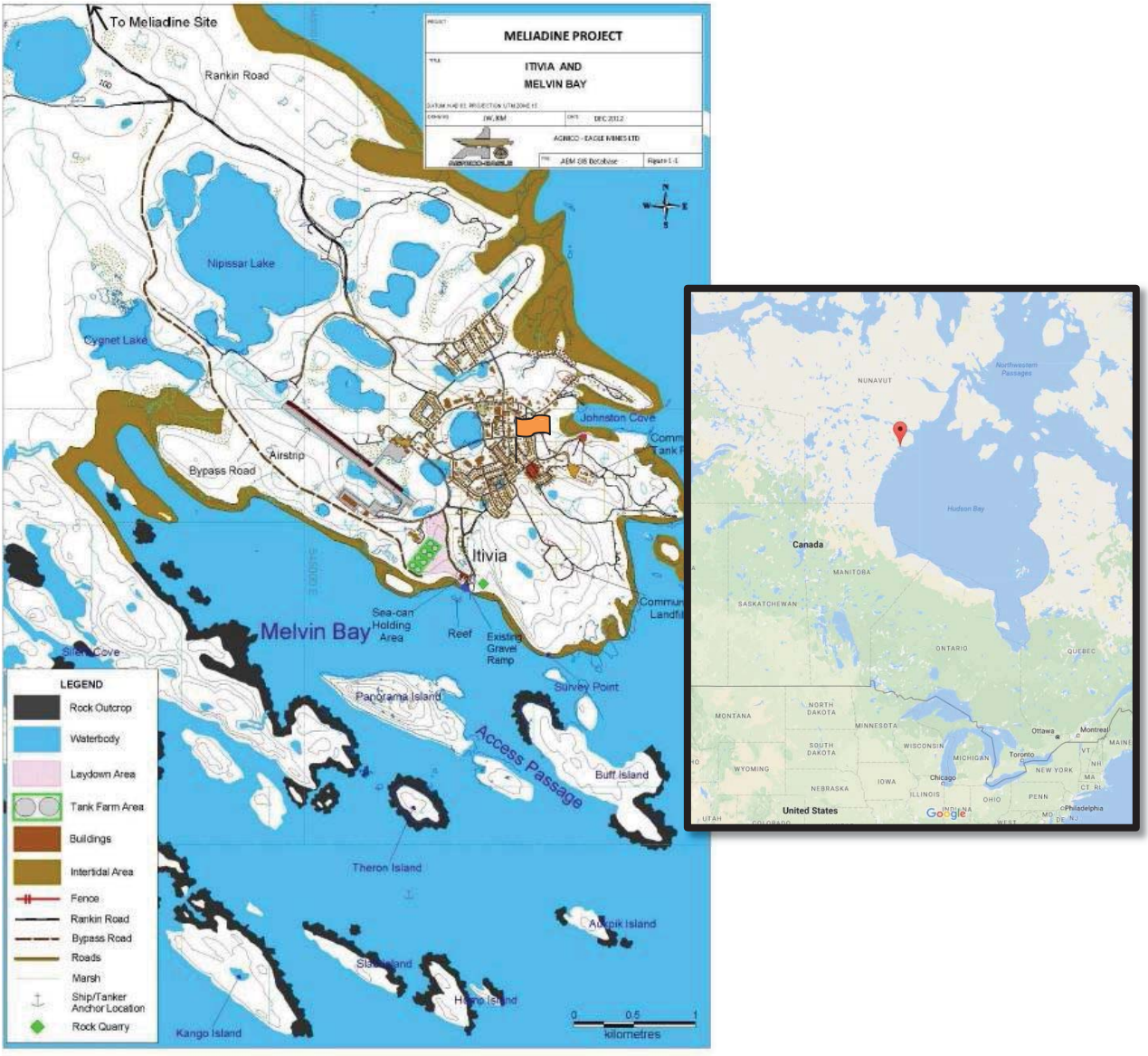
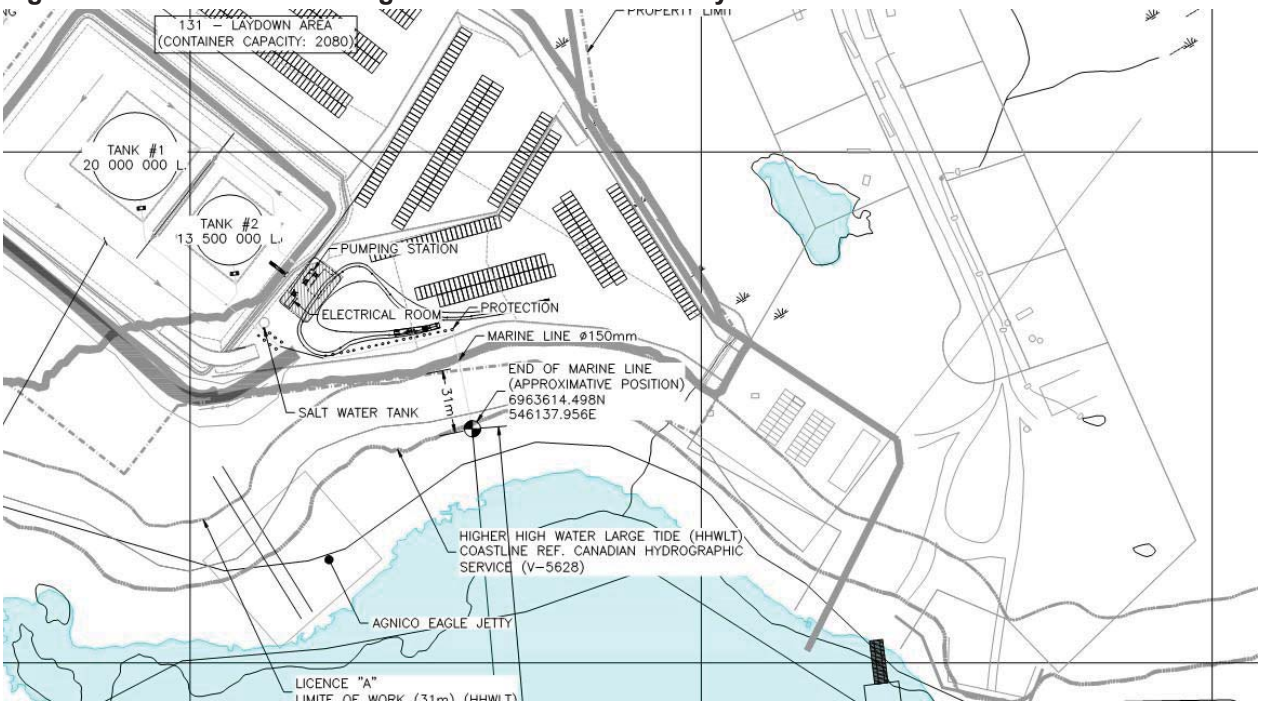


Figure 2 - Itivia Site Fuel Storage and Containment Facility



4.2 Fuel Storage Facilities Infrastructure

4.2.1 P-50 Fuel Tanks

The diesel fuel tanks are contained within an impermeable lined and bermed area. The steel fuel tanks were field-erected and built to API-650 standards. The bermed area is capable of containing 110% of the volume of the largest storage tank. The impermeable lined and bermed cell has the following:

- A granular base for the tank completed with an impermeable LLDPE liner system and granular dikes;
- A tank complete with the required appurtenances such as stairs, base manholes, water draw offs, re-supply nozzle, suction nozzle, tank lighting, tank level monitoring, roof manhole, manual gauge hatch, tank temperature and P/V vent;
- Piping for unloading and loading; and
- Site lighting via fixtures mounted from the dispensing building.

The Tank Farm Facility is designed to meet the following standards:

- National Fire Code 2010;
- *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* – 2008; and
- Canadian Council of Ministers of the Environment, "*Environmental Code of Practice of Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied*

Petroleum Products – 2003 (Updated in 2013) (PN1326)".

The OHF is constructed and operated in accordance with TC Arctic Waters Oil Transfer Guidelines (TP 10783E) and OHF Guidelines (TP 12402E).

4.3 Rankin Inlet Shoreline and Marine Characteristics

The following Rankin Inlet Shoreline and Marine Characteristics were gathered during the Environmental Impact Assessment that was performed prior to construction of the Rankin Inlet Marshalling facility and Tank Farm.

4.3.1 Topography

The bulk fuel storage area is located south of the residential area of Rankin Inlet, and within the industrial area of the community of Rankin Inlet, south of the Rankin Inlet Regional Airport. The OHF sits on a terrace parallel with the shoreline of the coast of Hudson's Bay, the bay in which Rankin Inlet is located is known as Melvin Bay. There is a gradual slope (5 to 10% grade) toward Melvin Bay with an approximate elevation change of 3-5 m from the OHF to the coastal shoreline. The Melvin Bay shoreline is gently sloping, well-drained, very rocky, comprised of boulders and rock.

4.3.2 Flora and Fauna

There are no trees and few shrubs in the area surrounding the bulk fuel storage facility. The site is covered by low-lying vegetation; predominated by grassy hummocks, dwarf willow, sedge, green moss and lichen.

Arctic ground squirrels, ptarmigans and songbirds inhabitthe area surrounding the bulk fuel storage facility. Lake cisco, lake trout, arctic char, lake whitefish, round whitefish, slimy sculpin and stickleback are predominant species found in Hudson Bay in the vicinity of Rankin Inlet.

4.3.3 Tides and Currents that Prevail at the Facility

There is a general cyclonic (counter clockwise) current in Hudson Bay with mean monthly residual currents of approximately 4 to 6 cm/sec. In Hudson Bay, stronger currents occur in summer than in winter and more variability occurs at the surface than at depth. Based on the navigation charts prepared by Canadian Hydrographic Service, flow through the Access Passage into Melvin Bay can reach approximately 26 cm/s (0.5 knot; CHS 1997). Tidal range is about 4.6 metres at Panorama Island in Melvin Bay.

4.3.4 Meteorological Conditions Prevailing at the Facility

Monthly meteorological data has been collected from 1981 to 2009 at the Rankin Inlet A climate station, which is a Meteorological Service of Canada climate station. Snow and rain are combined to give monthly average precipitation. The prevailing winds for the area are generally from the north to north-west and average 23 km/h.

4.3.5 Surrounding Area Environmental Sensitivities

The hamlet of Rankin Inlet is situated on the Kudlulik Peninsula which protrudes into Rankin Inlet of Hudson Bay. Rankin Inlet itself has three (3) main rivers entering it: the Diane River in its northwest, and the Meliadine River and Char River in the northeast. Melvin Bay is fringed with drying flats on the north side and encumbered by islands, islets, reefs and shoal water. The access passage is mostly bedrock.
Itivia is situated on the northeast shore of Melvin Bay as shown in Figure 1. Itivia has an intertidal zone of up to 56 metres with the substrate predominately comprised of 70% gravel/cobble, 20% fines and 10%

boulders. The substrate at this location was strongly influenced by the addition of gravel to develop the harbour's boat launch. In the open water season, Itivia provides a place for residents to moor and launch their boats. A few cabins are situated across Melvin Bay from Itivia but otherwise there are no buildings on the shore. Itivia is used for the loading and unloading of community supply vessels. In the winter, it is used by residents for snowmobile access to the sea ice in Melvin Bay and beyond.

Melvin Bay has a typical biological assemblage of macrophytes, plankton, zooplankton, benthic invertebrate and fish found elsewhere in this area of Hudson Bay. Near shore macrophyte coverage around Melvin Bay is sparse and is predominately rockweed (Fucus spp.) and kelp (Laminaria spp.). Phytoplankton are predominately dinoflagellates while the zooplankton community is more variable. Incidental invertebrate species are observed and include amphipods, barnacles, unidentified bivalves (e.g., mussels, clams), winkles (Littorina sitkana), ascidians (sea squirts), and unidentified crab species. Arctic char were not captured in Melvin Bay during the baseline survey. The predominate fish was Greenland cod followed by slender eelblenny and fourhorn sculpin.

SECTION 5. SITE ACTIVITIES

5.1 Nature of the Oil Product

The main fuel stored at the Agnico's Rankin Inlet Fuel Farm is P50 diesel. Appendix D includes the MSDS for Diesel. All other fuels such as gasoline, Jet-A and possibly other grades of diesel are purchased in drums or 1 m^3 totes and brought to the mine site for storage at the Itivia Site Fuel Storage and Containment Facility, or purchased and brought to site from a supplier or contractor in Rankin Inlet.

5.2 Bulk Transfer

The tankers delivering diesel fuel are anchored within Melvin Bay. From there, transfer hoses (Conduit) are connected to a shore based pipeline for transfer of P-50 diesel fuel to the diesel tank farm.

Ballast are not required for the inward voyage as the tanker arrives at Rankin Inlet loaded with diesel fuel. After transferring the fuel to the tank farm, the tanker takes on ballast in its segregated ballast compartments before sailing out.

Due consideration is given to prevailing and expected wind, weather and tide conditions when undertaking ship-to-shore fuel transfers.

The tanker is discharging at a rate of 400 m^3/hr. Communications between the shore and the tanker is maintained throughout to ensure the safe transfer of the fuel and to avoid the overfilling of the tanks. The ship-to-shore transfer procedure being use is similar to the one used at communities throughout Nunavut.

5.3 Measures to Minimize a Diesel Pollution Incident

The small tanker is anchored offshore in water of sufficient depth to allow for draught and tidal changes during transfer.

The transfer of the fuels uses sound, well-rehearsed practices, including an adequate number of trained and alert personnel, have sufficient materials, and use well maintained, thoroughly tested equipment. A team of trained personnel on the tanker is in charge of the tanker fuel transfer equipment, while an onshore team is in charge of the land based transfer equipment. Agnico has at least 2 trained personnel on the land to observe for any leak detection: a third party contractor (Intertek) and the Rankin Inlet Supervisor. The role of the third party contractor is to apply procedure and oversee operation during the fuel transfer. To do this, the third party contractor needs to come on site at least one (1) day before the first day of transfer to receive the appropriate training given by the Environmental Department. Fire-fighting, spill response equipment, and supplies are located on the tanker and onshore near the transfer point as required by TC. This includes readily available absorbent material (including absorbent pads) at the flexible hose connections on deck and onshore to quickly address minor spills at predictable minor spill locations. Additionally, Agnico placed a sea can with spill response supplies (including boat) and equipment at the Itivia Site Fuel Storage and Containment Facility area where it can quickly be accessed in the event of a spill.

Four-inch (10 cm) steel piping able to accommodate a flow rate of approximately 400 m^3/hr leads down to the shore from the diesel tank farm. Conduit from ship-to-shore are connected to the fuel-receiving manifold located onshore using a dry-break coupling(s).

- Complete checklist before / during transfer for the on-land responsible (See Appendix E);
- Complete checklist, provide by Desgagnes, with vessel captain before transfer begin (Appendix E);
- Complete inspection / inventory of spill response sea can before transfer;
- During the transfer, regular monitoring are undertaken for detection of incipient spills and leaks between the tanker and the tank farm;
- Radio test before transfer and at hour intervals during transfer between the personnel on land and the captain of the vessel
- Transfer operations will be suspended should any leak be detected or filling alarm are activated;
- The onshore area and ship deck are well-lit as fuel transfers could continue around the clock;
- Have a good knowledge of the OPEP requirement and protocol to follow in case of a spill by receiving a training / review each year before the transfer season; and
- The regular update of the OPEP.

During the ship-to-shore transfer, Agnico has competent personnel on location at all times to monitor the fuel transfer and maintain contact with the tanker's crew. Should problems arise, the ship can be called to shut down the transfer and onshore piping will be closed down. In the event of a spill that escapes the containment boom, diversion booming will be deployed to minimize migration of a spill throughout Melvin Bay. Adequate lighting is in place during all transfers, to allow for proper inspections of transfer locations around the clock. The lighting system intensity is not less than 54 lx at each transfer connection point of the vessel and OHF and a lighting intensity not less than 11 lx at each transfer operation work area around each transfer connection point of the vessel and OHF.

For more information, please refer to Appendix C: MEL-ENV-0029: OHF / Ship to Shore Fuel Discharge Procedure.

5.4 Permanent Containment Structure

At the connection of the ship's conduit to the OHF manifold, a permanent containment structure was erected for the transfer of product. This structure is capable of holding ~400 L of liquid in the case that there is a leak at the flange or residual drips out of the conduit or hard wall pipe.

Spill "pop-up" pools/secondary containment berms will be in place under each joint for the conduit used to fill the Fuel tanks during fuel transfer. These pop-up pools/berms are only capable of holding 20-50 L of fuel and are in place to catch residual and be a first line of defense in the case of a leak.

SECTION 6. MELIADINE RESPONSE TO EMERGENCIES

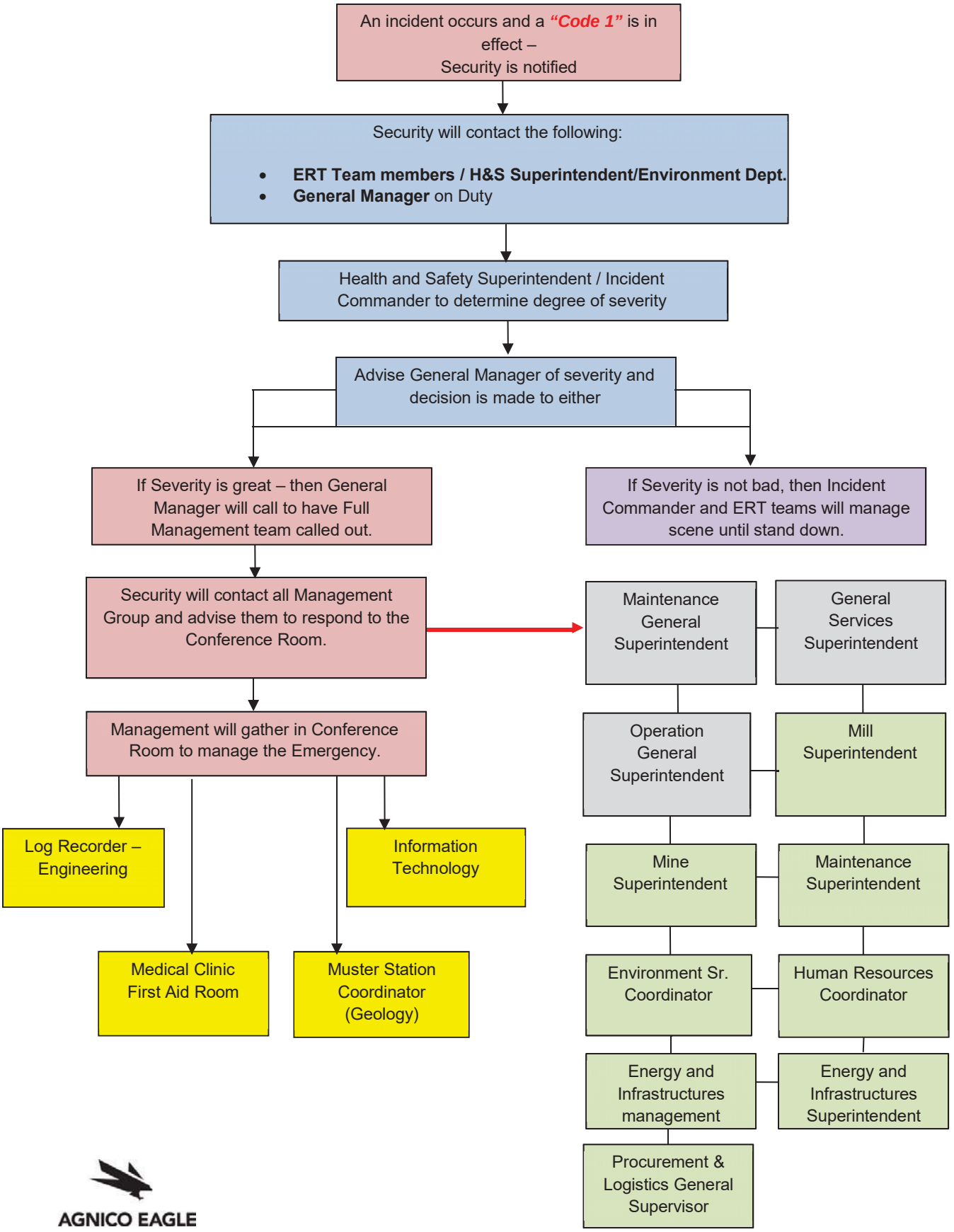
The Itivia Site Fuel Storage and Containment Facility OHF is considered Level 2 Handling facility as indicated in the OHF Standards TP 12402. With a transfer rate of ~400 m^3/hr, Agnico's OHF must have the spill response capacity to respond to a minimum of a 5 m^3 spill.

6.1 Response Management Structure

Agnico has an Emergency Response Team (ERT) at the Meliadine site trained and responsible for controlling Level 2 or greater spills at the Itivia Site Fuel Storage and Containment Facility, and for assisting with medical and other emergencies that may occur at the mine site or the OHF.

Figure 3 depicts the Response Management System.

Figure 3. Response Management System



6.2 Logistics and Planning

The Emergency Measures Counsellor (EMC) ensures that site drawings and equipment lists are posted in key locations throughout the site so that important information is always readily available. This includes the following:

- Location and isolation points of energy sources;
- Location of emergency equipment (e.g., fire water pumps, fire extinguishers, monitors, self-contained breathing apparatus);
- Emergency procedures outlines, such as specialist firefighting, chemical neutralization;
- Location of equipment for combating pollution (e.g., booms, pumps, absorbents, dispersants);
- Availability of internal and external emergency medical support (e.g., hospitals, clinics, ambulances, medical supplies, personnel with medical or first aid training);
- Location of toxicity testing facilities (e.g., gas and water);
- Location of wind direction / speed indicators;
- Directions on how to contact the local or regional weather forecasting service;
- Location of personal protective equipment (PPE) and directions on its proper use; and
- Location of first aid stations and muster areas.

The Incident Commander, EMC, and Health and Safety Superintendent know where, throughout the project site, all of this information is posted and where emergency equipment is stored. These individuals are also trained in the proper use of emergency equipment.

SECTION 7. EQUIPMENT AND PPE

The following sections describe the items that are available in the case of a spill at the Agnico Eagle Mines Limited's Rankin Inlet Fuel Farm OHF. Equipment has been classified into items available for spill sizes either up to or greater than 5 m^3. However, any and all means will always be used to respond to a spill in a timely manner and ensure a prompt clean-up of any spill.

7.1 OHF Response Equipment for spills up to ~5 m^3

The following equipment (Table 2) is available right at the OHF during open water season in a sea can designated for ***Environmental Emergency*** and can be deployed on scene within one hour, if it is safe to do, to contain and control the spill.

Table 2 - Material available in the Spill Response Sea Can at Agnico's OHF

Agnico Eagle Boom Sea Container		
Line #	**Description**	**QTY**
1	Anchor Set; 25kg anchor, 50' x 1/2" chain ballast, 50' rode line and 21" marker buoy	6
2	Tow bridles with bullet float	4
3	8" float x 12" skirt OptiMax II Boom - 25' sections	32
4	Mini Max Hydraulic Skimmer with pump, Power pack	1
5	14' aluminum boat with 15 hp outboard prop motor	1
6	1/2" Polyester Yacht Braid rope (600' rolls)	10
7	Drive pin anchors	5
8	Slater anchors	5
9	Wing anchors	5
10	Sorbent Boom, 5" X 4 per bag	30
11	Mustang Floater Suit	4
12	Personal Floatation Devices (PFD)	8
13	Oil resistant gloves	12
14	Leather gloves	12
15	Sledge Hammer with Fibreglass Handle	2
16	Spade - Long Handle	2
17	Fire Extinguisher - 20lb ABC with brackets	2
18	Tyvex Suit XL	20
19	Alberta Standard #3 First Aid Kit	1
20	Storage Totes for Small Items	4
21	Quick Tank (500 gallon / 1893 ltrs.)	1

7.2 Additional Response Equipment or for Spills >5m^3

All equipment previously mentioned is available for use during any emergency situation for a spill greater than 5 m^3. The following equipment would take time to get to the spill site, time would vary depending on distance from the spill. All these equipment and resources can be deployed on scene in <6 hours for the recovery and clean-up of the spill.

7.2.1 General Equipment

This section addresses the emergency response machinery, equipment, tools and other resources that can be made available on-site for spill counter measures.

7.2.1.1 Mobile Equipment

Mobile equipment available to Agnico, that will be used for spill contingency include:

- Graders-1
- Cranes-3
- Snowmobiles-3
- Vacuum Truck-1
- Loaders-6
- Backhoe-3
- Bulldozer-1
- Forklift & Hysters-4
- Water Trucks-6
- Winch Trucks-2
- Pickup Trucks-40
- Generator Sets/Light tower-26
- Fire Truck-1
- Boats-4
- Fuel Trucks-1
- Bobcat-4
- Haul Trucks-13
- Snow Cat-1

All the previous listed equipment can be found on the Meliadine Project site. Wheeled equipment can be at the OHF in Rankin Inlet in 3-6 hours. Tracked equipment would have to be loaded and transported which would take 5-6 hours.

7.2.1.2 Emergency Transportation

Emergency transportation that will be used under an emergency situation are:

- Seasonal Aircraft (fixed wing or helicopter)
- 4-wheel drive vehicles >70
- Snowmobiles x 9
- Boats and motor x 4

7.2.2 Spill Response Kits and Containers

7.2.2.1 Kits

Spill response kits are strategically located where required. Each department and work area is responsible for providing sufficient spill response kits in their respective work areas. The kits are kept in marked and accessible locations. The locations include all fuel storage areas, chemical storage areas and so on.

All of the mobile equipment for the Meliadine project (including heavy equipment) contains an emergency spill kit. Regular audits are completed to ensure these are in place.

7.2.2.2 Emergency Trailer

Agnico also have an Environmental Emergency Trailer which is easily accessible and mobile. The trailer is located at the Meliadine Project Site east of the Environmental Office. This trailer contains the following items:

2018-Emergency spill trailer equipment	
Items	**Quantity**
Evac system	2
Leak control kit	1
Drum opener	1
Westcott	2
Hammer	2
Scew driver	3
Plier	1
Empty drum	4
Berms 4x4	2
Tarp	2
Spill pad-Universal (bags)	2
Spill roll-Univesal	2
Booms (5x10)-Univesal (bag of 4)	2
Booms (8x10)-Universal (bag of 4)	2
Absorbent (gator)-(Bag)	3
Absorbent (pellet)-(bag)	2
Quatrex-bags	5
Milk crate	1
ty-wrap	Pack
Yellow liner roll	1
Anti-spark Gaz pump	1
Pump Hose	200ft
Shovel 4ft round tip	3
Re-bar 3-4-5ft	14
Sledge hammer	2
Jerry can (full gaz)	2
Crow bar 4 ft	2
Pig tale (3 balls)	1
Pin for pig tale	1

7.2.2.3 AWAR Sea cans

Along the AWAR there are 2 Environmental Emergency sea cans. These sea cans are strategically

placed along the road at water crossings. Each Environmental Emergency sea can contain the following material:

2018-AWAR SPILL SEACAN (KM 7)

Seacan	Items	Quantity
271029-0	Empty drums (Sealed) 45 gal.	10
	Quatrex Bags	10
	Yellow liner (Q-bag liner) Roll	1+1/4
	Mini Berm 3'x3'	2
	Mini berm 2'x3'	4
	Spill Kit (blue drum)	1
	Tarp 8'x10'	3
	Tarp 20'x30'	0
	Tarp 30'x50'	1
	Universal boom 5"x10'	20
	Universal boom 8"x10'	20
	Oil only booms 5"x10'	20
	Maritime barrier (Baffle)	3
	ABS pipe : 10' (4")	0
	Absorbent Sheet (bags)-Universal	10
	Absorbent Roll-Universal	10
	Absorbent pellet (bag)	7
	Oil gator absorbant (bag)	10
	Plug pattie	0
	Fork lift crate (pallets)	6
	Long handle round and sqaure point shovel	6
	Chisel point crow bar 16 lbs 57"	2
	Ice braker chisel	1
	Sledge hammer 12 lbs 36''	3
	Steel Rod bar (4')	16
	Steel Rod bar (6')	10
	stream skimmer	0
	temporary storing device (old bladders, pipes and fitting)	0
	CI agent granules (100lbs)	0
	Oil spill kit (pail)	1
	Yellow Nylon rope (bags)	2
	Mini-Sledge Hammer	1
	Ty-wrap (pack)	1
	26' Tape	1
	Multi-purpose shears	1
	Crescent wrench	1
	Hook knife	1
	Mechanics wire roll	1
	Side cutters	1

2018-AWAR SPILL SEACAN (KM 18)

Seacan	Items	Quantity
278737-1 (KM 18)	Empty drums (Sealed) 45 gal.	10
	Universal boom 5"x10'	12
	Universal boom 8"x10'	12
	Oil only booms 5"x10'	12
	Maritime barrier (Baffle)	3
	Absorbent Sheet (bags)-Universal	10
	Absorbent Roll-Universal	10
	Absorbent pellet (pail)	10
	Fork lift crate (pallets)	6
	Yellow Spill Kit	1
	Evac System	2
	Silt Bags	2
	Silt Fence	2
	Yellow Liner Roll	1
	Q-Bags	10
	Rebar 3''	4
	Rebar4''	10
	Sledge Hammer	1
	Mini Sledge Hammer	1
	Nylon rope roll	1/2
	'Pingouin''	1
	Tarp	4
	Bolt cutter	1
	Side cutters	1
	Knife	1
	Mechanic wire roll	1
	Yellow and red ruban	1 roll each
	Ty-wrap (pack)	1
	Pipe wrenck	1
	Westcott	2
	Crow bar	1

7.3 PPE

7.3.1 PPE at OHF for Spills <5 m^3

The following PPE (Table 3) can be found in the Emergency Trailer and also in sea can at the OHF:

Table 3 - PPE available at OHF

Quantity	Equipment/tool name
3	Rain gear -- Pants and Top (L & 2-XL)
3	Rubber boots (size 8,10,12)
6	Rubber gloves
3	Goggles
3	Tyvex suits (L & 2 XL)
3	Safety glasses
3	Leather gloves

This is adequate PPE intended for 3 persons. Additional PPE will be available from the Meliadine Project site.

7.3.2 PPE for Spills >5 m^3

PPE is stored in bulk quantities at the Meliadine Warehouse. Quantities of each can be found on site using the JD Edwards system. In addition, the community of Rankin Inlet has certain PPE that can be purchased through Agnico Eagle after consulting the Agnico Eagle Procurement and Logistics department; however quantities of this PPE cannot be relied on within Rankin Inlet.

SECTION 8. COMMUNICATION

The primary basis for communication is the phone system; back-up communication is also available via radios or satellite phone. For on-site communication, hand-held radios is mandatory for all employees working or travelling in remote areas from the OHF. Cell phones can be used as an additional means of communication however only CDMA service is available at the OHF. Back-up power sources and replacement batteries for communications equipment is available to provide continuous, uninterrupted operation either at fixed facilities or at emergency sites.

Key site personnel are accessible at all times by either portable radios, radios in vehicles, or office radios. The Health Care Professional carries a hand-held radio and is available at all times. Security personnel monitor the emergency channel twenty-four hours per day. Senior management personnel will rotate as "On-Call Managers" for after-hour emergencies. An accommodations list that highlights key personnel will be posted and updated as required.

In the event of a major emergency, all external communications for the project site and associated areas will be cut and all external contact will take place solely through the Emergency Control Center at the Meliadine Site.

During fuel transfer operation, the vessel master and the operator of the OHF always have a two-way communication on a continuing basis. This two-way communication is the direct communication by radio and the use of the cell phone.

8.1.1 Communication with the Public

Communication with public bodies during the state of emergency is the responsibility of the General Mine Manager or the Communications & Public Affairs Corporate Director.

In the case that the community of Rankin Inlet should need to be evacuated on short notice, the Emergency Response Team will immediately assist in the evacuation of the community. The General Mine Manager will immediately contact the Mayor of the Hamlet to inform regarding the situation. In addition, if safe to do so, a radio notification should be immediately broadcasted on the Rankin Inlet Radio station.

8.1.2 Hand Held Radio Communication

The channels used for hand held radio communication on the Meliadine Project site, the All Weather Access Road, OHF, and associated facilities are as follows in Table 4:

Table 4 - Meliadine Radio Channels

CAMP
CONSTRUCTION
EXPLORATION
ROAD
UG OPERATION
DRILL & BLAST
WAREHOUSE
MAINTENANCE

**Grey represents channels used at Itivia

8.1.3 Contacts

Internal contact information is contained in Table 5 for all Agnico personnel involved in spill recovery. Table 6 contains contact information for contractor contacts which can be called for assistance with spill recovery. Table 7 is a list of government officials and external contacts to notify and provide subsequent reporting.

Table 5 - Agnico Contact

Title	Name	Telephone No.
Sr. Vice President, Environment and Sustainable Development	Louise Grondin	416.847.8656 Cell: 819.724.2020
Vice President of Environment and Sustainable Development	Michel Julien	416-947-1212 ext. 3738 Cell: 514.244.5876
Corporate director, Communications & Public Affairs	Dale Coffin	416.847.8669 Cell: 647.274.4154
Director Shared Services	Jason Allaire	819.759.3555 ext. 4608004 Cell: 819.355.2608
Meliadine General Mine Manager	Martin Plante	819-759-3555 ext 4608058 Cell: 819.856.1873
H&S Superintendent	Dominic Richard	819.759.3555 ext.4603076 Cell: 819.856-4104
H&S General Supervisor	Nathalie Ledoux	819.759.3555 Ext 4603968
Emergency Measure Counsellor	Dave Loder Darren Wilcox	819.759.3555 ext.4603113
Environmental Superintendent	Nancy Duquet Harvey	819.759.3555 ext.4603175 Cell: 819.856.4385
Environmental General Supervisor	Kevin Buck	819.759.3555 ext.Cell: 819.860.4515
SR. Environmental Coordinator	Jennifer Brown Daniel Gorton	819.759.3555 ext.4603996
Environmental Department	Environmental Technicians	819.759.3555 ext.4603903 & 4603925

On-site Nurses		819.759.3555 ext.4603011

Table 6 - Contractors / Local Contacts

Title	Telephone No.	Contact in Emergency for:
Nolinor Aviation Services	Protocol Agent (819).759.3555 ext. 8008 Emergency (450) 476.0018 (888) 505.7025	Flight services for additional crew, or additional supplies
Calm Air	(867) 645.2746 Emergency (204) 677.5013 (204) 677.5019	Flight services for additional crew, or additional supplies
Dyno Nobel Explosives Ltd.	(867) 793-4610 ext. 3926	Heavy Equipment, Man power, Emergency Blasting
Desgagnes Group (Shipping)	(867) 979-3799	Fuel Hauler
Sarliaq Holdings Ltd.	Richard- Office 867.645.2653 Cell 867.645.1281 Silu - Office 867.645.2651 Cell 867.645.7645 James - Office 867.645.2759 Cell 867.645.6718 Kilabak - Office 867.645.2759 Cell 867.645.7851 Marvin - Cell 867.645.6799 Shop - 867.645.2753	Equipment, man power, Ground transportation services
M & T Enterprises	Sean Sykes – 250.505.6105 Raymond Boisvert – 250.551.2894	Equipment, man power, Ground transportation services
Inuksuk Construction	John Winter – 902.483.0398 Tony King – 902.478.4700 Inukshuk Construction – 867.645.4032	Man power, equipment, trades personnel i.e. pipefitter, plumber, electrical

Table 7 - External Contacts

All phone numbers will be reviewed each year at the beginning of July and updated.

Organization/Authority	Telephone Number	Fax Number
NT-NU 24-Hour Spill spills@gov.nt.ca	(867) 920-8130	(867) 873-6924
Workers' Safety & Compensation Commission	(867) 979-8500	(867) 979-8501
Kivalliq Inuit Association (KIA)	(867) 645-5725	(867) 645-2348
Nunavut Water Board (NWB)	(867) 360-6338	(867) 360-6369
CIRNAC Inspector (Tim Morton Nunavut Regional Office (NRO) – Indigenous and Northern Affairs Canada (INAC) – Iqaluit	(867) 669-2442 (867) 975-4500	(867) 669-2871 (867) 975-4560
Department of Fisheries and Ocean (DFO) – Nunavut Regional Office - Iqaluit	(867) 979-8000	(867) 979-8039
Manager, Environmental Protection, Government of Nunavut – Kristi Lowe	(867) 975-7748	(867) 975-6099
Kivalliq Health Services – Rankin Inlet Emergency on call Nurse	(867) 645-8300 (867) 645-6700	(867) 645-8304
Rankin Hamlet Office	(867) 645-2895	(867) 645-2146
Rankin Ambulance or Fire Emergency	(867) 645-2525	
RCMP 24 Hour Emergency Number	(867) 645-0123	
Canadian Coast Guard (in the event of a spill to the marine environment 24 hours) Superintendent, Environmental Response Coast guard e-mail for notification iqanordreg@innav.gc.ca	(800) 265-0237 (519) 383-1954 (867)-979-5724	 (519) 337-2498
Transport Canada – Marine Safety Jaideep Johar Ian Salisbury Philip Levesque - Marine Safety Inspector	(204) 880-0754 or (204) 984-8618 (204) 984-2254 (780) 495-8360 (250) 754-0290 (204).984.5786 204.801.6951(cell)	 (780) 495-8607

SECTION 9. ROLES AND RESPONSIBILITIES

9.1.1 First Responder (Third Party Contractor (Intertek Personnel) and Spud Barge Supervisor)

The person who has caused a spill or is the first to observe the spill is the first responder.

The responsibilities of the First Responder are as follows:

- Oversee the fuel transfer operation;
- Follow procedure set-up in the OPEP to prevent and minimize spill (See Section 5.3)
- In case of spill to land, ice or water, contact the Rankin Inlet Gatehouse to report the incident;
- Identify and contain the spill, IF SAFE TO DO SO; commence preparing spill response equipment, and
- Participate in spill response as a member of the clean-up crew.

9.1.2 Supervisor Fuel Discharge

The responsibilities of the Supervisor are as follows:

- Contact the Rankin Inlet Gatehouse; contact the Environment Department;
- Gather facts about the spill; and
- Participate in spill response.

9.2 Roles & Responsibilities of the Emergency Control Group

Below are the roles and responsibilities of the Emergency control group.

9.2.1 Official In-Charge

The Official In-Charge (General Manager or designate) will take charge for overseeing and approving the overall emergency strategy.

Immediate duties of the Official In-Charge include:

- Consult with the Incident Commander the status of emergency;
- Appoint an Emergency Log Recorder to maintain a written record of the time and events, including all discussions, instructions and decisions made by the Emergency Control Team;
- Issues specific tasks to the members of the Management Team as they arrive at the Control Room, as per this guideline;
- Brief the Emergency Control Team;
- Ensure that the safety of personnel is maintained, throughout the operation;
- Ensure procedures are in place for prompt dispatch of requested personnel, materials and

equipment to the emergency area;

- Arrange for all reports to be presented at specific intervals to the Emergency Control Team;

- Finalize the recommendations of the Incident Commander for rescue and recovery operations;

- The Official In-Charge is the only person authorized to release information to Government Agencies, Corporate Office or the Local Communities. He may delegate this activity to other members of the Emergency Control Team;

    - Verify all information you release;
    - Keep a record of all inquiries (media and non-media);
    - Do not speculate on causes;
    - Do not speculate on resumption of normal operations or when the problem will be solved; and
    - Advise that further updates will be forth coming.

- Notify the corporate management, if the following appear probable:

    - Fatalities;
    - Injuries that could probably become items of local, regional or national media interest;
    - There is a public health or environmental risk;
    - An incident involving chemicals where there is a large volume or the potential for over reaction (e.g., cyanide);
    - A spill of effluent or contaminated water or chemical substance to an area that lies outside the area of drainage control of the mine site (i.e., an external spill);
    - Mine operations may be stopped for more than two (2) days; and
    - Government authorities will become involved.

- Ensure all response teams, regulatory agencies and any other agency on emergency alert notice are advised when the emergency has ended;

- Ensure all documentation (i.e., notes, log sheets, written instructions, etc.) is gathered for the creation of the final report; and

- Participate in debriefing.

9.2.2 General Superintendents

- Energy & Infrastructure, Operations and Maintenance will report to the Emergency Control Room and support the General manager/Designate in whatever capacity required;

- They will also ensure that the Superintendent/Designate in each of their respective Department's is aware of the emergency; and

- They will assist with the investigation and write up of the final report.

9.2.3 Incident Commander: A Trained Staff Member (ERT Coordinators or Supt.)

The responsibilities of the Incident Commander include:

- Ensure Security has been notified of emergency;
- Ensure the evacuation procedures have been activated, if required;
- Ensure that there are sufficient ERT members available to respond to the emergency;
- Ensure that the ERT has back-up support, a standby Team;
- Ensure that ERT Team has refreshments and nourishment (if the emergency requires several hours to resolve);
- Assess the size and severity of the emergency and the likely consequences. Establish response priorities; as well coordinate prevention of fire or explosion;
- Maintain communication with the ERT Captain;
- Advise the Official In-Charge of the ERT Team's activities, regarding the rescue and recovery operations;
- Appoint sufficient personnel, equipment and outside services are available. Utilize the members of the Emergency Control Team to organize these resources;
- Advise Official In-Charge when the emergency situation is under control and give the "All Clear";
- Participate in emergency investigation;
- Coordinate an orderly return to normal operating conditions;
- Arrange for a debriefing session, and utilize the services of all involved in resolving the emergency; and
- Assist to write the final report.

9.2.4 Emergency Response Team (ERT Team) Duties:

- The ERT Team Members must report to the Fire Hall, when paged for a "Code One" emergency;
- ERT Team Members will be given instructions on the emergency by the Incident Commander;
- ERT Team Members will follow instructions from the Incident Commander and will not put the Team at risk; and
- The ERT Team Captain will maintain radio contact with the Incident Commander throughout the emergency.

9.2.5 Environmental Superintendent /Designate Duties:

The following are the responsibilities of the Environmental Superintendent/Designate;

- Provide technical advice on probable environmental effects resulting from a spill and how to minimize them;
- Provide advice to the Official-in-Charge for appropriate spill response procedures;
- Ensure that Environmental Staff are available to direct the spill response action plan; and
- Assist with restoring of the Operations back to normal operating standards.

9.2.6 Health and Safety Superintendent/Designate Duties:

The Health and Safety Superintendent/Designate will be responsible for:

- Ensure that an Incident Commander is in place to oversee the ERT Teams;
- Ensure that all Management respond to the emergency and meet in the emergency control room;
- Oversee all activities that require Security or Nursing and arrange for Medevac transport, if required;
- Assist with getting a “head count” for the Official in-charge; and
- Assist with obtaining outside help if required.

9.2.7 Energy & Infrastructure Superintendent/Designate Duties:

The following are the responsibilities of the Energy & Infrastructure Superintendent/Designate;

- Ensure that all employees are accounted for;
- Ensure that all ERT Crew Members respond to the “ Code One” emergency;
- If the “ Emergency” involves the site facilities, assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower; and
- Assist with restoring of the Operations back to normal operating standards.

9.2.8 Human Resources Coordinator/Designate Duties:

The following are the responsibilities of the Human Resources (HR) Superintendent/Designate:

- Ensure that all HR employees are accounted for; and

- Provide assistance to the Official-in-Charge if there are employee issues, such as injuries, transportation requirements, etc.

9.2.9 Health Care Professional (Nurse/Medic):

The on-site health professionals are responsible for the following:

- Providing on-site first aid and other medical support;
- Establish a triage location if there are multiple casualties;
- Arrange for medevac transportation, if required; and
- Ensuring that the first aid room is maintained at all times, by using First Responders as support.

9.2.10 Security (Sarliaq Holdings Ltd.):

The on-site Security Supervisor is responsible for the following:

- Ensuring that the Security officer has activated the appropriate level of emergency notification;
- Ensure that access points to the emergency are properly guarded;
- Notify the Rankin Inlet Gatehouse if the emergency involves the all-weather private road (AWPR); and
- Assist with other duties as requested by the Emergency Control Group.

9.3 Debriefing

After an incident has taken place and the location is brought back to normal operating standards a debriefing session will occur between ECG, Field Supervisors for the incident, ERT Captain(s), and the supervisor of the department involved with the spill.

The point of this debriefing session to determine the *who, what, where, when, why, and how* the incident occurred. It will also be the time to reflect on the steps that were taken to carry out the response and to determine what was done right and what corrective measures need to be put in place to better the response if needed in the future.

SECTION 10. GENERAL SPILL PROCEDURES

SPILL RESPONSE PRIORITIES

1. **Safety of the personnel working at or around the OHF**
   a. Contact all personnel working around the spud barge area and make them aware
   b. Make contact with the vessels Captain to make aware the ship and stop the transfer of the product
   c. Wear appropriate PPE
   d. STOP the spill
2. **Make safe the facility**
   a. Create a no entry perimeter to ensure unaware persons do not enter the area in which the incident took place.
   b. Barricade entrances to the facility with red danger tape
   c. Have a person designated to watch entrances to ensure no community persons come on to site.
3. **Make the community of Rankin Inlet aware of the Spill to ensure measures can be taken to ensure safety of the community**
   a. Contact Mayor / Hamlet counsel
   b. Fire department
   c. RCMP
4. **Prevent fires or explosions / Stop all ignition sources**
   a. Disconnect power supplies
   b. Do not contain diesel fuel if vapors might ignite
   c. Allow fuel vapors to evaporate before intervention
5. **Minimize the Spill**
   a. When safe to proceed stop the spread of the product
   b. Use spill response equipment in emergency sea cans and ask for additional material if the spill is greater than 5 m^3
6. **Notice and Report the Spill**
   a. Spill needs to be reported to Transport Canada, Coast Guard, Environment and Climate Change Canada and Government of Nunavut immediately
   b. Other governing bodies will also be notified (see section 10.2)
7. **Environmental Impact**
   a. Deter wildlife from entering spill area. Keep track of any wildlife mortalities
   b. Determine what impacts the spill will have on the Environment
8. **Clean-up**
   Commence clean-up of the spill

10.1 Coordination with Government Agencies

10.1.1 Coordination with TC Technical Service Environmental Response

In the event of a marine spill TC Technical Service Environmental Response (TC) will be contacted immediately regarding the incident. Agnico will adhere to further recommendations from TC in response to the spill.

TC will also be contacted annually prior to the deposition of fuel at the OHF. As well, annual approval of this OPEP will be required by TC Pollution Prevention Officer.

10.1.2 Coordination with Canadian Coast Guard

In the event of a marine spill, the coordination with Canadian Coast Guard (CCG)[2] is required and they will be contacted to report the incident. A description of the event will be provided to the CCG Environmental Response. Agnico will adhere to further recommendations from CCG in response to the spill.

On an annual basis prior to the shipment of fuels to the OHF commencing, Agnico will contact the CCG and make them aware that the shipping season will be starting so they are aware that fuels will be travelling to Agnico's Rankin Inlet Fuel Tank Facility constructed in Rankin Inlet.[3] Also Agnico will inquire if there are any updates to "*The Central and Arctic Regional Response Plan (2008).*"

Agnico's Environmental Group will annually, prior to fuel transfer, review "*The Central and Arctic Regional Response Plan (2008).*" A copy of this plan can be found in Appendix F for reference. The plan will be reviewed to ensure that the OPEP and the actions of Agnico's OHF meet all requirements listed for an OHF.

10.1.3 Other Government Agencies

Agnico will contact all government agencies associated with the Meliadine Gold Project as is the norm for any reportable spill. These groups include: Government of Nunavut (GN) via 24 hour spill reporting line, Crown - Indigenous Relations and Northern Affairs Canada (CIRNAC), Department of Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Nunavut Water Board (NWB), and Kivalliq Inuit Association (KIA).

10.2 Reporting Requirements

As per the Canada Shipping Act. spills to the marine environment will be reported to the TC Technical Service Environmental Response and Canadian Coast Guard (contact numbers in Table 7). Marine spills will be reported in accordance with TC Guideline TP- 9834E, *Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants*. Others to receive the spill report include the KIA, Hamlet of Rankin Inlet, DFO, ECCC, Canadian Coast Guard and INAC. Incidents that require media communications will be the responsibility of Agnico General Mine Manager or Public Affairs Corporate Director. The copy of NT-NU spill report form is provided in Appendix H.

To ensure compliance with Section 36(3) of the *Fisheries Act*, all spills of fuel or hazardous materials, regardless of quantity, into a water body or onto ice will be reported immediately to the NT-NU 24-HOUR SPILL REPORT LINE (phone: (867) 920-8130, fax: (867) 873-6924, spills@gov.nt.ca).

[2] CCG: 1-800-265-0237, Superintendent Environmental Response Phone: 519-383-1954 Cellphone :519-381-6186

[3] *JJ Brickett with CCG was contacted on July 7, 2015*

Agnico possess a thorough internal spill reporting system that documents all spills for internal tracking. A copy of this Agnico internal spill report can be found in Appendix G, this is this spill report that the first responder will have to complete. Regardless of the volume, these spills are all reported to the Environment Department and if the NT-NU spill limits are exceeded or if the spill occurs in a water body, the Environmental Department reviews the incident, produces the NT-NU spill report and submits the NT-NU spill report to the regulator listed above. Investigation of all reportable spills is completed by the Meliadine Environment Department.

10.3 Treatment and Disposal

All diesel recovered through the spill response and any contaminated material will be taken to the Meliadine Project site for recovery and, if applicable, incineration. It could also be packaged for disposal/recycling by a certified hazardous waste management company in southern Canada.

10.4 Resuming Unloading

The unloading of fuel from the tanker to the OHF will not resume if it hinders the response to the spill in any way. Unloading will resume once all problems are corrected, thus ensuring that the spill will not continue.

SECTION 11. SPILL SCENARIOS AND RESPONSE STRATEGIES

Agnico will strive to prevent any accidental spills and take all reasonable steps to minimize the risk of spill incidents and their impact on the environment. A mock spill exercise is conducted this year and the summary is provided in Appendix I.

11.1 Product Properties and Response Strategy

P50 Diesel is a bright oily substance that has a low viscosity. It spreads rapidly on the water, has a low solubility in salt water (60 mg/L), and a high evaporation rate as described in the text box below.

At Itivia, the wind is largely from the NW to N and the current in the access passage is 0.93 km/h to the south.

Predicted Evaporation Rate of Spilled Diesel

Weight percent Evaporation = (5.8 + 0.045T) in(t)
Where T = water temperature
t = time in minutes

After a time span of 60 minutes at a surface temperature of 5°C, up to 25% weight of the spilled diesel would have evaporated.

After 240 minutes, or 4 hours, the weight percent of the diesel that would have evaporated would be 33%.

Source: *Environment Canada, Emergencies Science and Technology Division*

As a result of the properties of diesel and the environmental conditions that predominate at Itivia, the spill response will aim to stop the spilled product from spreading across Melvin Bay to the south shore and into the access passage. This could include activating the Shipboard Oil Pollution Emergency Plan. The tanker has response equipment on board and a fully trained crew in spill response. This, coupled with a shore-based response under the OPEP, ensures sufficient resources are available to control and recover as much diesel fuel as feasibly possible.

11.2 Pipeline safeguards

There are a number of safeguards in operating the ship-to-shore pipeline; these include:

- Save-all trays to capture any minor spills at the ends of the floating pipeline;
- Dry-break couplings at both ends of the floating pipeline;
- A pressure test is performed before the diesel transfer to confirm the system is free of leaks; and

- Both the crew on the tanker and Agnico's shore based personnel are fully trained in spill response and spill recovery.

11.3 Wildlife

During a spill event, Agnico will take care to deter any animal that will be near the spill area to minimize the risk to wildlife. In a case of mortalities, Agnico will track any mortality and report these numbers to the GN and ECCC.

11.4 Scenarios

Three scenarios are considered, these being:

1. A spill between the ship and the flange of the OHF, the floating pipeline, resulting in a spill smaller than 1000 L of diesel fuel;

2. A major failure between the ship and the flange of the OHF, the floating pipeline, resulting in a spill greater than 1000 L but smaller than 5000 L of diesel fuel; and

3. Spill greater than 5000 litres.

In most instances Agnico personnel and/or contractors will be able to respond to the spill but if necessary, backup can be requested by calling for the assistance of the Agnico Emergency Response Team that is stationed at the Meliadine site located 35 kilometers away. The ERT can be at Rankin Inlet within 60 minutes to take charge of the spill response. Agnico will make every effort to have its equipment and resources deployed within 6 hours of an incident.

Scenario 1: **Loss between the ship and the flange of the OHF, the floating pipeline, resulting in spill smaller than 1000 L of diesel fuel.**

Appropriate Actions	Resources
1. Communicate with vessel and immediately stop the ship-to-shore transfer of fuel, if it's safe to do. The transfer should not restart in a manner that would interfere with the immediate, effective and sustained response to the oil pollution. 2. Make sure that the environment is safe for the facility and vessel personnel, the facility and Rankin Inlet community. 3. Make sure that risk of fire or explosion are minimize. 4. Contact person found on OHF Declaration to initiate the OPEP. 5. Minimize the oil pollution incident by containing the spilled fuel to spreading within the marine environment, if it's safe to do. 6. Notify CCG, local and regulatory authorities. 7. Containment boom is manned to prevent the escape of fuel outside the boom. 8. If necessary, place a diversion boom outside the containment boom to stop the diesel from getting onto the beach. 9. Spread absorbent material on the spill to capture it. 10. Monitor any fuel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary. 11. If diesel reaches the beach, excavate the contaminated beach material and take it to the Landfarm area at the Meliadine site.	a. Crew on the tanker trained in spill response. b. Agnico's shore based personnel trained in spill response and recovery. c. Emergency Response Team to take control of the spill response and recovery. d. Spill response equipment and supplies maintained on board the tanker and also in the sea can located on shore of Itivia Site Fuel Storage and Containment Facility. e. Save-alls (Pop-up pools/plastic totes) placed under the pipeline manifolds to collect minor spills. f. Shore-based boat to position booms. g. Absorbent booms to recover spilled diesel on sea water. h. Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks available if beach is contaminated.

Scenario 2: **Loss between the ship and the flange of the OHF, the floating pipeline, resulting in spill greater than 1000 L but smaller than 5000 L of diesel fuel.**

Appropriate Actions	Resources
1. Communicate with vessel and immediately stop the ship-to-shore transfer of fuel, if it's safe to do. The transfer should not restart in a manner that would interfere with the immediate, effective and sustained response to the oil pollution. 2. Make sure that the environment is safe for the facility personnel, the facility and Rankin Inlet community. 3. Make sure that risk of fire or explosion are minimized. 4. Contact person found on OHF Declaration to initiate the OPEP. 5. Minimize the oil pollution incident by containing the spilled fuel to spreading within the marine environment, if it's safe to do. 6. Notify CCG, local and regulatory authorities. 7. Containment boom is manned to prevent the escape of fuel outside the boom. 8. If necessary, place a diversion boom outside the containment boom to stop the diesel from getting onto the beach 9. Spread absorbent material on the spill to capture it 10. For larger amounts of spilled materials on water, use absorbent booms to collect the spilled diesel 11. Monitor any fuel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary. 12. If diesel reaches the beach, excavate the contaminated beach material and take it to the Landfarm area at the Meliadine site.	a. Crew on the small tanker trained in marine spill response. b. Crew from the large tanker anchored outside the access passage. c. Agnico's shore based personnel trained in near shore spill response and recovery. d. Emergency Response Team trained for near shore spill response. e. Shore-based boat to position booms and spread absorbent material. f. Spill response equipment and supplies maintained on board the tanker, in Agnico sea can locate at Itivia Site Fuel Storage and Containment Facility. g. Additional booms to place outside the containment boom. h. Additional boats can be transported from the Meliadine site as well local boats can be rented from local contracting companies i Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks for waste materials. j. in the case of larger spills an Incident Command System will be set up at the Meliadine site as laid out in the Meliadine Emergency Response Plan.

Scenario 3: **A spill >5,000 litres**

In the case of an ***Extreme*** spill, Agnico will follow the actions listed in Scenario 2 to complete the best clean up possible. Between the spill response equipment that the tanker delivering fuel has on board and the spill response supplies at the OHF, a spill up to the size of 5, 000 - 10, 000L will be able to be controlled and cleaned up. However if the spill is greater than 10, 000L, at this point Agnico will require external assistance with the clean-up.

The Canadian Coast Guard (CCG) and Transport Canada are made aware each year prior the fuel transfer, there is a possibility that under direction of CCG that their spill depot supplies located in Rankin Inlet may be used.

SECTION 12. PREVENTIVE MEASURES

Agnico recognises that spill prevention is more desirable than any modern efficient cleanup measures after the fact. Preventive measures have been adopted in relation to any transport, transfer, use and storage of diesel fuel. The tankers carry a Ship Oil Pollution Emergency Plan (SOPEP) (Appendix A) as per the MARPOL 73/78 requirement under Annex I. All ships with 400 GT and above must carry an oil prevention plan as per the norms and guidelines laid down by the International Maritime Organization (IMO).

A SOPEP contains the following things:

- The action plan contains duty of each crew member at the time of spill, including emergency muster and actions;
- General information about the ship and the owner of the ship etc.;
- Steps and procedure to contain the discharge of oil into the sea using SOPEP equipment;
- On-board Reporting procedure and requirement in case of oil spill;
- List of authorities to contact and reporting requirements in case of oil spill. Authorities like port state control, oil clean up team etc. are to be notified;
- Drawing of various fuel lines, along with other oil lines on board vessel with positioning of vents, save-all trays, etc.;
- General arrangement of ship, which includes location of all the oil tanks with capacity, content, etc.; and
- The location of the SOPEP locker and contents of the locker with a list of inventory (Marine Insight 2012).

The Spill Contingency Plan, Emergency Response Plan and the Oil Pollution Emergency Plan identify potential causes of emergencies and provides for the development and implementation of strategies to minimize the likelihood of the same.

As described in the Spill Contingency Plan, exercises are part of training for the Emergency Response Team. This includes comprehensive spill response exercise to practice the use of spill response equipment, including the use of booms and oil water separator.

The OPEP is updated annually based on the results of spill exercises, changes to the infrastructure at Agnico's Fuel Handling Facilities, changes to procedures and other variables. The updated OPEP is distributed to the Agnico Emergency Response Team, TC, the Kivalliq Inuit Association, the Municipality of Rankin Inlet and other agencies as appropriate.

12.1 Training

The environmental department and ERT team received training from a response organization and as a result will be able to respond to or assist with incidents that may occur at the OHF.

12.1.1 Meliadine site Personnel

A designated Emergency Response Team consisting of on-site personnel is established at Agnico's Meliadine Project site. Agnico ensures that the ERT is trained and staffed in sufficient number so that

the ERT is present at all times. All members of the team are trained and familiar with emergency and spill response resources, including their location and access, the Spill Contingency Plan, the Oil Pollution Emergency Plan and appropriate emergency spill response methodologies. The ERT have up to 20 members, each of whom will be trained.

The training includes the following:

- Worker health and safety during emergency interventions;
- A review of the spill response plan and responsibilities of the ERT members;
- The nature, status, and location of fuel and chemical storage facilities;
- The on-site and off-site spill response equipment and how to use it;
- Emergency contact lists;
- Communication methods and signals;
- Desktop exercises of “worst case” scenarios;
- Emergency evacuation;
- Fires or explosions;
- Emergency equipment and use;
- PPE and clothing;
- Marine shoreline recovery operations; and
- The likely causes and possible effects of spills.

The Environmental Department regularly provides tool-box sessions to give information on spill response and reporting procedures.

Basic spill response training is completed by all Agnico employees and contractors working on the Meliadine project as part of the mandatory induction for all personnel arriving on site. ERT members receive more extensive spill response training and learn how to respond while wearing personal protective clothing, use of specific spill response gear, proper deployment of absorbents and maritime boom.

12.1.2 OHF Personnel Training

Prior to the first discharge of fuel from the vessel to the OHF, a mandatory training takes place. This is a review with all the personnel responsible for the shore based portion of the fuel transfer, including the third party contractor and the Rankin Inlet supervisor, the current OPEP and make them aware of the procedures to follow in case of a spill before the first fuel barge arrives. A copy of the 2018 log sheet is provided in Appendix I.

A mock spill training is planned for the summer of 2019 to practice the response of all involved personnel to a hypothetical spill situation.

12.1.3 Boat Operators

All people involved in the supervision during operation and / or on the spill response has complete the training course for the pleasure craft operator. Records of pleasure craft operator certification is retained by the Meliadine Training department.

All concerned persons working for Agnico Eagle Mines Ltd. must possess a pleasure craft operator card and provide proof of this certification prior to operating any boat relating to the Meliadine project which includes the Rankin Inlet Marshalling facility. This includes emergency responders.

SECTION 13. COASTAL SHIPPING

13.1.1 Coastal Shipping

Please refer to Appendix A - 1.2 for the 2018 contact information for Coastal Shipping during the barge season. This is reviewed with Coastal Shipping on an annual basis.

SECTION 14. REFERENCES

Transport Canada *Oil Handling Facilities Standards*, TP12402E.

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Moller, T.H. & Santner, R.S. 1997. *Oil Spill Preparedness and Response: the Role of Industry,* 1997 International Oil Spill Conference, Technical Report IOSC-005.

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Journal of Petroleum Science Research (JPSR) Volume 2 Issue 3, July 2013 - Modeling Oil and Petroleum Evaporation by Merv F. Fingas

APPENDICES

APPENDIX A – SOPEP and Contact info – Desgagnes Group

Transport Desgagnés Inc.

21, rue du Marché-Champlain
Québec (Québec) G1K 8Z8
Canada

Téléphone : (418) 692-1000
Télécopieur : (418) 692-6004
info@desgagnes.com

M/T *Dara Desgagnés*

Shipboard Marine Pollution Emergency Plan

For Oil and Noxious Liquid Substances

As defined by MARPOL 73/78, Annex I, Regulation 37 and annex II, Regulation 1

Prepared by Transport Desgagnés In

October 31, 201

Distribution List

M/T Dara Desgagnés (1)
M/T Esta Desgagnés (1)
M/T Jana Desgagnés (1)
Transport Desgagnés Inc. Emergency Room (1)
Transport Canada, Marine Safety (1)

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

In accordance with Regulation 37 of Annex I and Regulation 17 of Annex II of MARPOL 73/ 78

SHIP'S IDENTIFICATION

GL-Register-Number	33862
Name of Ship	DARA DESGAGNES
Distinctive Number or Letters (Call Sign)	VCBW
IMO-Number	9040089
Type of Ship	Chemical Tanker
Port of Registry	Quebec
Gross Tonnage	6262
Flag	CANADA

Owner / Managers: see „Ship Interest Contacts“

GL **Approved**

as being in compliance with
MARPOL 73/78 Annex II Reg. 17 and Annex I Reg. 37
(former Reg.16 and Reg. 26)
authorised by the Government of Canada

EdM

Hamburg **2013-01-07** **Ref.-No. 13-001410**

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Foreword

1. This Plan is available to assist the ship's personnel in dealing with an unexpected discharge of oil or noxious liquid substances. Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge of those substances and to mitigate its effects.

1.2 Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.

1.3 The primary objectives of this Plan are to :

- prevent pollution;
- stop or minimize outflow when a damage to the ship or its requirements occurs;
- stop or minimize outflow when a operational spill occurs in excess of the quantity or instantaneous rate permitted under the present Convention.

1.4 Further, the purpose of the Plan is to provide the Master, officers and certain crew members with a practical guide to the prevention of marine spills and in carrying out the responsibilities associated with regulation 37 of Annex I and Reg. 17 of Annex II of MARPOL 73/ 78:

- procedures to report an oil / marine pollution incident;
- Coastal State contacts (Focal Points) and Port Contact Lists to be contacted in the event of any pollution incident;
- response actions to reduce or control the discharge of substances following an incident;
- co-ordination with national and local Authorities in combating a pollution.

1.5 In summary, the Plan will serve to promote a practised response when the ship's personnel is faced with a spill.

1.6 Although the Plan is designed as a ship-specific tool it must also be considered as an additional instrument and as a link to shore-based plans. With this the Plans allows an efficient co-ordination between the ship and shore-based Authorities/ Organizations in mitigating the effects of any pollution incident.

1.7 The Plan includes a summary flowchart (see under iii) to guide the Master through reporting and acting procedures required during an oil pollution incident response.

1.8 The Plan is likely to be a document used on board by the Master and officers of the ship and must therefore be available in the working language used by them.

Summary Flowchart

Discharge of Oil
Probable or Actual

⇩

Assessment of the Nature of Incident

⇩

Actions required

Alert crew members
Identify spill source
Personell Protection
Spill Assessment
Vapour Monitoring
Evacuation

REPORTING	**ACTION TO CONTROL DISCHARGE**	
By Master and/ or designated crew member	**Measures to minimize the escape of oil and threat to the marine environment**	
When to report All probable and actual spills How to report - By quickest means to coastal radio station - Designated ship movement reporting station or - Rescue Co-ordination Centre (at sea) - By quickest available means to local autho-rities Who to report - Nearest Coastal State Harbour and termi-nal operators (in port) - Shipowner´s manager; P & I insurer - Head Charterer; Cargo owner - Refer to contact lists What to report - Initial report (Res. A.851(20)) - Follow-up reports - Characteristics of material spilled - Cargo/ ballast/ bunker dispositions - Weather and sea conditions - Slick movement - Assistance required • Salvage • Lightening capacity • Mechanical equipment • External strike team • Chemical dispersant/ degreasant	NAVIGATION MEASURES - Alter course/ position and/ or speed - Change of list and/ or trim - Anchoring - Setting aground - Inititate towage - Assess safe haven require-ments - Weather/ tide/ swell fore-casting - Slick monitoring - Record of events and commu-nications taken	SEAMANSHIP MEASURES - Safety assessment and pre-caution - Measures for safety of crew - Advice on priority countermea-sures/ preventive measures - Get vapours off deck - Damage stability and stress consideration - Ballasting/ deballasting - Internal cargo transfer opera-tions - Emergency ship-to-ship trans-fers of cargo and/ or bunker - Set up shipboard response for: • Leak sealing • Fire fighting • Handling of ship-board response equipment (if available)

⇩

STEPS TO INITIATE EXTERNAL RESPONSE

- Refer to Costal Port State listings for local assistance
- Refer to ship interest contact list
- External clean-up resources required
- Continued monitoring of activities

⇩

Introduction

1. This Plan is written in accordance with the requirements of the Canadian Regulations for the Prevention of Pollution from ships and for Dangerous Chemicals SOR/2012-69, regulation 37 of Annex I and regulation 17 of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto. As recommended by IMO this plan is a combination of a SOPEP and a Shipboard Marine Pollution Emergency Plan for noxious liquid substances.

2. The purpose of the Plan is to provide guidance to the master and officers on board the ship with respect to the steps to be taken when an oil and/or noxious liquid substance pollution incident has occurred or is likely to occur.

3. The Plan contains all information and operational instructions required by the Guidelines. The appendices contain names, telephone, telex numbers, etc., of all contacts referenced in the Plan, as well as other reference material.

4. This plan has been approved by the Classification Society for the Administration and, except as provided below, no alteration or revision shall be make to any part of it without the prior approval of the Classification Society for the Administration.

5. Changes to Section 5 and the appendices will not be required to be approved by the Classification Society for the Administration. The appendices will be maintained up to date by TRANSPORT DESGAGN□S INC.

Regulatory Requirements

The Canadian Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals SOR/2012-69 and Regulation of Annex I of MARPOL 73/78 require every oil tanker of 150 gross tons and above, and every vessel other than an oil tanker of 400 gross tons and above, to have a shipboard emergency plan with four elements:

1) Procedures for reporting oil pollution incidents;
2) A listing of authorities to be notified;
3) A detailed description of actions to be taken by a vessel's crew to reduce or control an oil discharge; and
4) Procedures for co-ordinating onboard activities with national and local authorities.

This Shipboard Marine Pollution Emergency Plan meets the MARPOL requirements.

The plan required by Regulation 37 of Annex I and Regulation 17 of Annex II of MARPOL 73/78 will **not** fully meet the US regulations under the Oil Pollution Act of 1990 (OPA 90). However, OPA 90 regulations only pertain to tankers and other vessels that carry oil either as primary or secondary cargo.
They do not apply to dry cargo vessels such as freighters, containerships, Ro/Ro, etc. While there is no requirement to do so, operators of these vessels are encouraged to develop Vessel Response Plans (VRP) in the unlikely event of a pollution incident as the result of bunker transfer operations or other incidents involving fuel. The OPA 90 VRP for this vessel meets the intent of OPA 90 for operations in US navigable waters.

Under OPA 90 each state is allowed to develop more stringent regulations for spill prevention and spill response activities. As such, some states also require owners and operators of dry bulk vessels to develop and maintain Vessel Response Plans. One state also requires owners and operators of tank and dry cargo vessels to develop and maintain Spill Prevention Plans.

US WATERS NAVIGATION

Then In case of navigation in US waters Masters and Officers must refer to the US VRP Prepared by Hudson Marine for the company and follow the instructions available in case of an emergency situation in US waters.

Safety and Environmental Policy

POLICY STATEMENT

It is the policy of the Company to provide healthy and safe working conditions, and to maintain a safe pollution-free operating practice that complies with national and international regulations and relevant standards and guidelines.

Company objectives are to:

- provide for safe practices in ship operation and a safe working environment;
- establish safeguards against all identified risks; and
- Continuously improve the safety management skills of personnel ashore and aboard ship, including preparing for emergencies related both to safety and environmental protection.

The objectives will be achieved by:

- maintaining high standards of safety consciousness, personal discipline and individual accountability by adherence to a comprehensive and documented system of training;
- actively promoting employee participation in measures aimed at improving safety and protecting the environment;
- keeping all personnel fully informed of any known or potential hazards that may affect themselves, their colleagues, the ship or the environment by transmittal of pertinent documentation;
- ensuring adherence at all times to the documented operating procedures by a system of internal verification of procedures and activities; and
- continuously reviewing all mandatory rules, regulations industry codes and guidelines that are relevant to specific vessel types and trades.

All employees are expected to comply with Safety and Pollution Prevention Regulations and Procedures at all times, and to take the necessary precautions to protect themselves, their colleagues, the ship, its cargo and the environment.

Plan Approval
M/T *Dara Desgagnés*

Original Plan Approved by:	Date:	Document No.
Official Stamps:		

Revised Plan Approved by:	Date:	Revision No.
Official Stamps:		

Revised Plan Approved by:	Date:	Revision No.
Official Stamps:		

Revised Plan Approved by:	Date:	Revision No.
Official Stamps:		

Record of Changes

Revision Number	Date of revision	Section revised	Initials	Remarks
0	25-10-2012	New Manual	DC	All Sections revised

Section 1 – Generalities

This Shipboard Marine Pollution Emergency Plan should be used for response to oil/noxious liquid substances (NLS) spill incidents and other vessel casualties that occur in any part of the world that is located *outside* of the navigable waters of the United States, including the Exclusive Economic Zone (EEZ, or 200 Mile Limit).

While within the navigable waters of the United States, including the Exclusive Economic Zone (EEZ, or 200 Mile Limit), use the OPA 90 Vessel Response Plan (VRP) , which is prepared in accordance with the Oil Pollution Act of 1990 (OPA 90), the requirements of Title 33 Code of Federal Regulations (CFR) Part 155, and the requirements of each state, and approved by the U.S. Coast Guard.

1.1. CONCEPT OF PLAN

This Shipboard Marine Pollution Emergency Plan is intended to provide the Master and his crew, as well as shore-based personnel, with the necessary information on how to deal with oil/NLS spills and threats of oil/NLS spills, and other vessel casualties, anywhere in the world, except in the navigable waters of the United States. *(See OPA 90 Vessel Response Plan (VRP) for similar information while in U.S. waters.)* It is also intended to guide personnel in taking the necessary actions to stop or minimise the discharge through:

- Response procedures;
- Reporting procedures;
- Contact points;
- Co-ordination with national authorities; and
- Training and drills.

Where possible, this Plan makes use of flow charts and checklists to guide the Master through the various actions and decisions that will be required in an incident response. Flow charts and checklists provide a visible, and logically sequenced, form of information, thus reducing the chance of oversight or error during the early stages of dealing with an emergency situation.

Personnel with key functions on board and ashore must be familiar with the plan. For any plan to be effective, it has to be reviewed and updated regularly, and it has to be tested in drills and regular practices. Exercises in implementation of the plan as part of the shipboard mitigation procedures must be held at regular intervals. In the same way, exercises in the communications procedures are necessary in order to verify that the shore-side plans are also working properly.

It is recognised that no plan can foresee the many circumstances and combinations of events that may arise with respect to a particular incident. It is accepted that the Master and officers of the vessel will exercise prudent judgement, assess risk factors, and make decisions under emergency conditions on the basis of incomplete information. The guidance contained herein is always subject to events beyond the control of the parties named.

1.2. COMPANY POLICY

Quality is an integrated part of the Transport Desgagnés Inc.'s business idea and operating philosophy. Quality reflects the approach to all aspects of conduct and policy in ship owning, ship operation, and ship management. Quality means Safety, Punctuality, and Efficiency in securing the requirements of our customers. The final measure of quality is customer satisfaction.

In pursuing the objectives, Transport Desgagnés Inc. has outlined the following main policies to be known and observed by all personnel:

- Maximum safety for personnel, environment, ship and cargo in all operational activities shall always be the overriding consideration;
- Strict observation of relevant regulations shall always be the rule;
- Maximum emphasis shall be put on proper and careful planning of operations as insufficient planning and preparation is the most frequent reason for operational irregularities; and
- Transport Desgagnés Inc.'s management expertise and market knowledge shall be fully utilized in the structuring and management of vessel operations and crew training.

Transport Desgagnés Inc.'s Quality and Safety Management System has been established to enable the company's management to implement the above objectives in a consistent manner. In this context, Quality and Safety Management becomes an important means of achieving the objectives.

All Company personnel will adhere to this policy and will correct, or identify to appropriate supervisory levels, situations that will run counter to this policy.

This Shipboard Marine Pollution Emergency Plan is describing in details the procedures to be followed in any oil/NLS spill incident or threats of spills.

1.3. ADMINISTRATION AND UPDATING

This Shipboard Marine Pollution Emergency Plan should be reviewed by the company annually, and as needed in light of changes in local law or regulation, contact names and numbers, and company policy. In addition, this Plan should be reviewed and evaluated after every drill, exercise, and spill, and where lessons learned requires changes.

The Quality, Safety, Security and Environment Department is responsible for revising the Plan.

The Master should submit to the company any additional or updated information involving the vessel, the shipboard personnel, and on-board equipment. In addition, the Master and his officers are encouraged to submit proposals for changes to the Plan.

1.4. DISTRIBUTION LIST

The Shipboard Marine Pollution Emergency Plan is distributed as follows:

RECIPIENTS	NUMBER OF COPIES	LOCATION
M/T *Dara Desgagnés*	1	Master's office
M/T *Esta Desgagnés*	1	Master's office
M/T *Jana Desgagnés*	1	Master's office
Transport Desgagnés Inc.	1	Transport Desgagnés Emergency Room
Flag State Administration	1	Transports Canada, Marine Safety

Shipboard Marine Pollution Emergency Plan

Section 2 – Reporting Requirements

GENERAL

A. The Canadian "Pollutant Discharge Reporting Regulations", SOR 95-351 and, Article 8 and Protocol I of MARPOL 73/78, require that the nearest coastal state should be notified of actual or probable discharges of oil/NLS to the sea. The intent of the requirement is to ensure that coastal states are informed without delay of any incident giving rise to pollution, of the marine environment, as well as the need for assistance and salvage measures, so that appropriate action may be taken.

B. The reporting requirements of this section comply with those of regulation 37 Annex I and 17 Annex II of MARPOL 73/ 78.

C. When the ship is involved in an incident which results in the discharge of oil or NLS, the Master is obliged under the terms of MARPOL 73/ 78 to report details of the incident, without delay, to the nearest Coastal State by means of the fastest telecommunication channels available. Transport Canada's Publication "*Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful substances, and Marine Pollutants* (TP 9834) gives detailed reporting procedures when the incident occurs in Canadian waters or fishing "ones.

D. The intent of these requirements are to ensure that Coastal States are informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of assistance and salvage measures, so that appropriate action may be taken.

E. Without interfering with shipowners' liability, some coastal states consider that it is their responsibility to define techniques and means to be taken against a marine pollution incident and approve such operations which might cause further pollution, i.e. lightening. States are in general entitled to do so under the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 and the Protocol relating to Intervention on the High Seas in Case of Pollution by Substances other than Oil, 1973.

2.1 WHEN TO REPORT

All oil/NLS discharge in excess of the quantity permitted by laws and regulations must be reported.

2.1.1 ACTUAL DISCHARGE

The Master is obliged to report to the nearest Coastal State whenever there is a discharge of oil resulting

- from damage to the vessel.
- from damage to the vessel s equipment.
- for the purpose of securing the safety of a ship or saving life at sea.
- during the operation of the vessel in excess of the quantity or instantaneous rate permitted under the present Convention.
- During the operation of the ship, a discharge of oil/NLS in excess of the quantities permitted by the Canadian Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals SOR/2007-86, and the Arctic Shipping Pollution Prevention Regulations, e.g.:

    - 0 PPM Arctic waters
    - 5 PPM Inland waters
    - 15 PPM Outside inland waters

Reports to coastal states should be in the style given in Section 2.2.

2.1.2 PROBABLE DISCHARGE

The Master is obliged to report even when no actual discharge of oil or NLS has occurred but there is a probability that one could.

However, as it is not practicable to lay down precise definitions of all types of situations involving probable discharge of oil/NLS which would warrant an obligation to report the Master is obliged to judge by himself whether there is such a probability and whether a report should be made.

Therefore, it is recommended that, at least, the following events

- Damage, failure or breakdown which affects the safety of the ship (e.g. collision, grounding, fire, explosion, structural failure, flooding, cargo, cargo shifting etc.)

or

- Failure or breakdown of machinery or equipment which results in impairment of the safety of navigation (e.g. failure or breakdown of steering gear, propulsion, electrical generating system, essential shipborne navigation aids etc.)

are carefully considered by the Master – taking into account the nature of the damage failure or break- down of the ship, machinery or equipment as well as the ship's location, proximity to land, weather, state of the sea and traffic density – as cases in which a probable discharge is most likely.

If in doubt, the Master should always make a report in cases aforementioned.

In all cases the Authorities should be kept informed by the Master as how the situation progress and be advised when all threat of pollution has passed.

2.1.3 FOLLOW UP REPORTS

Once the vessel has transmitted an initial report, further reports should be sent at regular intervals to keep those concerned informed of developments.

Follow up reports to coastal states should always be in the style given in Section 2.2, and should include information about every significant change in the vessel's condition, the rate of the release and spread of oil/NLS, weather conditions, and details of agencies notified and clean-up activities.

2.2 INFORMATION REQUIRED

As required in article 8 and Protocol I of MARPOL 73/ 78 Convention the Master or other persons having charge of the ship should report the particulars of any pollution incident. In this context the International Maritime Organization (IMO), in 1997, adopted Resolution A. 851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and/ or Marine Pollutants".

The intent of the Resolution aforementioned is to enable Coastal States and other interested parties to be informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of assistance and salvage measures, so that appropriate action may be taken.

Nothing in this chapter relieves the Master in using sound judgement to make sure that any incident or probable discharge is reported as quickly as possible in the prevailing situation.

When transmitting initial reports to the authorities of the nearest Coastal State the Master or other persons dealing with such a transmission should take note of Resolution A. 851 (20).

Especially, the format of the initial report as well as supplementary of follow-up reports should conform to the guidance contained in Res. A. 851 (20).

All reporting whether initial or follow-up, should follow IMO's reporting format as outlined below and should contain the following information

LABEL	FUNCTION	EXPLANATION
A	Ship	Name, call sign and nationality
B	Date and time (UTC) of event	A 6-digit group giving day of month (first two digits), hours & minutes (last four digits)
C or:	Position	A 4-digit group giving latitude in degrees and minutes suffixed with N or S, and a 5-digit group giving longitude in degrees and minutes suffixed with E or W
D	Position	True bearing (first 3 digits) and distance (state distance) in nautical miles from clearly identified landmark (state landmark)
E	True course	A 3-digit group
F	Speed at time of incident	In knots and tenths of knots as a 3-digit group
L	Route information	Details of intended track
M	Radio communications	Full details of radio stations (names) and frequencies being guarded
N	Time (UTC) of next report	A 6-digit group as under BB above
P	Cargo on board: can be included in 'RR' as relevant	Type(s) and quantity(ies) of cargo/ bunker on board and brief details of any harmful substances and gases that could endanger persons or the environment, pollution category, manufacturer, etc.
Q	Defects, damage or deficiencies or other limitations	Brief details of conditions of the ship as relevant; ability to transfer cargo/ ballast/ bunker fuel
R	Description of pollution or possible overboard discharge	Brief details of pollution; this should include the type(s) of oil or NLS, an estimate of the quantity discharged, whether the discharge is continuing, the cause of the discharge and, if possible, an estimate of the surface area of the spill and the movement and area

S	Weather conditions	Brief details of weather and sea conditions prevailing including wind force and direction and relevant swell details
T	Ship's representative and/ or owner	Name, address, telex and telephone number of the ship's owner and representative (charterer, manager or operator of the ship or their agents)
U	Ship's size and type	Details of length, breadth and type of ship as well as draught
X	Miscellaneous and additional information	Any other information including relevant details such as brief details of incident, need for outside assistance, action being taken to limit further discharge; details of any personnel injuries sustained, details of P & I Club and local correspondent.

Note: See blank form at the end of this section.

All follow-up reports by the Master should include information relevant to the Coastal State Authorities to keep them informed as the incident develops.

Follow-up reports should include information on any significant changes in the ship's condition, the rate of release and spread of the substances, weather and sea conditions and clean-up activities underway.

In this context details of bunker and cargo disposition, condition of any empty tanks and nature of any ballast carried are information needed by those involved in order to assess the threat posed by an actual or probable discharge from the damaged ship.

The following additional information should be sent to TRANSPORT DESGAGNÉS INC. either at the same time as the initial report or as soon as possible thereafter:

- Number of casualties;
- Further details of damage is still sustained;
- Whether damage is still sustained;
- Assessment of fire risk and precautions taken;
- Damage to other ships or property;
- Disposition of cargo on board and quantities involved;
- Time (UTC) assistance was requested and time (UTC) assistance expected to start;
- Name of salvor and type of salvage agreement;
- Whether further assistance is required;

- Priority requirements for spare parts and other materials;
- Details of outside parties advised or aware of the incident;
- Any other important information.

After transmission of the information contained in an initial report, as much as possible of the information essential for the safeguarding of life and the protection of the ship and the marine environment should be reported to the coastal state, owner and/or operator, in order to keep them informed of the situation as the incident develops. This information should include items P, Q, R, S and W, as appropriate.

Blank forms are available at the end of section as well as in the Master's office.

2.3 WHOM TO CONTACT

The Master is responsible for reporting any incident involving an actual or probable discharge of oil or NLS.

Nothing in this chapter relieves the Master from using sound judgement to make sure that any incident is reported as quickly as possible in the prevailing situation.

2.3.1 COASTAL STATE CONTACTS

In order to expedite response and minimize damage from a pollution incident, it is essential that appropriate coastal states are notified without delay. This process is begun with the Initial Report. Guidelines for compiling reports are provided in Section 2.2.

The report should be transmitted in one of the following manner:

1. If the incident occurs in Canadian waters or fishing zone, the report shall be made with the highest possible priority and using the quickest means available, to a pollution prevention officer.

2. If the vessel is in area governed by Vessel Traffic Services (VTS) Standards, the report should, where expedient, be routed through that system. If area not covered by VTS but covered by Coast Guard radio station system, the report should, where expedient, be routed through the latter system.

3. If the incident occurs outside Canadian waters and fishing zones, the report should be made to the nearest coastal state through an appropriate coast station, preceded by the safety signal (if the incident affects the safety of the navigation), or by the urgency signal (if the incident affects the safety of the ship or persons);

4. On appropriate frequencies in the band 405-525 kHz, 1605-2850 kHz or 156-174 MHz;

5. If the ship is not within reach of an MF or VHF coast radio station, to the most appropriate HF coast radio station or on the maritime satellite communication system.

6. When the ship is within or near an area where a ship movement reporting system has been established, to the designated radio station of that system.

This Plan includes, in APPENDIX 1, a list of agencies or officials of administration responsible for the receipt, transmission and processing of urgent reports of incidents involving harmful substances including oil or noxious liquid, E.G., ships to coastal state.

2.3.2 PORT CONTACTS

Notification of local agencies will speed response. However, the variety of trades in which ships engage may make it impractical to list local agencies in the Plan. Where this is feasible, the Master should obtain details concerning local reporting procedures upon arriving in port.

Nevertheless, a list of Coastal State Contacts is available in Appendix 1 as required by article 8 of MARPOL 73/78 and a list of National Operational Contacts is available in Appendix 2.

If an oil/NLS spill occurs, whatever the cause, it is the Master's duty to immediately activate the vessel's Oil/NLS Pollution Team, and report the incident. Precise details of whom to notify locally should be obtained on arrival, but the following is a guide:

a) Local Authority (Coast Guard/Government);
b) Owners/Owners' Managers;
c) Owners Local Representatives / Spill Manager;
d) Terminal / Loading Master;
e) Local State (Environmental) Authority and, if time permits;
f) Local Fire Department (in case of explosion and/or fire);
g) Agent;
h) Port Authority;
i) The vessel's local P&I representative (P&I Club List of Correspondents is filed in the Master's office);
j) Charterer; and
k) Clean-up Contractor.

If a change in the ship's range of trade or a change in the addresses of persons/ Authorities of the ports/ terminals served regularly takes place the Master or any other person aboard delegated by the Master is required to issue a new list.

2.3.3 SHIP INTEREST CONTACTS

The Plan provides details of all those parties with an interest in the ship who should be advised in the event of an incident. While reporting an incident to other interests, it should be remembered that in the event of a serious incident, the ship's personnel may be fully engaged in saving life and taking steps to control and minimise the effects of the casualty. They should therefore not be hampered by having non-essential communications requirements imposed upon them. Thus, Transport Desgagn□s Inc. officials should ensure these communications are made.

The Plan clearly specifies who will be responsible for informing the various interested parties such as cargo owns insurers and salvage interests. It is also essential that both the ship's plan and the company's corporate plan are coordinate d to guarantee that all parties having an interest are advised and that duplication of reports is avoided.

A list of ship interest contacts is detailed in Appendix 3, which also indicates the order of priority for notifying those concerned. Out-of-hours contacts are included.

Precise details of whom to notify will vary from company to company, but the following is a guide:

- Head Office;
- Charterer;
- Classification Society; and
- P & I Club.

All further reports and copies of messages sent to coastal states and/or port authorities should be sent to the company. If required, the company's office will be staffed as soon as possible after receipt of an initial report.

Once the initial report has been made, the company's corporate plan (Office Contingency Plan) will ensure that other interests such as Flag State authorities, P & I Club, Classification Society, and others, are notified and kept up to date on the incident.

These updating reports are a vital necessity to ensure appropriate measures are being taken whilst unnecessary risks and expenses are avoided.

The master or owner of a ship must report, without delay, any discharge or anticipated discharge of a pollutant to a Pollution Prevention Officer (PPO). These initial reports should be made to any Marine Communications and Traffic Services (MCTS) on the frequencies listed in the publication, Radio Aids to Marine Navigation (RAMN) - DFO 5470 (Great Lakes and Atlantic) and DFO 5471 (Pacific).

In addition to the above process for reporting spills from a ship to PPO's through the Marine Communications and Traffic Services (MCTS), the Coast Guard maintains a 24-hour Duty Manager alerting process which can be contacted at the numbers listed below.

Canadian Coast Guard
Safety & Rescue Environmental Response Systems Marine Programs
Department of Fisheries and Oceans
200 Kent Street,
Ottawa, Ontario, K1A 0E6
Pager: +1 613 751 0605 (24 hours)
Fax: +1 613 998 0434 Note: This number is operational on a 24-hr basis but is only monitored during business hours.
E-mail: erhqsr@dfo-mpo.gc.ca
Languages understood: ENGLISH/FRENCH

Enquiries regarding pollution preparedness and response should be directed to:

Manager, Environmental Response
Canadian Coast Guard
Safety & Rescue Environmental Response Systems Marine Programs
Department of Fisheries and Oceans
200 Kent Street, 5th Floor
Ottawa, Ontario K1A 0E6

Phone: +1 613 990 7011
Fax: +1 613 996 8902
E-mail: melhuish@dfo-mpo.gc.ca
Languages understood: ENGLISH/FRENCH

Within Canada administrative enquiries related to pollution prevention, vessel regulations, design and construction should be directed to:

Director, Ships & Operations Standards
Transport Canada

Tower C, Place de Ville
330 Sparks Street, 11th floor
Ottawa, Ontario K1A 0N8

Phone: +1 613 991 3131
Fax: +1 613 993 8196
E-mail: dayrh@tc.gc.ca
Languages understood: ENGLISH/FRENCH

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN
Initial Notification

A	(Ship name, call sign, flag)
B	(Date and time of event, UTC) _____ _____ _____ D D H H M M
C D	(Position: Lat, Long.) or (Bearing x dist Landmark) (dd mm) _____N/S _____ (ddd mm) _____E/W ddd N miles
E F	(Course) (Speed) _____ _____ d d d kn kn 1/10 kn
L	(Intended track)
M	(Radio station guarded)
N	(Date and time of next report, UTC) _____ _____ _____ D D H H M M
O P	(Type and quantity of cargo / bunker on board) Draught _____fwd _____ aft
Q	(Brief details of defects / deficiencies / damage)
R	(Brief details of pollution, including estimate of quantity lost)
S	Wind dir._____(ddd) Swell dir. _____(ddd) Speed _____(beaufort) Height _____(m)
T	(Contact details of ship's owner operator, agents) Transport Desgagnés Inc. Tel: (418) 692-1000 21 Marché-Champlain Street Fax: (418) 692-6044 Québec, Québec G1K 8Z8 E-Mail: info@desgagnes.com Agent: _____
U	(Ship size and type) Length: Breadth: Tonnage:
V W	(Additional information) Details of incident: _____ _____ Need for outside assistance: _____ Action to be taken: _____ Number of crew and details of injury: _____ Details of P & I club and correspondent: _____ _____ Others: _____

The alphabetical reference letters in the above format are from the guidelines for reporting incidents involving dangerous goods, harmful substances and /or marine pollutants. The letters do not follow the complete alphabetical sequence as certain letters are used to designate information required for other standard reporting formats, e.g., those used to transmit route information.

Section 3 – Steps to Control Discharge

Whenever an oil/NLS spill occurs, it is the duty of the person finding the spill to inform immediately the Master of responsible officer, who should call out the vessel's Oil/NLS Pollution prevention team (see Appendix 4). Remember that an oil/NLS spill may create a fire or explosion hazard, requiring safety precautions to be observed.

Ship personnel will most probably be in the best position to take quick action to mitigate or control the discharge of oil or noxious liquid substances from their ship.

Therefore, this Plan provides the Master with clear guidance on how to accomplish this mitigation for a variety of situations.

It is the Master's responsibility to initiate a response in the event of a discharge of oil/NLS or substantial threat of discharge – actual or probable – into the waters.

In no case action should be taken that in any way could jeopardize the safety of personnel either onboard or ashore.

In cases of a discharge of noxious liquid substances the Master has to refer to the "Characteristics of Liquid Chemicals Proposed for Marine Transport in Bulk" (Data Sheets) provided onboard for any NLS cargo. Considerations have to be made to any danger resulting from discharge of such substances, i.e. mixing with water, air and other materials/substances.

Special consideration is to be taken in case of the necessity to transfer cargo into another compartment onboard the compatibility of the material to be transferred and the material of pipes and tanks to be used for such action.

The following enumeration specifies different kinds of possible operational spills with regard to reactions to be taken.

3.1 OPERATIONAL SPILLS

3.1.1 OPERATIONAL SPILL PREVENTION

Crew members shall maintain a close watch for the escape of oil or NLS during bunker or cargo operations.

Prior to bunker or cargo transfer the competent crew members should mobilize the spill equipment, as far as available on board, and place it close to the planned operation, e.g. along the railing on the side at which bunker operation takes place.

Before bunker or cargo handling commences, all deck scuppers and open drains must be effectively plugged. Accumulations of water should be drained periodically and scupper plugs replaced immediately after the water has run off. Any free floating substances should be removed prior to draining.

Bunker or cargo tanks which have been topped up should be checked frequently during the remaining operations to avoid an overflow.

Unless there are permanent means for retention of any slight leakage at ship/ shore connections for bunker or cargo transfer, it is essential that a drip tray is in place to catch any leaking substance.

3.1.2 PIPELINE LEAKAGE DURING CARGO AND BUNKER TRANSFER

Measures to implement immediately:

- Stop all cargo and bunkering operations and close manifold valve;
- Sound general alarm bell; notify situation by public address system;
- Initiate emergency response procedures;
- Inform terminal/bunkering personnel of incident

Further measures:

If a leakage occurs from a pipeline, valve, hose or metal arm, operations through that connection should be stopped immediately until the cause has been as contained and the defect remedied.

The defective pipe section should be isolated. Affected sections should be drained down to an available empty or slack tank.

If there is any possibility of released vapours entering an engine room or the accommodation intake, appropriate preventive steps must be taken quickly.

If a leakage occurs from a hydraulic pipeline, operations should be stopped immediately.

Initiate clean-up procedures.

The removed substances and the used clean-up material should be retained on board until it can be discharged to a reception facility.

Inform in line with Section 2 all parties interested about Pipeline Leakage and the actions taken so far.

Refer to checklist in Appendix 5.

3.1.3 TANK OVERFLOW DURING LOADING OR BUNKERING

If there is a tank overflow all bunker/cargo operations should be stopped immediately and should not be restarted until the fault has been rectified and all hazards from the released substances have been eliminated.

If there is any possibility of released vapours entering an engine room or the accommodation intake, appropriate preventive steps must be taken quickly.

As far as the substance permits in view of the material compatibility of tanks/pipes, shift liquid from the tank overflowed to an available empty or slack tank or prepare pump(s) or transfer the excess ashore.

Initiate clean-up procedures.

The removed substances and the used clean-up material should be retained on board until it can be discharged to a reception facility.

Inform in line with Section 2 all parties interested about Tank Overflow and actions taken so far.

AFTER DEALING WITH AN OIL/NLS SPILL, ONCE CLEANUP OPERATIONS ARE COMPLETED, REQUEST PERMISSION TO RESUME OPERATIONS FROM PROPER AUTHORITIES.

Refer to checklist in Appendix 5.

3.1.4 HULL LEAKAGE

Signs leading to the suspicion of hull fractures:

- Excessive list;
- Oil/NLS in water around the vessel.

Measures to implement:

- Stop all cargo and bunkering operations and close manifold valve;
- Sound general alarm bell; notify situation by public address system;
- Initiate emergency response procedures;
- Inform terminal/bunkering personnel of incident

Further measures:

- Use the Oil/NLS Pollution Prevention team in an attempt to locate the source of leakage;
- Consider whether to stop air intake into accommodation and non-essential air intake in engine room.

When the source of leakage is identified:

- Reduce the hydrostatic head of leaking cargo/bunker tank by transferring in an empty or slack tank;
- Consider changing trim/list condition to use seawater as equalising or exceeding bunker tank hydrostatic pressure;
- Consider possibility of pumping water in ballast tank to change effect of hydrostatic pressure;
- Consider possibility of pumping water into leaking cargo/bunker tank to create a water cushion to prevent further oil/NLS loss;

- If the leakage is located below the waterline, call in divers for further investigation.

If it is not possible specifically to identify the tank:

- The level of oil/NLS in the vicinity of the suspected area should be lowered. Remember to consider the effect of hull stresses and stability of the vessel.

AFTER DEALING WITH AN OIL/NLS SPILL, ONCE CLEANUP OPERATIONS ARE COMPLETED, REQUEST PERMISSION TO RESUME OPERATIONS FROM PROPER AUTHORITIES.

Refer to checklist in Appendix 5.

3.1.5 SPILLS CAUSED BY EQUIPMENT IN MACHINERY SPACES

If operational spills are caused by a failure of equipment in machinery spaces any further operations of this equipment should be stopped immediately or measures are to be taken to avoid a spill.

Such equipment may be:

- Oily-water separating equipment or oil filtering equipment to oil bilge water from the engine room bilges
- Valves in pipes connecting ballast/ bilge/cargo systems
- Cooling pipes in cooler systems
- Gearing of bow thrusters
- Stern tubes

3.2 SPILL RESULTING FROM CASUALTIES

Priority actions

In responding to a casualty, the master's priority will be to ensure the safety of personnel and the ship and to take action to prevent escalation of the incident. In casualties involving spills, immediate consideration should be given to measures aimed at preventing fire, personnel exposure to toxic vapours, and explosion, such as altering course so that the ship is upwind of the spilled cargo, shutting down non-essential air intakes, etc. If the ship is aground, and cannot therefore manoeuvre, all possible sources of ignition should be eliminated and action should be taken to prevent toxic vapours or flammable vapours entering accommodation and engine-room spaces. When it is possible to manoeuvre, the master, in conjunction with the appropriate shore authorities, may consider moving his ship to a more suitable location in order, for example, to facilitate emergency repair work

or lightening operations, or to reduce the threat posed to any particularly sensitive shoreline areas. Such manoeuvring may be subject to coastal State jurisdiction
Prior to considering remedial action, the master will need to obtain detailed information on the damage sustained by his ship. A visual inspection should be carried out and all cargo tanks, bunker tanks, and other compartments should be sounded. Due regard should be paid to the indiscriminate opening of ullage plugs or sighting ports, especially when the ship is aground, as loss of buoyancy could result.

Having assessed the damage sustained by the ship, the master will be in a position to decide what action should be taken to prevent or minimize further discharge. When bottom damage is sustained, hydrostatic balance will be achieved (depending on physical properties) fairly rapidly, especially if the damage is severe, in which case the time available for preventive action will often be limited. When significant side damage is sustained in the way of fuel/lubrication and/or cargo tanks, bunkers or cargo will be released fairly rapidly until hydrostatic balance is achieved and the rate of release will then reduce and be governed by the rate at which bunkers or cargo is displaced by water flowing in under the bunkers or cargo. When the damage is fairly limited and restricted, for example, to one or two compartments, consideration may be given to transferring the substance involved internally from damaged to intact tanks. When considering the transfer of oil or noxious liquid substances from a damaged tank to an intact tank, the master should consider:

1. the extent of the damage;
2. hydrostatic balance;
3. the ship's ability to transfer cargo; and
4. the physical properties of the substance(s) (for ships certified to carry NLSs) involved such as:
    - solubility;
    - density;
    - water reactivity
    - solidification; and
    - compatibility.

Great care in casualty response must be taken to consider stability and strength when taking actions to mitigate the spillage of oil or noxious liquid substance or to free the ship if aground. The Plan provides the master with detailed guidance to ensure that these aspects are properly considered. Nothing in this section shall be construed as creating a requirement for damage stability plans or calculations beyond those required by relevant international conventions.

Internal transfers should be undertaken only with a full appreciation of the likely impact on the ship's overall longitudinal strength and stability. When the damage sustained is

extensive, the impact of internal transfers on stress and stability may be impossible for the ship to assess. Contact may have to be made with the owner or operator or other entity in order that information can be provided so that damage stability and damage longitudinal strength assessments may be made. These could be made within the head office technical departments. In other cases, classification societies or independent organi□ations may need to be contacted. Additionally, in the case of ships certified to carry NLSs, consideration as to the compatibility of all substances involved such as cargoes, bunkers, tanks, coatings, piping, etc., must also be considered before such an operation is undertaken.

Mitigating Activities

If safety of both the ship and the personnel has been addressed the Master shall care for following issues:

- Assessment of the situation and monitoring of all activities as documented evidence
- Care for further protection of the personnel, use of protection gear, assessment of further risk for health and safety
- Containment of the spilled material by absorption and proper and safe disposal of all material onboard until proper delivery ashore under close guidance of the safety information given by the Product Data Sheet
- Decontamination of personnel after finishing the cleanup process

3.2.1 LIGHTERING / SHIP-T0-SHIP TRANSFER

If a ship becomes disabled or stranded, it may be necessary to transfer all or part or her cargo/bunker to another ship. In the case of tankers, reference should be made, to the *Ship-to-Ship Transfer Manual* available onboard and approved by the Classification Society.

In Ship-to-Ship transfer operations involving a speciali□ed ship, the Master of that ship will normally be in overall charge.
In the case of non-speciali□ed ships, the Master or other person in overall charge of the operation should be mutually agreed and clearly established by the Masters concerned prior to the start of operations. In all cases each master remains responsible for the safety of his own ship, its crew, cargo/bunker and equipment and should not permit their safety to be jeopardi□ed by the action of the other Master, his owner, regulatory officials or others.

The Ship-to-Ship transfer operations should be coordinated with the appropriate responsible local Authority. In addition, the Master should take note of supplemented instructions issued by the Company.

The operation will be greatly expedited if the ship to be lightened makes the following preparations where possible:

a) Establish contact with the lightening ship and makes a detailed plan of the proposed operation including the designation of a communication channel. Fixed or portable hand-held radio telephones may be usefully employed;

b) Lay out mooring lines, heaving lines, messengers, stoppers, fenders, etc. If no large fenders are available, mooring ropes and any other soft material should be strung over the ship's side in strategic positions;

c) Prepare the cargo manifold and have reducers ready available to facilitate the connection of a wide range of hoses (from 200mm to 400mm) on both sides of the ship. In most cases the lightening ship will prefer to berth with her port side to the disabled ship's starboard side, if this is practicable;

d) Top-up derricks or cranes to assist in hose connection. Also have messenger ropes, lifting tackles, etc. available;

e) Have the anchors cleared ready for use, if in waters where use may be possible;

f) Brief the officers and crew on the operation, with particular reference to the safety aspects and complete the appropriate safety check list if possible.

Cargo transfer:

If the disabled ship has power and its cargo piping system is intact, transfer should be made in the usual way.

If the ship's pipelines are not intact, approved portable submersible pumps with power packs should be obtained. The power for submersible pumps may be electric, air or hydraulic. When using submersible pumps, the tanks being emptied of cargo may be counter-flooded with water in order to reduce the head. This may also assist in preventing pollution.

3.2.2 GROUNDING OR STRANDING

The GENERAL ALARM must be sounded immediately for the personnel to muster at their designated positions.

If the vessel is aground and therefore cannot manoeuvre, all possible sources of ignition must be eliminated and action taken to prevent flammable vapours from entering the engine room spaces or the accommodation.

The Master's next priority should be to ensure that he as soon as possible receives detailed information on the damage that the vessel has sustained, in order to find out what remedial action needs to be taken to ensure the safety of the vessel and its crew.

- A visual inspection should be carried out.
- All cargo and bunker tanks to be sounded (ullage)
- All other compartments which have contact with the sea should be sounded to ensure that they are intact.
- Soundings of cargo tanks are to be compared with last soundings to check for possible leaks.
- Any list shall be noted and included in the report for assistance.

Also consider:

- Danger to the vessel's complement if the vessel should slide off grounding site.
- Danger of vessel being broken down by heavy seas or swells.
- Health hazards to the vessel's complement and surrounding population due to release of hazardous substances is dangerous concentrations.
- That fire may start due to released flammable substances due to uncontrolled ignition sources.
- Furthermore, the vessel's Master must take into account the following considerations:
- Is the vessel constantly being struck in the seaway?
- Is the vessel exposed to torsion?
- Sounding to be taken around the vessel to establish the vessel's position on the bottom.
- Are there strong tidal currents in the grounding area?

- May the vessel drift further up on the shore, due to high tides, wind and waves?

3.2.2.1 PREVENTION OF FIRE AND EXPLOSION

If the ship is aground and therefore cannot manoeuvre, all possible sources of ignition should be eliminated and action taken to prevent flammable vapours from entering the machinery spaces or the accommodation.

3.2.2.2 EXTENSION OF HULL DAMAGE

First, a visual inspection should be carried out.

Check for visible oil along hull or in wake of the ship during day time. At night a stick with white cloth (or sheet of sorbent) around it may be lowered into the water alongside the ship to check for oil leakages.

All ballast/ bunker tanks to be sounded (ullage).
All other compartments which may have contact with the sea should be sounded to ensure that they are intact.

Soundings of ballast/cargo/bunkers tanks are to be compared with last soundings to check for possible leaks.

Sounding to be taken around the ship establish the ship's position on the grounding area.

When the ship is aground, due regards should be given to the indiscriminate opening of ullage plugs, sighting ports etc. as loss of buoyancy could be the result of such actions.

Any list of the ship shall be noted and included in the report for assistance.

3.2.2.3 PROCEDURES TO REDUCE OR STOP OUTFLOW OF OIL OR NLS

The Master should assess the possibility of damage to the environment and whatever action can be taken to reduce further damage from any release, such as:

- Transfer of bunkers/cargo internally, provided shipboard piping system is in an operational condition and in careful view of the compatibility of the substance and the tanks/pipes used for transfer, and taking into account the impact on the ship's overall stress and stability
- Isolate damaged/ penetrated tank(s) hermetically to ensure that hydrostatic pressure in tanks remains intact during tidal changes

- Evaluate the necessity of transferring bunkers/cargo to barges or other ships and request such assistance accordingly
- Evaluate the possibility of additional release of oil or NLS in close co-operation with coastal states.

In case of large differences between the tide levels, the Master should try to isolate the damaged tank(s) to reduce additional loss of substances.

3.2.2.4 REFLOATING BY OWN MEANS

The Master should also evaluate the question of refloating the vessel by own means. Before such an attempt is made, it must be determined:

- whether the ship is damaged in such a way that it may sink, break up or capsize after getting off
- whether the ship after getting off may have manoeuvring problems upon leaving the dangerous area by own means
- whether machinery, rudder or propeller are damaged due to grounding or may be damaged by trying to get off ground by own means
- whether the ship may be trimmed or lightened sufficiently to avoid damage to other tanks in order to reduce additional pollution
- weather evaluation: whether there is time/ reason to await improvements in weather or tide.

3.2.2.5 SECURING THE SHIP

The risk of further damage to the ship is greater in an attempt to refloat the ship by own means, than in remaining aground until professional assistance has been obtained, the ship's Master should try to secure the ship as much as possible by:

- Trying to prevent the ship from moving from is present position
- By dropping anchors (adequate water depth and anchor ground provided)
- By taking ballast into empty tanks, if possible
- Trying to reduce longitudinal strain on hull by transferring ballast or bunkers internally
- Reducing fire risk by removing all sources of ignition.

Inform in line with Section 2 all parties interested about the Grounding and the actions taken so far.

3.2.3 TOUCHING BOTTOM

Should the vessel experience unusual shaking or vibrations of the hull, unexplained movements or changes in engine revolutions, it may be suspected that the vessel has touched bottom. Procedures should be initiated to ensure that vessel is intact and that there is no oil/NLS leakage.

- If vessel has pilot on board, ask for possible explanation.
- Stop engine immediately, and observe any unexpected speed reduction.
- Consult vessel's charts for area and check depth information.
- Observe accurate position by bearings of fixed points.
- Check for visible oil/NLS along hull or in wake of vessel during day time. At night a stick with white cloth (or sheet of sorbent) around it may be lowered into the water alongside the vessel to check for oil/NLS leakage.
- Take soundings of all tanks, cargo/bunkers and other compartments (ballast tanks etc) to ensure that the vessel has not sustained any damage.
- Isolate penetrated tank by closing the tank hermetically. Very important when large differences in tides occur.

If the vessel is aground, follow instructions provided in 3.2.2

3.2.4 COLLISION

Should the ship be involved in a collision with another ship, the Master should as soon as possible identify the extent of damage to his own vessel.

When a collision occurs, the GENERAL ALARM should be sounded immediately for the personnel to muster at their designated Muster Stations.

The following check list should assist the Master in assessing the situation:

- Are any tanks penetrated above or below the waterline?
- If ships are dead in the water and interlocked, what is most prudent, to stay interlocked or separate?

- Is there any spill at present small or large? Will a separation of the interlocked ships create a larger spill than if the ships stay interlocked?
- If there is a spill, will the separation of the ships cause sparks that can ignite the spilled material or other flammable substances leaked out from the ships?
- Are the ships creating a greater danger to other traffic in the area if the are interlocked than if separated?
- Is there a danger to either ship of sinking after being separated?
- If the ships are separated, how is the manoeuvrability of the own ship?

Shut down all none essential air intakes.

Isolate damaged/ penetrated tank(s) by hermetically closing the tank(s), if possible.

When it is possible to manoeuvre, the Master, in conjunction with the appropriate shore authorities, should consider moving his ship to a more suitable location in order to facilitate emergency repair work or lightening operations, or to reduce the threat posed to any sensitive shoreline areas.

Inform in line with Section 2 all parties interested about the collision and the actions taken so far.

3.2.5 FIRE AND EXPLOSION

When a fire and/or explosion occur, the FIRE ALARM must be sounded immediately for the personnel to muster at their designated positions.

Chemical fires produce additional hazards and great care is necessary when fighting them. The data sheets of all chemical cargoes must be carefully studied before and during carriage, so that all personnel are familiar with their properties.

- Water may react with some chemicals with the following results:
  - Productions of flammable solutions;
  - Production of toxic vapours;
  - Re-ignition due to low auto-ignition temperature;
  - Production of heat and increased amounts of flammable gases.
- Chemicals soluble in water will destroy normal foam.
- Some chemicals produce toxic vapours when heated. While burning a chemical transformation may produce highly toxic vapours of a different chemical composition.
- Some chemicals that are heavier than water can be blanketed with water if the jet stream is applied slowly and carefully.
- All personnel are to wear breathing apparatus ready for immediate use should toxic vapours or fumes be produced.
- The Emergency Team should always wear breathing apparatus at fire practices.
- The Emergency Team should supplement any fixed fire fighting system with foam or water sprays, if appropriate.
- Small fires in scuppers or around decks should be fought with appropriate portable extinguishers.
- Any sealed space in which a fixed fire fighting system has been used should be entered only after thorough ventilation and testing of the atmosphere.

Should an explosion and a fire occur on board; the vessel's Emergency Teams will under the leadership of the Chief Officer initiate the necessary steps to bring the situation under control.

Such steps shall be:

- Find out immediately where the fire/explosion has taken place.
- Try to determine the extent of damage, and if anyone of the compliment is injured or dead.
- Deploy the members of the vessel's Emergency Teams to the positions deemed best for fighting the fire.
- Use all available means to fight the fire such as:
- Water w/spray nozzles
- Water cannons (monitors)
- Foam cannons (monitors)
- CO2
- Try to contain the fire and prevent it from spreading to other parts of the vessel.

The occurrence shall be reported to the local authorities, informing them about the situation and if the fire cannot be controlled by the complement, request outside assistance as per section 4.

In case of fire and explosion the following priorities exist when the Damage control measures are initiated:

- Rescue lives.
- Limiting the damage to vessel and cargo.
- Preventing environnemental pollution.

When alerting the local authority and firefighting contractors, report as per IMO-format (Section 2), but most important give:

- Name of vessel and nationality.
- Location.
- Type of incident and cargo on board.
- If anyone is injured or missing.
- Any oil/NLS spill or threat of spill.

3.2.6 HULL FAILURE

Should the ship loose one or more shellplatings, develop major cracks, or suffer severe damage to the hull, the Master should immediately sound the GENERAL ALARM to call the crew members to their Muster Stations, and inform them of the situation, and prepare lifeboats for launching if necessary.

The Master should then asses the situation, and confers with his senior officers.

The Master should obtain the latest weather forecast and asses its impact on the present situation.

Furthermore, the following questions should be considered and should be asked:

- Is the ship in any immediate danger of sinking or capsi□ng?

If YES:

- Send distress message
- Immediately abandon the ship

If NO, initiate damage control measures as found necessary by considering the following points:

- Can the vessel manoeuvre on its own?
- Has the ship lost buoyancy?
- If the ship has a list due to loss of ballast, cargo/ bunker or buoyancy, is it necessary and possible to rearrange the bunker or ballast by internal transfer operation in order to bring the ship to an even keel?
- Is it necessary to dump cargo in order to maintain stability without changing the stress situation?

- Can this operation wait till another ship/ barge can receive that cargo?
- Is there any abnormal change in the ship's stability and stress situation?
- Can the change in the ship's stability and stress situation be monitored and calculated on board? If not, the Master should seek assistance.
- Does the ship need assistance or escort to nearest port of refuge or repair port?
- Might it be prudent to salve part of the crew members in case the situation should worsen, or is it necessary to abandon the ship totally?

Inform in line with Section 2 all parties interested about the Hull Failure and the actions taken so far.

3.2.7 EXCESSIVE LIST

Should the ship for some reasons suddenly start to list excessively during discharging/ loading operations, or bunkering, all ongoing operations should be stopped immediately until the cause has been determined.

The Officer on Duty should inform the Master and/ or Chief Officer without delay.

The Master should try to determine the reason for the excessive list, and take steps to rectify the situation and to stabilize the ship's condition:

- Check reason(s) for list;
- Soundings/ ullage to be taken in all tanks;
- Bunker/ ballast/cargo pumps to be made ready;
- Consider measures to minimize list in transferring liquid from one compartment to another;
- Ensure water tightness of empty spaces;
- Close all openings;
- Secure vent pipes to avoid ingress of water;
- If bunkering: Change to corrective tanks for rectifying the situation;
- If ballasting/ deballasting: Change to corrective tanks to rectify the situation;
- If there is reason to believe that the list may cause any spill, notify as per Section 2;
- If the ship's crew is in jeopardy, prepare lifeboats for launching, and notify as per Section 2.

If the situation is brought under control, inform all parties interested.

3.2.8 EQUIPMENT FAILURE

If the main engine stops or steering gear fails, the bridge watch shall immediately:

- Call Master and Chief Engineer.
- If vessel is considered to be in immediate danger, prepare for dropping an anchor.

When the Master comes to the bridge, his first priority shall be to assess the situation and get a complete picture of the situation, and base his further action based on:

- Position of the vessel relative to shore, shallows or installations.
- Weather and drift (speed and direction).
- Estimated time to get engine or steering gear back into operations.

Action should be taken according to worst case scenario development of the situation.

Main engine failure:

The main engine instruction book failure search list should be used to locate the failure. If the engine cannot be repaired within the permissible time given by the Master, emergency operation of the main engine should be considered on the Master's order.

Steering gear failure:

For location of the steering gear failure, the ICS "STEERING GEAR GUIDANCE ON TEST ROUTINES AND CHECK LISTS" can be used in addition to the steering gear instruction book.

3.2.9 DANGEROUS REACTIONS OF CARGO (for vessels certified to carry NLSs)

In case of spillage of NLS cargo on deck, in the water or incidental mixture with other cargo through internal tank leakage consider dangerous reactions of such mixture. Promptly consult the Data Sheet available for the cargo shipped onboard about possible hazards and necessary precautions/actions to be taken according to the information provided.

Take necessary actions for the safety of the crew for the case of (possible) contamination with the spilled material or its vapours.

3.2.10 DANGEROUS CARGO RELEASE (for vessels certified to carry NLSs)

When a dangerous cargo release is detected, the vessel's emergency team must, under the leadership of the chief officer initiate the necessary steps to bring the situation under control.

Such steps should be:

If at sea or at berth

- First to Raise the alarm

The leaking product must be identified as soon as possible so that potential hazards to the vessel, crew and the environment can be determined by checking with the Material Safety Data Sheet for the substance involved. Particular concern is to be given to flammability and toxicity of vapours.

Engine room personnel should be instructed to switch ventilation to the re-circulation mode and to close air intakes. All non-essential water intakes should be closed after having determined which ones must remain open.

As soon as a source of leakage has been determined, steps to minimise/stop leakage are to be established. This may include discharging, internal cargo transferring and adjusting list and trim.

Radio warnings should be broadcast.

Spills, and probable spills, must be reported immediately to the company and to the authorities in accordance with the rules and regulations.

If at Terminal

- Stop cargo transfer, if any, and raise the alarm.

Ensure that ventilation is switched to the re-circulation mode and that all air intakes are closed. All non-essential water intakes should be closed after having determined which ones must remain open.

Be ready to leave berth without assistance in case of an emergency. Consideration should be given as to lifeboat use in case of vessel evacuation.

3.2.11 LOSS OF TANK ENVIRONMENTAL CONTROL (for vessels certified to carry NLSs)

Consider any hazards arising out of loss of environmental control in view of possible explosion dangers by contacting the Data Sheets of the cargo concerned.

Avoid any intake of air into the uncontrolled spaces to avoid a dangerous mixture to be built up within the respective space.

3.2.12 CARGO CONTAMINATION YIELDING A HAZARDOUS CONDITION (for vessels certified to carry NLSs)

Normally proper cargo stowage should have reduced this eventuality to a minimum.

Measures to be implemented immediately:

- Sound emergency alarm.
- Turn ship off wind.
- Shut accommodations ventilation.
- Eliminate all sources of ignition.
- With the help of M.S.D.S. (reactivity) try to evaluate the type of reaction you can expect.
- Records events and communications.

Personnel Safety:

- Refer to Emergency Procedure for Ship Carrying Dangerous Goods (Ems). If personnel to work in vicinity of noxious substance, they must be protected by required equipment.
- Check cargo(es) against IBC code chapter 17 column "n" if letter E is present, respiratory equipment is necessary for escape purposes. Advices crew by Public Address (P.A.) accordingly.

Further measures:

- Monitor toxic vapours.
- Assess the extend of reaction.
- Initiate mitigation of hazardous cargo contamination release if practicable (if limited quantity on deck, consider washing overboard with copious amount of water).

3.2.13 HAZARDOUS VAPOUR RELEASE (for vessels certified to carry NLSs)

Measure to be implemented immediately:

- Sound Emergency Alarm.
- Shut accommodations ventilation.
- Eliminate all sources of ignition.
- Turn vessel off wind.
- With the help of M.S.D.S. assess if fire, explosion or toxic vapours risk are present.
- Assess cause of vapour release.
- Record events and communications.

Personnel Safety

- Refer to Emergency Procedures for Ship Carrying Dangerous Goods (EmS). If personnel to work in vicinity of noxious substance, they must be protected by required equipment.
- Check cargo(es) against IBC code chapter 17 column "n" if letter E is present, respiratory equipment is necessary for escape purposes. Advices crew by Public Address (P.A.) accordingly.

Further measures:

- Monitor toxic vapours.
- Initiate mitigation of hazardous vapour release if practicable
- A very isolated source of hazardous vapour can be directed away with the air draft of an open, high pressure, fog nozzle.

When a spill on board creates toxic, corrosive or flammable vapours, the master should consider manoeuvring the vessel to the extend that, in his judgment, spill and weather conditions permit, so that vapours move away from vessel accommodation and operation spaces.

Entry into spaces with suspected gas leaks should always be with a self-contained breathing apparatus (SCBA) and protective clothing, monitoring equipment and under supervision by a responsible vessel's officer. Gases that are inert and normally considered to be non-flammable and non-toxic may cause an oxygen deficient atmosphere in compartment spaces. Other gases have narcotic effects while others change composition and produce highly poisonous gas when in contact with fire.

Ventilation to remove leaking of gases may not always be effective, particularly with heavier-than-air gases that settle and accumulate in low spaces. When dealing with flammable vapours and gases, ignition sources (naked lights, electric tools, etc.) should be prohibited.

3.3 OTHER CONSIDERATIONS

3.3.1 STRESS AND STABILITY – GENERAL CONSIDERATIONS

a. Great care must be taken when taking actions to mitigate the spillage of oil or free the ship if aground.

b. Internal transfers should only be undertaken when the overall impact on stress and stability has been calculated.

c. When damage is extensive, the impact of internal transfers on stress and stability may be impossible for the Master to assess. Contact should be made with the technical manager for the necessary calculations to be carried out.

d. Information required by the Technical Manager will include:

1) Intact Ship's condition.

2) Damage - location and extent.

3) Condition of ship- draft- cargo fuel loss or change in amount and disposition

4) Local Conditions- tide- wind- sea state- weather forecast If the ship has sustained extensive structural damage consideration may be given to transfer all or part of the cargo /bunkers to another ship. This should not be undertaken without a full assessment of the impact this will have on the stability and stress of the ship at all stages of the transfer The ship to ship transfer operations should be co-ordinated with the appropriate local authority. Current cargo, bunker and ballast information, including quantities and specifications, is available in the ships office.

3.3.2 MITIGATING ACTIVITIES

If safety of both the ship and the personnel has been addressed the Master shall care for following issues:

- Assessment of the situation and monitoring of all activities as documented evidence.
- Care for further protection of the personnel, use of protection gear,
- Assessment of further risk for health and safety.
- Containment of the spilled material by absorption and safe disposal

- Within leakprof containers of all onboard until proper delivery ashore with due consideration to possible fire risk.

- Decontamination of personnel after finishing the cleanup process.

- Disposal of removed oil and clean-up material.

- Isolation procedures.

Shipboard Marine Pollution Emergency Plan

Section 4 – National and Local Coordination

Quick efficient co-ordination between the ship and Coastal States or other parties involved becomes vital in mitigating the effects of any pollution incident.

As the identities and roles of various national and local Authorities involved vary widely from state to state and even from port to port, the Master should take note of these particularities, as far as possible. In this context the Master should call upon the owner's representatives in the state/ port of question to receive the relevant information.

Prior to undertaking mitigation actions – especially in cases of an actual discharge due to casualties in the territorial waters of a Coastal State – the Master should contact the Coastal State for authorization of his action.

The Master should co-ordinate all his activities with the Coastal State.

The Master should call the Coastal State for allowance to use chemical agents for response to pollution on the sea. Without authorization of the Authorities of the appropriate Coastal State no chemical agents should be used.

Where no responsibility for discharge response by a Coastal State is noticed the Master should take all the necessary steps as deemed appropriate to minimize the escape of oil or NLS.

With respect of the accident happened the Master should take measures as stated in Section 2 and Section 3 of this Plan.

a) Canada

Canadian Coast Guard Pollution Prevention Officer in the area that the vessel is in; Contact of a PPO can be made via any CGRS or VTS.

Operation Centre, H.O.
Phone: (613) 990-5600 – 24 hrs/day
Fax: (613) 995-4700
TLX: 0053 3128

East Coast, ECAREG VTS Centre, Dartmouth, N.S. (1-800-565-1633)
Or via any Coast Guard radio station.
Phone: (902) 426-5664/5
TLX: 019-22625 or 019-22510, Cable: ECAREG Canada

West Coast, WESTREG via any Coast Guard radio station
Phone: (604) 661-6011
TKX: 043-52586, Cable: WESTREG Canada
Arctic, NORDREG or via any Coast Guard radio station.
Phone: (819) 979-5724
TLX: 063-15529, Cable: NORDREG Canada

b) United States

U.S. Coast Guard Captain of the Port in the area that the vessel is in and National Response Centre (1-800-424-8802) as required by federal regulations. Telex: 892427

Failure to notify the National Response Centre in addition to the local Coast Guard is punishable by a fine up to $10,000 or one year in prison. It is important that both the Coast Guard and the National response Centre be notified at the toll free number whenever a spill occurs in U.S. waters.

See Vessel Response Plan Procedures

c) International Port / Waters

Appropriate equivalent government body for that particular country the vessel is in (see Appendix 1).

Section 5 – Additional Information

5.1 PLAN REVIEW PROCEDURES

This plan can only be changed and/or updated by the Quality, Safety, Security and Environment Management Team.

All comments, corrections and suggestions shall be directed to the above department through the qsse@desgagnes.com email address. All users of the plan have the responsibility of pointing out changes that affect the validity and/or use of the plan.

Major changes on the plan shall be made as soon as possible.

Any change or update which requires a page change shall be entered in the "Record of changes".

All approved changes shall be sent, without delay to the registered copy holders, as follows:

- Owners Emergency Response Room
- Vessel;
- Canadian Coast Guard, Marine Safety.

5.2 REVISION OF PLAN

The plan must be kept updated at all times which means that if any changes occur during the operation and which may affect this document, it must be corrected and recorded and all parties concerned must be advised.

5.3 ON BOARD SPILL EQUIPMENT

5.3.1 INVENTORY

To get the inventory and the storage location for all spill kit materials, consult appendix 7.

If your Vessel is also equipped with an Emergency Air Pump, please consult appendix 8 to familiarize with the Procedure and Piping Arrangement for Oil Spill Air Pump.

5.3.2 PLANNED VERIFICATIONS & MAINTENANCE SCHEDULE

1. Prevention equipment

1.1 Tank lids, checks

- Tank lids sit squarely on coatings
- Packing is in good condition
- Cleats have sufficient movement
- Ullage ports are tight
- Packing of ullage ports in good condition
- Drain valve closed and plug fitted on manifold drip trays

1.2 Deck pipelines (cargo, bunker, thermal oil and hydraulic)

- General condition of deck lines, no apparent leakage
- State of temporary repairs, if any; head office informed of situation
- Check expansion joints for signs of leakage
- All manifolds and unused hoses blanked and fully bolted
- Sample/pressure cocks fitted tightly, no leakage

1.3 Hull plating check

- Assessment condition of hull for signs of damage or possible weak spots, notify Head office of areas of concern.

1.4 Miscellaneous

- Proper opening/closing of pressure/vacuum valves on tanks
- Proper operations of Wessoe gauges

2. Containment equipment

Check:

- Drip trays are sound with no obvious cracks or holes
- Save-alls around bunker tanks are sound and drain plugs fitted
- Condition of scupper plugs
- Proper operation of diaphragm pumps
- Sufficient inventory on board at all times

3. Spillage equipment

Check:

- Oil dispersant and solvant available. USE AS DIRECTED ONLY
- Foam & dry powder fixed extinguishing systems are operational and ready for immediate use
- Company's Oil/NLS Response Plan has been brought to attention of all involved parties
- All communication methods have been proved satisfactory

4. Equipment

Check:

- All components of bilge oily separator work satisfactorily
- A sign is in place in vicinity of overboard discharge relating to use of valves and the need for them to be sealed in port
- All components of the ballast discharge monitoring system works satisfactorily
- Oil/Water interface detector is in good working order and readily available.

WARNING:

THE MASTER SHOULD ENSURE THAT BEFORE ANY DISPERSANTS OR DETERGENTS ARE USED, LOCAL AUTORISATION IS OBTAINED AS INDISCRIMINATE USE OF SUCH MATERIALS MAY BE HARMFUL TO ENVIRONMENT.

5.4 EVIDENCE REQUIRED FROM THE VESSEL

(Text extract from The Nautical Institute's The Master Role in Collecting Evidence, 1989)

In order to defend claims of oil/NLS pollution and to prevent future spills, owners and their insurers will require a detailed account of how the spill occurred, the steps taken to prevent the spill, and the efforts made to minimise damage. Such an account should be supported by the items of evidence listed below, and the Master should ensure that such information and documents are retained and available. This information includes the following:

1. Log books in which the following information should be recorded:

    a) Use of such equipment as scupper plugs and drip trays,
    b) Carrying out of oil/NLS spills drills
    c) The procedures followed during transfer of oil/NLS within the vessel
    d) Evidence of previous oil/NLS pollution in berth or port area

2. Engine Room logs in which the following information should be recorded:

    a) Bunkering procedures
    b) Members of the crew in charge of bunkering operations
    c) Methods of effecting emergency stops
    d) Times and results of inspections of equipment used in cargo and bunkering operations, and
    e) Rates and sounding / ullages during loading and discharging operations

3. A copy of the bunkerer's instruction or delivery note containing an acceptable loading rate.

4. Records of stocks of cleaning materials such as sprayers and absorbent material

5. Samples of any oil/NLS that has been discharged from the vessel

6. Video films of the extent of the film (if possible)

7. A record of the quantity of pollutant

8. If the pollution was caused by broken equipment on board the vessel, the broken parts should be preserved

9. Accounts of the events from all the members of the crew involved in the incident

10. Oil record book

11. Cargo loading / discharge plan

12. Owners / charterer's instructions

13. Tank and pipeline diagrams

14. Sounding pipe and ullage plug diagram

15. Vessel's Contingency plan

16. All relevant telexes, cables and other correspondence

In addition of the information listed above, the Master should ensure that a record is made of the following information:

1. The operation being carried out at the time of the spill and the grades of oil/NLS involved

2. The type of oil/NLS which went over the side

3. The quantity of pollutant on deck, and the quantity which went over the side

4. Actions taken to report the spill

5. Action taken to commence cleaning operations

6. The state of the tide at the time of the spill

7. The extent of the pollution, the extent of the area which the spill covered and whether it affected other vessels or properties

8. The weather condition at the time of spill

9. The identity of any vessels in the vicinity when the oil/NLS spill occurred

10. The date, time when, and place where the spill occurred

11. Details of the action taken on board to contain and clean up the pollutant

12. Details of the action taken on shore to contain and clean up the pollutant

13. The type and industrial name of the oil dispersant or any other chemical used

Appendix 1
List of Coastal State Contacts

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Regulation ~~26~~ of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) (Shipboard Oil Pollution Emergency Plan), entered into force on April 4, 1993. The Shipboard Marine Oil Pollution Emergency Plan should include as an appendix the list of agencies or officials of administrations responsible for receiving and processing reports as developed and updated by the Organisation in compliance with Article 8 of MARPOL 73/78.

The attached list contains contact details for coastal stated known at the time of publication. This list has three sources of information: 1) the Provisions Concerning the Reporting of Incidents Involving Harmful Substances under MARPOL 73/78 (the IMO Publication); 2) responses to the IMO Shipboard Marine Pollution Preparedness, Response and Co-operation Information System (OPRC Questionnaire); and 3) the International Tanker Owner Pollution Federation (ITOPF). It is recognised that the list may not be complete.

The information has been provided in response to the OPRC Questionnaire, as well as directly by Member States with amendments to the list. Additions and / or amendments to the list will continue to be provided by the International Maritime Organisation (IMO).

***

Coast stations and their frequencies are given in the ITU List of Coast Stations, and also in appropriate national publications, e.g. Admiralty List of Radio Signals Vol 1.

Appendix 2
List of National Operational Contact Points

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This information enables compliance with Regulation ~~26~~ of Annex 1 of MARPOL 73/78 which, inter alia, requires that shipboard marine pollution emergency plans (SMPEP) shall contain a list of authorities or persons to be contacted in the event of an oil pollution incident.

Appendix 3
List of Ship Interest Contacts

Liste des contacts en cas d'urgence
Emergency Contact List

ARMATEUR ET OPÉRATEUR	**TRANSPORT DESGAGNES INC.**

OWNER & OPERATOR	***TRANSPORT DESGAGNES INC.***

SIÈGE SOCIAL	
Adresse :	**21, rue du Marché-Champlain Québec (Québec) Canada G1K 8Z8**
Téléphone :	**(418) 692-1000**
Télécopieur :	(418) 692-6044
Courriel :	info@desgagnes.com
Site Internet :	www.desgagnes.com

HEAD OFFICE	
Address:	***21 Marché-Champlain Street Quebec, Québec, Canada G1K 8Z8***
Telephone:	***(418) 692-1000***
Fax:	*(418) 692-6044*
E-mail:	*info@desgagnes.com*
Website:	*www.desgagnes.com*

SALLE D'INTERVENTION D'URGENCE	
Téléphone :	(418) 692-5525
Télécopieur :	(418) 692-5443
Courriel :	emergency@desgagnes.com

EMERGENCY RESPONSE ROOM	
Telephone:	*(418) 692-5525*
Fax:	*(418) 692-5443*
E-mail:	*emergency@desgagnes.com*

CONTACT 1 :	**Surintendant du navire**

CONTACT 1:	***Vessel Superintendent***

Pour les navires :	**Dara, Esta et Jana Desgagnés**
	Daniel Colan
Cellulaire :	(506) 533 5025
Courriel	daniel.colan@rigelcanada.com
Ou :	**Officier en devoir**
	(506) 533-9000

For vessels:	***Dara, Esta, and Jana Desgagnés***
	Daniel Colan
Cellular:	(506) 533 5025
E-mail	*daniel.colon@rigelcanada.com*
Or:	***Officer on Duty***
	(506) 533-9000

Pour les navires :	**Acadia, Sedna et Maria Desgagnés**
	Eugen Milasan
Cellulaire :	(418) 929-4961
Cellulaire 2 :	(514) 473-6076
Courriel :	eugen.milasan@desgagnes.com

For vessels:	***Acadia, Sedna and Maria Desgagnés***
	Eugen Milasan
Cellular:	*(418) 929-4961*
Cellular 2:	*(514) 473-6076*
E-mail:	*eugen.milasan@desgagnes.com*

Pour le navire :	**Mia et Paul A. Desgagnés**
	Olivier Garon
Cellulaire :	(418)-953-8293
Courriel :	olivier.garon@desgagnes.com

For vessel:	***Mia and Paul A. Desgagnés***
	Olivier Garon
Cellular:	*(418)-953-8293*
E-mail:	*olivier.garon@desgagnes.com*

Pour le navire :	**Zélada Desgagnés**
	Zélada Desgagnés
Cellulaire :	(418) 563-7573
Domicile :	(418) 635-2803
Courriel :	zelada.desgagnes@desgagnes.com

For vessel:	***Zélada Desgagnés***
	Zélada Desgagnés
Cellular:	*(418) 563-7573*
Home:	*(418) 635-2803*
E-mail:	*zelada.desgagnes@desgagnes.com*

Pour les navires :	**Nordik Express, Bella, Claude A. Miena et Nordika Desgagnés**
	Éric Desrochers
Cellulaire :	(418) 569-3597
Domicile :	(418) 683-3849
Courriel :	eric.desrochers@desgagnes.com

For vessels:	***Nordik Express, Bella, Claude A. Miena and Nordika Desgagnés***
	Éric Desrochers
Cellular:	*(418) 569-3597*
Home:	*(418) 683-3849*
E-mail:	*eric.desrochers@desgagnes.com*

Pour les navires :	**Damia, Rosaire A. et Sarah Desgagnés**
	Sylvain Tremblay
Cellulaire :	(418) 571-0429
Domicile :	(418) 889-8917
Courriel :	sylvain.tremblay@desgagnes.com

For vessels:	***Damia, Rosaire A. and Sarah Desgagnés***
	Sylvain Tremblay
Cellular:	*(418) 571-0429*
Home:	*(418) 889-8917*
E-mail:	*sylvain.tremblay@desgagnes.com*

Pour les navires :	**Espada et Laurentia Desgagnés**
	Philip John
Cellulaire :	(418) 802-7977
Courriel :	philip.john@desgagnes.com

For vessels:	***Espada and Laurentia Desgagnés***
	Philip John
Cellular:	*(418) 802-7977*
E-mail:	*philip.john@desgagnes.com*

Pour les navires :	**Argentia, Taïga Desgagnés et HHL New York**
	Geremy Girard
Cellulaire :	(418) 573-7608
Courriel :	geremy.girard@desgagnes.com

For vessels:	***Argentia, Taïga Desgagnés and HHL New York***
	Geremy Girard
Cellular:	*(418) 573-7608*
E-mail:	*geremy.girard@desgagnes.com*

CONTACT 2 :	**André Marmen** **Directeur des opérations**
Cellulaire :	(418) 931-9340
Domicile :	(418) 908-0955
Courriel :	andre.marmen@desgagnes.com

CONTACT 2:	***André Marmen*** ***Operations Manager***
Cellular:	*(418) 931-9340*
Home:	*(418) 908-0955*
E-mail:	*andre.marmen@desgagnes.com*

CONTACT 3 :	**David Fox,** **PDT - Navires Citernes** **Surintendant – Navigation**
Cellulaire :	(418) 805-1384
Courriel :	david.fox@desgagnes.com

CONTACT 3:	***David Fox,*** ***DPA - Tanker Vessels*** ***Superintendent – Navigation***
Cellular:	(418) 805-1384
E-mail:	david.fox@desgagnes.com

CONTACT 3 :	**Marc Desgagnés,** **PDT - Navires Cargo** **OSC -Tous les navires de la Flotte** **Directeur QSSE**
Cellulaire :	(418) 569-6537
Domicile :	(418) 406-1059
Courriel :	marc.desgagnes@desgagnes.com

CONTACT 3:	***Marc Desgagnés,*** ***DPA - Cargo Vessels*** ***CSO – All Fleet Vessels*** ***QSSE Manager***
Cellular:	(418) 569-6537
Home :	(418) 406-1059
E-mail:	marc.desgagnes@desgagnes.com

CONTACT 3 :	**Daniel Colan** **OSC – Dara, Esta et Jana Desgagnés**
Cellulaire :	(506) 533 5025
Courriel	daniel.colan@rigelcanada.com

CONTACT 3:	***Daniel Colan,*** ***CSO – Dara, Esta and Jana Desgagnés***
Cellular:	(506) 533 5025
E-mail	*daniel.colan@rigelcanada.com*

CONTACT 4 :	**Claude Dumais Vice-président – Opérations et projets spéciaux, Groupe Desgagnés (Chef d'intervention d'urgence)**		***CONTACT 4:***	***Claude Dumais Vice-President – Operations and Special Projects, Groupe Desgagnés (Incident Commander)***
Cellulaire :	(418) 952-6486		*Cellular:*	*(418) 952-6486*
Courriel :	claude.dumais@desgagnes.com		*E-mail:*	*claude.dumais@desgagnes.com*
CONTACT 5 :	**Serge Le Guellec Président-directeur général (TDI)**		***CONTACT 5:***	***Serge Le Guellec President and General Manager***
Cellulaire :	(581) 888-8920		*Cellular:*	*(581) 888-8920*
Courriel :	serge.leguellec@desgagnes.com		*E-mail:*	*serge.leguellec@desgagnes.com*

Communications avec les bureaux
Communications with offices

Coordonnées des compagnies | *Companies' Contact Information*

Nom *Name*	Statut *Status*	Contact *Contact*	Adresse Address	Numéros Numbers
Groupe Desgagnés inc.	Société mère *Parent company*	Louis-Marie Beaulieu	21, rue du Marché-Champlain Québec (Québec) G1K 8Z8	**Siège social** ***Head Office*** ☎ (418) 692-1000 (418) 692-6044 info@desgagnes.com **Salle d'intervention d'urgence** ***Emergency Response Room*** ☎ (418) 692-5525 (418) 692-5443 emergency@desgagnes.com
Transport Desgagnés Inc.	Armateur et exploitant *Shipowner* *and ship operator*	Serge Le Guellec	Même que ci-dessus *Same as above*	Mêmes que ci-dessus *Same as above*
Desgagnés Marine Cargo Inc.	Fournisseur d'équipage (navires de charge) *Crewing* *(general cargo ships)*	Pascal Lévesques	Même que ci-dessus *Same as above*	Mêmes que ci-dessus *Same as above*
Desgagnés Marine Petro Inc.	Fournisseur d'équipage (navires-citernes) *Crewing* *(tankers)*	Pascal Lévesques	Même que ci-dessus *Same as above*	Mêmes que ci-dessus *Same as above*
Navigation Desgagnés inc.	Affréteur (navires de charge) *Charterer* *(general cargo ships)*	Alexandre Beauchamp Parent	Même que ci-dessus *Same as above*	Mêmes que ci-dessus *Same as above*
Petro-Nav Inc.	Affréteur (navires-citernes) *Charterer* *(tankers)*	Christopher King	Bureau 601 204, rue Saint-Sacrement Montréal (Québec) H2Y 1W8	☎ (514) 843-8800 (514) 843-9195 info@petro.nav.desgagnes.com

Nom ***Name***	**Statut** ***Status***	**Contact** ***Contact***	**Adresse** **Address**	**Numéros** **Numbers**
Desgagnés Transarctik Inc.	Affréteur (navires de charges) Arctique *Charterer (general cargo ships) Artic*	Dominic Desgagnés	6565, boul. Hébert, bur. 201 Sainte-Catherine (Québec) J5C 1B5	☎ (450) 635-0833 (450) 635-5126 info@transactik.desgagnes.com
Marlow Navigation	Fournisseur d'équipage à l'international (navires de charge) *International Crewing (general cargo Ship)*	Mike Naradko	13, Alexandrias Street P.O. Box 54077 CY-3720 Limassol Cyprus	☎ +357 25882588 +357 25882599 marlow@marlow.com.cy

INSCRIPTION DES NAVIRES AUPRÈS DES ORGANISMES D'INTERVENTION *(RESPONSE ORGANIZATIONS)* AU CANADA

NAVIRE	ECRC (SIMEC) Grands Lacs, Saint-Laurent, Côte Est		ALERT St. John, NB		PTMS Port Hawkesbury, NS		WCMRC Côte Ouest	
	Nº de contrat	Échéance	Nº de contrat	Échéance	Nº de contrat	Échéance	Nº de contrat	Échéance
Acadia Desgagnés	C001-00416	31.12.17	C001-00416	31.12.17	C001-00416	31.12.17	N/A	
Argentia Desgagnés								
Bella Desgagnés								
Claude A. Desgagnés								
Nordik Express								
Rosaire A. Desgagnés								
Sedna Desgagnés								
Zélada Desgagnés								
Nordika Desgagnés								
Miena Desgagnés	TBC		TBC		TBC		N/A	
HHL New York	TBC		TBC		TBC		N/A	
Maria Desgagnés	C002-00002	31.12.17	C002-00002	31.12.17	C002-00002	31.12.17	N/A	
Sarah Desgagnés							N/A	
Damia Desgagnés								
Mia Desgagnés								
Paul A. Desgagnés	TBC		TBC		TBC		N/A	
Espada Desgagnés	C002-05959	19.11.17	C002-05959	19.11.17	C002-05959	19.11.17	N/A	
Laurentia Desgagnés	C002-05315	07.05.17	C002-05315	07.05.17	C002-05315	07.05.17	N/A	
Taïga Desgagnés	C001-21354	16.04.18	C001-21354	16.04.18	C001-21354	16.04.18	N/A	

COORDONNÉES DES ORGANISMES D'INTERVENTION

Organismes d'intervention

ECRC / SIMEC
Eastern Canada Response Corporation Ltd.
Société d'intervention maritime de l'Est du Canada ltée

275 Slater Street, Suite 1201
Ottawa (Ontario) K1P 5H9
Tél. : (613) 230-7369
Téléc. : (613) 230-7344

Mr. Paul Pouliotte, poste 304
Ms. Ann Therrien, poste 308
atherrien@ecrc.ca

URGENCE 24 H
(613) 930-9690

Bureau régional de Québec
281, de l'Estuaire
Québec (Québec) G1K 7J8
Tél. : (418) 692-8989
Téléc. : (418) 694-9649
M. Pierre Samson, poste 2229

ALERT
Atlantic Emergency Response Team

P.O. Box 2353
Saint John (New Brunswick) E2L 3V6
Tél. : (506) 632-4499
Téléc. : (506) 632-4450

Mrs. Andrea Melanson

URGENCE 24 H
(506) 632-4499

PTMS
Point Tupper Marine Services Ltd.

P.O. Box 316
Port Hastings (Nova Scotia) B0E 2T0
Tél. : (902) 625-3611 ou 625-1846
Téléc. : (902) 625-1556 ou 625-3098

Capt. Ed Kehoe, Response Manager
Cell. : (902) 227-7696
Téléav. : (902) 558-2572

URGENCE 24 H
(902) 625-1711

WCMRC
Renseignements disponibles auprès de la Chamber of Shipping of British Columbia aux numéros ci-dessous :
Tél. : (604) 681-2351
Téléc. : (604) 681-4364

Burrard Clean operations division

URGENCE 24 H
(604) 294-9116

Zones d'intervention

ECRC / SIMEC	ALERT	PTMS	WCMRC
Le réseau canadien des Grands Lacs et les canaux les reliant dans la province de l'Ontario incluant le lac Supérieur, la rivière St. Mary, le lac Huron, la rivière St. Clair, le lac St. Clair, la rivière Detroit, le lac Érié, le lac Ontario; le fleuve St-Laurent, le lac Winnipeg, la rivière Athabasca de Fort McMurray au lac Athabasca, et le lac Athabasca. Les eaux de la Baie James, de la Baie d'Hudson et de la Baie d'Ungava; les eaux de la province de Québec (incluant le St-Laurent) et les eaux des provinces atlantiques (excluant les eaux au nord de la latitude 60° Nord et les régions couvertes par ALERT et PTMSL).	Les eaux canadiennes comprises entre la frontière Ouest constituée d'un arc d'un rayon de 50 milles nautiques du point 45º08'03" N, 66º17'12" W et la frontière Est constituée d'un arc d'un rayon de 50 milles nautiques du phare de Cape Spencer.	Les eaux canadiennes à l'intérieur d'un rayon de 50 milles nautiques à partir du phare de Bearhead, 45º33' N, 61º17' W, excluant le nord du détroit de Canso dans St. Georges Bay, les eaux des lacs Bras D'or, des canaux St. Andrew, St. Patrick, Great Bras D'or et les autres eaux intérieures de l'île du Cap Breton.	Les eaux bordant la province de la Colombie-Britannique, les eaux internes de cette province, et excluant les eaux au nord du 60º parallèle de latitude.

RÉV. 2018-06-11

Numéros importants en cas d'urgence au Canada
Important numbers in case of emergency in Canada

Catégorie *Category*	Nom et adresse *Name and Address*	Numéros *Numbers*	Contacts / Remarques *Contacts / Remarks*
Hot Lines	**Shell**	☎ 24hrs (713) 241-2532	**Department Stasco**
	Valero	☎ 1-800-964-2210 1-210-736-2210	
	Suncor	☎ (905) 399-9954	**Masiz Rahman**
		Marshal Dunbar ☎ (905) 804-3449 ☎ cell. : (647) 459-2671	**Contact 1 Suncor DPP**
		Francine Dagenais ☎ (905) 804-7153 ☎ cell.: (417) 200-9140	**Contact 1 Suncor CPP**
		Marshal Dunbar *en interim* ☎ (905) 804-3449 ☎ cell. : (647) 459-2671	**Contact 1 Suncor Lub**
		A. Haq ☎ (905) 804-7150 ☎ Cell.: (905) 320-6541	**Contact 2 All products**
		24hours / 7 days ☎ (403) 296-3000	**Contact 3 All products**
		Jason He ☎ (403) 237-3498 ☎ cell.: (403) 813-8158	**Contact 1**
		Emergency line ☎ (703) 217-6121	**Contact 2**
	Irving	☎ (506) 333-9379	**Eric Olsen**
	Kildair	**Steven Packwood** ☎ (450) 746-0994 ext 322 (450) 746-0999 tracy@kildair.com kildair@kildair.com	
		Hydro Quebec CAM Operator ☎ (418) 986-7299 ext 7230	**Kildair – Cap-aux-Meules**
	La fédération des coopératives du nouveau Québec (FCNQ)	**Jean-Luc Mallette** ☎ (514) 457-9371 ext 356 (514) 457-4626	Directeur Principal/ *Senior Manager* Services Pétroliers/ *Petroleum Services*

Ports ***Ports***	**Port de Montréal**	**Urgence Marine** ☎ (514) 640-3138 🖹 (514) 640-4509	**Real Ricard Jr.** **Chargé de projet** ***Ship Maintenance Expert*** ☎cell. (514) 829-6908 **Stephen Chouinard** **Directeur des opérations** ***Director of Operations*** ☎ cell. (514) 821-7347
		Capitainerie ☎ Général (514) 283-7011 ☎ Urgence (514) 283-6911	
	Port de Québec	**Capitainerie** ☎ (418) 648-3556	**24hrs sur la voie VHF 77**
	Port-Cartier	☎ (418) 766-8753	**Quai Arcelor Mittal** ☎ (418) 766-2000 Ext 2400, 2485 ou 2439
	Trois-Rivières	☎ (819) 378-2887	
	Port de Sept-Îles	☎ (418) 968-1231	**Shawn Grant** **Harbour Master** ☎ (418) 961-1229
	Rio Tinto Alcan (Port Alfred)	☎ (418) 544-3311	
Fournisseurs ***Suppliers***	**Expédition quais et écluses** 1621, rue Gladstone Montréal, QC H4E 1C6	☎ (514) 932-9959 🖹 (514) 932-2331	**Jacques Chiasson**
	Seagulf Marine Industries Inc. **Bureau de Montréal** 815, rue Mill Montréal, QC H3C 1Y5	☎ (514) 935-6933 🖹 (514) 935-3665	**Robert Zeagman** ☎ dom. (514) 672-5202
	Seagulf Marine Industries Inc. **Bureau de Halifax** Burnside Industrial Park 38 Payzant Avenue Dartmouth, NS B3B 1Z6	☎ (902) 481-1661 🖹 (902) 481-8548	
	Seagulf Marine Industries Inc. **Bureau de St Catharines** 113 Cushman Road, Unit 16-17 St-Catharines, ON L2M 6S9	☎ (905) 688-2661	

Remorqueurs ***Tugs***	**Groupe Océan** 105 Abraham-Matin, Bureau 500 Québec, (QC), G1K 8N1 Canada	☎ (418) 694-1414 (418) 692-4572 www.groupeocean.com ocean@groupeocean.com Hamilton : ☎ (905) 528-3960	Benoit Lefrenière ☎ cell. (418) 254-7487 benoit.lafreniere@groupeocean.co Maryse Paré (Bur. / Off. QC) Maryse.Pare@groupeocean.com Frank Montecalvo (Dir, ON) Frank.Montecalvo@groupeocean.com
	The Great Lakes Group 4500 Division Ave Cleveland, OH 44102-2228 USA **Cette compagnie offre aussi un service de réparation d'urgence 24hr/7**	☎ (216) 621-4854 (216) 621-7616 www.thegreatlakesgroup.com *This company also offer a 24hr/7 emergency repair services*	**Kyles Fries** **Assistant Vice-President-Ship Repair** ☎ 1-800-321-3663 ext 132 ☎ cell. (440) 714-1439
	McKeil Marine Limited Fleet Management	☎ (905) 528-4141 ext.248	**Chris Kirby** ckirby@mckeil.com
	Corporation de gestion de la Voie maritime du Saint-Laurent ***St. Lawrence Seaway Development Corporation*** 151, rue de l'Écluse Saint-Lambert, QC J4R 2V6	☎ (450) 672-4110 (450) 672-7098 www.grandslacs-voiemaritime.com	**Position des navires** **Montréal au Lac Ontario** ☎ (450) 672-4115 Surveillant ext :2232 Controleurs ext :2229 **Welland Canal** Surveillant ext :5370 Control Center ext :5450

TC Sureté Maritime ***TC Marine Security***	**Sûreté des Transport** **Région du Québec** 401-1550 av d'Estimauville Québec, QC, G1J 0C8	☎ 24hrs 1-888-857-4003 ☎ Bureau (418) 648-4351 ☎ cell: (418) 572-4604 💻 langis.tremblay@tc.gc.ca	
Inspecteurs sécurité maritime ***Marine Safety Inspectors***	**St. Catharines**	☎ (905) 688-4360 🖹 (905) 688-6285	
	Sarnia	☎ 1-877-281-8824 ☎ (519) 383-1826 🖹 (519) 383-1997	
	Thunder Bay	☎ (807) 345-6953 🖹 (807) 345-0521	
	Baie-Comeau	☎ (418) 296-3524 🖹 (418) 296-6680	
	Gaspé	☎ (418) 368-2444 🖹 (418) 368-7022	
	Îles-de-la-Madeleine	☎ (418) 986-6275 🖹 (418) 986-4751	
	Kangiqsujuaq	☎ (819) 338-1213 🖹 (819) 338-1241	
	Montréal	☎ Général: 1-888-649-6262 ☎ Inspection:(514)496-2084 🖹 (514) 283-6595 💻marinesafetymtl@tc.gc.ca	
	Québec	☎ (418) 648-4166 🖹 (418) 648-3790	
	Rimouski	☎ 1-800-427-4417 ☎ (418) 722-3040 🖹 (418) 722-3332	
	Sept-Îles	☎ 1-877-303-3435 ☎ (418) 968-4991 🖹 (418) 968-5516	
	Charlottetown	☎ 1-855-859-3123 ☎ (902) 566-7987 🖹 (902) 566-7991	
	Corner Brook	☎ 1-855-859-3123 ☎ (709) 637-4390 🖹 (709) 637-4391	
	Dartmouth	☎ 1-855-859-3123 ☎ (902) 426-4421 🖹 (902) 426-6657	

	Saint-John	☎ 1-855-859-3123 ☎ (506) 636-4748 🖹 (506) 636-4756	
	St. John's	☎ 1-855-859-3123 ☎ (709) 772-5166 🖹 (709) 772-0210	
	Sydney	☎ 1-855-859-3123 ☎ (902) 564-7002 🖹 (902) 564-7648	
Inspecteur en devoir / *Surveyor on duty :* : Se référer à la Garde Cotière / *Refer to Coast Guard* 1-800-363-4735			
Sécurité Maritime Garde Côtière Canadienne *CCG Marine Safety*	**200 rue Kent, 5e étage Ottawa, ON K1A 0E6**	☎ (613) 993-6943 🖹 (613) 998-3255	
Intervention Environnementale Garde Côtière Canadienne *Environmental Response Canadian Coast Guard*	**Région de Terre-Neuve et Labrador / *Newfouldland and Labrador Region***	☎ 24hrs 1-800-563-9089	
	Région du Centre et de l'Arctique *Cenral and Arctic Region*	☎ 24hrs 1-800-265-0237	
	Région du Québec *Quebec Region*	☎ 24hrs 1-800-363-4735	
	Région des Maritimes *Maritimes Region*	☎ 24hrs 1-800-565-1633	
	Région du Pacifique *Pacific Region*	☎ 24hrs 1-800-889-8852	

Bureau des Glaces ***Ice Office***	**Région de l'Atlantique** ***Atlantic Region***	☎ (709) 779-2078 ☎ 1-800-565-1633 🖷 (709) 772-5369 Telex : 016-4530 💻 CGGCICEWATCH@DFO-MPO.GC.CA	Basé à St-John's
	Région du Québec ***Quebec Region***	☎ (418) 648-7290 ☎ (418) 648-5620 🖷 (418) 648-7305	Basé à Québec
	Région du Centre et de l'Arctique ***Arctic and Central Region***	☎ (519) 383-1814 ☎ 1-800-265-0237 🖷 (519) 337-2498	Basé à Sarnia
Recherche et Sauvetage ***Search and Rescue***	**Terre-Neuve et Labrador** ***Newfouldland and Labrador***	☎ 1-800-563-2444 ☎ (902) 427-8200	Basé à Halifax
	Nouvelle-Écosse, Nouveau-Brunswick, Ile-du-Prince-Édouard ***Nova Scotia, New Brunswick, Prince Edward Island***	☎ 1-800-565-1582 ☎ (902) 427-8200	Basé à Halifax
	Québec ***Quebec***	☎ 1-800-463-4393 ☎ (418) 648-3599	Basé à Québec
	Ontario, Territoires du Nord-Ouest, Nunavut ***Ontario, NorthWest Territories, Nunavut***	☎ 1-800-267-7270 ☎ (613) 965-3870	Basé à Trenton
	Colombie-Britannique, Yukon ***British-Columbia, Yukon***	☎ 1-800-567-5111 ☎ (250) 413-8933 ☎ cell. #727	Basé à Victoria

Société de classification ***Classification Society***	**Lloyd's Register North America** **Bureau de Montréal** 1868, boul. des Sources, Suite 125 Pointe-Claire, QC H9R 5R2	☎ (514) 630-3784 (514) 630-3923 montreal@lr.org	**Emmanuel Patrouille** **Senior Surveyor** ☎ cell. (514) 209-3710 Emmanuel-Patrouille@lr.org **Igor Potey** **Surveyor (Quebec City)** ☎ cell. (418) 564-6736 igor.potey@lr.org
NAVIRES-CITERNES **Maria** **Sarah** **NAVIRE PASSAGERS** **Bella** **Nordik Express** **NAVIRE DE CHARGE** **Acadia**	**Lloyd's Register North America** **Bureau de Halifax** Suite 812, Queen Square 45 Alderney Drive Dartmouth, NS B2Y 2N6	☎ (902) 423-7506 (902) 425-2913 halifax@lr.org	**Bud Streeter** **VP & Operations Manager** ☎ cell. (902) 499-0244 bud.streeter@lr.org **Craig Williams** **Senior Surveyor In Charge** ☎ (902) 406-4166 ☎ cell. (902) 497-9849 Craig.Williams@lr.org
	Lloyd's Register North America **Bureau de Toronto** 3050 Harvester Road, Suite 208 Burlington, ON L7N 3J1	☎ (905) 631-9420 (905) 631-9430 toronto@lr.org	**Barry Shepherd** **Marine Manager Eastern Canada** ☎ cell. (905) 515-7385 barry.shepherd@lr.org **Vitaliy Melnyk** **Senior Surveyor In Charge** ☎ cell. (905) 320-6139 vitaliy.melnyk@lr.org **Michael Skrzypczak** **Senior Surveyor** ☎ cell. (905) 515-7384 Michael.Skrzypczak@lr.org **James Zheng** **Senior Surveyor** ☎ cell. (905) 320-9039 James.Zheng@lr.org
	Lloyds' Register of Shipping **Bureau de Londres** 71 Fenchurch Street London, England EC3M 4BS	☎ 011 44 20 7709 9166 www.lr.org	

NAVIRE <u>CITERNE</u> **Damia** **Mia** **Paul A.** **Rossi A.** **NAVIRE DE <u>CHARGE</u>** **Argentia**	**Bureau Veritas (Canada) inc.** 25 rue Marché-Champlain, Suite 403, Québec, Qc, Canada, G1K 8Z8	☎ (418) 914 1741 💻 www.bureauveritas.com	**Jocelyn Roussel** **Marine Surveyor** ☎ cell. (438) 823-8285 💻 Jocelyn.Roussel@ca.bureauveritas.com **Darrell Ashley** **Marine Surveyor** ☎ cell. (418) 806-3835 💻 Darrell.Ashley@ca.bureauveritas.com
NAVIRES-<u>CITERNES</u> **Dara** **Esta** **Jana** **Espada** **Laurentia** **NAVIRES DE <u>CHARGE</u>** **Claude A.** **Rosaire A.** **Sedna** **Taïga** **Zélada** **Nordika**	**DNV GL** **Montreal office** 4100 Rue Molson, Suite 100 Montreal, Qc., H1Y 3N1	☎ (514) 861-0660 📄 💻 montreal.maritime@dnvgl.com	**Ozan Burhan** **Directeur DNV GL Montréal** ☎ (514) 974-1658 💻 burhan.ozan@dnvgl.com **Krieger, Kai** **Senior Surveyor** ☎ cell. (514) 815-8134 💻 kai.krieger@dnvgl.com
	Halifax Office 99 Wyse Road, Suite 900 Dartmouth, Nova Scotia, B3A 4S5 Canada	☎ (902) 464-0905 💻 halifax.maritime@dnvgl.com	

Services d'intervention d'urgence en cas de déversement aux USA
Spill Emergency Response Services in USA

Catégorie *Category*	Nom et adresse *Name and Address*	Numéros *Numbers*	Contacts / Remarques *Contacts / Remarks*
USCG	*National Response Center*	☎ (800) 424-8802 ☎ (202) 267-2675 (202) 479-7165	VRP Section 10
USCG	*Captain of the Port*		VRP Section 10
USCG	*State Agencies*		VRP Section 10
USCG	*Boundary States*		VRP Section 10
Qualified Individual (QI)	**Hudson Marine Management Services** Ferry Terminal Building, Suite 300 2 Aquarium Drive Camden, NJ 08103 **(under contract)**	☎ **24 h** **(856) 342-7500** (856) 342-8888 hmms@hudsonmarine.com www.hudsonmarine.com	VRP Section 2 **Per W. Christensen** President and CEO **Cynthia A. Hudson** V.P. response management
Oil Spill Removal Organization (OSRO)	**National Response Corp. & Clean Pacific Alliance** Suite T-103 3500 Sunrise Highway Great River, NY 11739 **(under contract)**	☎ **24 h** **(800) 899-4672** ☎ (631) 224-9141 ext 0 (631) 224-9082 IOC* (631) 224-9086 iocdo.@nrcc.com dwick.@nrcc.com ** www.nrcc.com *IOC: International Operations Center **Login username : clients Password : access2007	VRP Section 2 **Steve A. Candito** President scandito@nrcc.com
Oil Spill Removal Organization (OSRO)	**Marine Pollution Control US Great Lakes** 8631 West Jefferson Detroit, Michigan 48209-2691 **(not under contract)**	☎ **24h** (313) 849-2333 ☎ **24h** 1-800-521-8232 (313) 849-1623 (313) 216-1778 info@marinepollutioncontrol.com www.marinepollutioncontrol.com	VRP Section 2 **Mike McInchak** Operations Manager **Jim Kemeny** Director of Operations
Oil Spill Removal Organization (OSRO)	**Washington State Maritime Cooperative (WSMC)** 100 West Harrison, suite S560, Seattle, WA 98119 **(not under contract)**	☎ **24h** (206) 448-7557 (206) 443-3839 admin@wsmcoop.org www.wsmcoop.org	VRP Section 2 **Roger Mowery** Executive Director

Catégorie ***Category***	**Nom et adresse** ***Name and Address***	**Numéros** ***Numbers***	**Contacts / Remarques** ***Contacts / Remarks***
Salvage, Firefighting, & Lightering	**Resolve Marine Group** P.O. Box 165485 Port Everglades, FL 33316 **(under contract)**	☎ **24 h** INTL (954) 764-8700 (954) 764-8724 ☎ **24 h** USA (866) 764-1397 www.resolvemarine.com info@resolvemarine.com	VRP Section 2 **Joseph E. Farrell Jr.** President / CEO **Todd Schauer** Senior Project Manager Mobile: (954) 658-6429 tschauer @resolvemarine.com **Frank Leckey** Director of Operations Resolve Towing and Salvage **Todd Duke** Resolve Fire and Hazards Response Cell. (954) 444-3433
Salvage, Firefighting, & Lightering	**Titan Maritime Industries Inc.** 700 NW 33rd Street, Suite 290 Pompano Beach, FL 33064, USA **(not under contract)**	☎ **24 h** (954) 545-4143 (954) 545-4552 www.titansalvage.com	**Dan Olson** **Operations Manager** Mobile (206) 854-4057 **Richard Fairbanks** **Vice President** Tel home: (954) 522-6276 Mobile: (954) 914-9876 Int'l. beeper: (954) 879-4806 **David Parrot** **Managing Director** Tel home: (954) 462-7763 Mobile: (954) 914-9874 Int'l beeper: (954) 879-6348 **Phil Reed** **Director Engineering** Tel home: (954) 753-8464 Mobile: (954) 682-9936

Salvage, Firefighting, & Lightering	**Donjon Marine Co. Inc.** 1250 Liberty Ave. Hillside, New Jersey 07205 **(not under contract)**	☎ **24 h** **(908) 964-8812** (908) 964-7426 www.donjon.com	**J. Arnold Witte** Pres. & CEO (Salv. Master) Tel. home: (908) 353-4718 **William "Billy" Kratz Jr.** Salvage Master Tel home: (609) 443-4972 **John A. Witte Jr.** Ex. V-P (Asst. Salv. Master) Tel home: (908) 352-8168
Dispersants and In-Situ Burning	**Spiltec** 19220 N.E. 143rd Place Woodinville, WA 98077-7839 USA **(not under contract)**	☎ (425) 869-0988 (425) 869-7881	VRP Section 2 **Alan A. Allen** Tel. home: (425) 869-2578
National Vessel Movement Center	Avis d'arrivée et de départ douanes américaines *Notice of arrival and departure US Customs*	☎ **24hrs** 1-800-708-9823	

Transports Canada – Région du Québec / Transport Canada – Quebec Region

Sécurité et sûreté maritimes / Marine Safety and Security

Octobre 2017 / October 2017

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DIRECTEUR RÉGIONAL / REGIONAL DIRECTOR (NM)
Michel Boulianne – (418) 648-4615
Fax (418) 648-3790

NM-SEP

Centre TC Sept-Îles / Sept-Îles TC Centre

418-968-4991
Fax : 418-968-5516

Gestionnaire intérimaire / Acting Manager
Bhérer, Charles

Experts maritimes / Marine Surveyors
Desrosiers, Luc (M)
Leblanc, Pierre (M)
Monger, Ken (C)
Rodrigue, Denis (C)
Thériault, Manon (N)

Adjointe / Assistant
Wright, Sindie
Poirier, Sophie-Josée

NM-POR

PORT-CARTIER

418-766-2758
Fax : 418-766-8711

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Foisy, Jérôme (M)

NM-BAI

BAIE-COMEAU

418-296-3524
Fax : 418-296-6680

Expert maritime / Marine Surveyor
Frattin, Marino (N)

NM-RIM

Centre TC Rimouski Rimouski TC Centre

418-722-3040
Fax : 418-722-3332

Gestionnaire / Manager
Fecteau, Robert

Experts maritimes / Marine Surveyors
Bélanger, Denis (N)
Blouin, Alain (C)
D'Amours, Éric (M)
Desgagnés, Éric (C)
Guay, Mathieu (N)
Larouche, Annie (N)
Leclerc, Bernard (M)

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Drewitt, Lysiane
Laliberté, Pascale (occ.)
Thibault, Geneviève

NM-GAS

GASPÉ

418-368-2444
Fax : 418-368-7022

Expert maritime / Marine Surveyor
Pelletier, Simon (C)

NM-ILE

ILES-DE-LA-MADELEINE

418-986-3785 # 224
Fax : 418-986-4751

Experts maritimes / Marine Surveyors
Hébert, Marie-Ève (M)
Hubert, Gilles (N)

NM-MTL

Centre TC Montréal Montreal TC Centre

1-855-842-7042
Fax : 514-283-6595

Gestionnaire / Manager
Baumelle, Cédric

Adjoint au gestionnaire / Manager Assistant
Plamondon, Pierre

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Brahimi, Kamel (N)
Briffaud, Denis (EL)
Caron, Mario (C)
Chaudhry, Mazhar (N)
Gagnon, Francis (M)
Germain, Guy (N)
Leduc, Alexandre (N)
Lefebvre, Luc (M)
Leghfiri, Mohamed (N)
Paradis, Serge (M)
Tabet, Élie (PB)
Thibault, Chantale (N)
Uhel, Vincent (C)
Zroud, Hicham (M)

Adjoints(es) / Assistants
Del Nigro, Nicola
Lacasse, Diane
Genaille, Ellen

CENTRE DE TRANSPORTS CANADA – QUÉBEC / QUEBEC - TRANSPORT CANADA CENTRE

NM

Division Coordination Politiques et initiatives de gestion / Policy Business Initiatives Division

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Fax : 418-648-3790

Coordonnateur
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Desrochers, Sylvie
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Division Administration/ Administration Division

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Leblanc, Julie
Roy, Guylaine

Adjointes / Assistants
Bouchard-Pearson, Karine
Deslauriers, Lise
Levac, Émilie (maternité)

NM-QUE

Division Inspection / Inspection Division

418-648-3234
Fax : 418-648-5106

Gestionnaire / Manager
Cormier, Denis

Adjointe au gestionnaire / Manager Assistant
Agnes Tomsic

Experts / maritimes Marine Surveyors
Bégin, Bernard (M)
Bernier, Laurent (C)
Desaulniers, Martin (M)
Duranceau, Danielle (N)
Lachance, Bernard (N)
Lezhankin, Yevgen (N)
Lizotte, Maxim (M)
Marcoux, Antonin (C)
Rousseau, François (M)

Adjoints(es) / Assistants
Jalbert, Ève-Marie
Seyer, Christine

NMB-QUE

QUÉBEC
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418-648-4351

Gestionnaire / Manager
Vigneault, Olivier

Experts maritimes Marine Surveyors
Allard, Francis
Blais, Louis
Brisson, Mireille
Lafleur, Hugues

Adjointe / Assistant
Duchesneau, Karen

DORVAL
Sûreté des Transports Transportation Security

514-633-2930

Experts maritimes / Marine Surveyors
Brodeur, Maxime
Miranda, Eusébio
Rubinato, Gino
Scott, Darren

Adjointe / Assistant
Vigneault, Carole

NMC

Division Intervention environnementale / Environmental Response Division

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Gestionnaire / Manager
Laflamme, André

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Adda, Oumelkheir (IE, IMH)
Aquin, Marie-Claude (IE, IMH)
Vézina, Lucie (IE, IMH)

NMD

Division Cargaisons & prévention de la pollution / Cargoes & Pollution Prevention Division

418-648-3325
Fax : 418-648-3790

Gestionnaire / Manager
Vallée, Paul Denis

Experts maritimes/ Marine Surveyors
Belounis, Arezki (N)
Breton, Bernard (M)
Gosselin, Gilbert (C)
Guay, Julie (N)
Harbour, John (N)
Ouarab, Brahim (N)
Laliberté, Charles (M)

Adjointe / Assistant
Coulombe Carrier, Tanya

NME

Division Services techniques / Technical Services Division & Nunavik

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Fax : 418-648-3790

Gestionnaire / Manager
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Experts maritimes / Marine Surveyors
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(Vacant) (N)
Boudreau, J.-S. (C)
Gendron, Sylvain (C)
Marquis, J-P. (E / N)
Therrien, Gaël (M)

Adjointe / Assistant
Nadeau, Suzy

NM-KAN

KANGIQSUJUAQ

819-338-1213
Fax : 819-338-1241
011-8816-314-342926

Expert maritime / Marine Surveyor
Greig, James (PB)

NMN

Bureau de la sécurité nautique / Office of Boating Safety

418-648-5331
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Gestionnaire / Manager
Noël, Sophie

Agents / Officers
Boivin, Nathalie
Girard, Isabelle
Larouche, Véronique
Racine, Marc
Tellier, Jean

NOTE : ↑ Hiérarchie organisationnelle

LEGENDE / LEGEND

(occ.)	*Employé(e) occasionnel(le), 90 jours / Temporaire*
(C)	Coque / Hull *(i.e. Architecte Naval)*
(EL)	Électrique / Electrical
(EQ)	Équipement / Equipment
(IMH)	Installations de manutention d'hydrocarbures / Oil Handling Facilities
(M)	Machinerie / Machinery
(N)	Nautique / Nautical
(PB)	Petits bâtiments / Small Vessels
(IE)	Intervention environnementale

SÉCURITÉ ET SÛRETÉ MARITIMES | MARINE SAFETY AND SECURITY

Région du Québec
401-1550, avenue d'Estimauville
Québec (Québec) G1J 0C8

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Téléc. : 418-648-3790
Sans frais : 1-888-649-6292

Quebec Region
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QUÉBEC – POLITIQUES ET INITIATIVES DE GESTION

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QUÉBEC – SERVICE TECHNIQUE

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Sophie Noël, Gestionnaire
Tél. : 418-572-5917
Téléc. : 418-648-7337

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KANGIQSUJUAQ

Nanuturlik Landholding
Corporation of Kangirsujuaq
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Kangiqsujuaq (Québec)
J0M 1K0

Tél. : 819-338-1213
Téléc. : 819-338-1241
Sans frais : 1-888-649-6292
Satellite :011-8816-314-342926

Nanuturlik Landholding
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Phone : 819-338-1213
Fax : 819-338-1241
Toll-free : 1-888-649-6292
Satellite : 011-8816-314-342926

MONTRÉAL – CENTRE DE SERVICES TC

8-305, boul. René-Lévesque O.
Montréal (Québec) H2Z 1X1

Cédric Baumelle, Gestionnaire
Tél. : 1-855-842-7042
Téléc. : 514-283-6595

Immatriculation
Sans frais : 1-877-242-8770

8-305, René-Lévesque W. blvd
Montreal, Quebec H3B 1X9

Cédric Baumelle, Manager
Phone : 1-855-842-7042
Fax : 514-283-6595

Ship Registry
Toll Free : 1-877-242-8770

QUÉBEC – CENTRE DE SERVICES TC

401-1550, av. d'Estimauville
Québec (Québec) G1J 0C8

Denis Cormier, Gestionnaire
Tél. : 418-648-3234
Téléc. : 418-648-5106

Immatriculation
Sans frais : 1-877-242-8770

401-1550, d'Estimauville Ave
Quebec City, Quebec G1J 0C8

Denis Cormier, Manager
Phone : 418-648-3234
Fax : 418-648-5106

Ship Registry
Toll Free : 1-877-242-8770

RIMOUSKI – CENTRE DE SERVICES TC

180, de la Cathédrale
Rimouski (Québec) G5L 5H9

Robert Fecteau, Gestionnaire
Tél. : 418-722-3040
Téléc. : 418-722-3332
Sans frais : 1-800-427-4417

180 de la Cathédrale
Rimouski, Quebec G5L 5H9

Robert Fecteau, Manager
Phone : 418-722-3040
Fax : 418-722-3332
Toll-free : 1-800-427-4417

GASPÉ - CENTRE DE SERVICES TC

Édifice Frédérica-Giroux
98-1, rue de la Reine
Gaspé (Québec) G4X 3B3

Tél. : 418-368-2444
Téléc. : 418-368-7022

Frederica-Giroux Building
98-1 de la Reine Street
Gaspé Quebec G4X 3B3

Phone : 418-368-2444
Fax : 418-368-7022

ÎLES-DE-LA-MADELEINE- CENTRE DE SERVICES TC

264, chemin du Quai
Case postale 1030
Cap-aux-Meules (Québec)
G4T 1J4

Tél. : 418-986-3785
Téléc. : 418-986-4751

264 Chemin du Quai
P.O. Box 1030
Cap-aux-Meules, Quebec
G4T 1J4

Phone : 418-986-3785
Fax : 418-986-4751

QUÉBEC – SÛRETÉ MARTIME

Sûreté maritime
401-1550, av. d'Estimauville
Québec (Québec) G1J 0C8

Olivier Vigneault, Gestionnaire
Tél. : 418-648-4368

Marine Security
401-1550, d'Estimauville Ave
Quebec (Quebec) G1J 0C8

Olivier Vigneault, Manager
Phone : 418-648-4368

SEPT-ÎLES - CTC

Case postale 596
701, boul. Laure, bureau 205
Sept-Îles (Québec) G4R 4K7

Charles Bhérer, gestionnaire int.
Qc. : 418-648-5340
Sept-I. : 418-968-5439
Téléc. : 418-296-6680

P.O. Box 596
701 Laure Blvd, suite 205
Sept-Iles, Quebec G4R 4K7

Charles Bhérer, Manager (int.)
Qc. : 418-648-5340
Sept-I. : 418-968-5439
Fax : 418-296-6680

PORT-CARTIER - CENTRE DE SERVICES TC

Centre Transports Canada
A l'intérieur du Centre local d'emploi,
2, rue Elie-Rochefort
Port-Cartier (Québec) G5B 2N2

Tél. : 418-766-2758
Téléc. : 418-766-8711

Transport Canada Center
Inside the Local employment centre
2, rue Elie-Rochefort
Port-Cartier (Quebec) G5B 2N2

Phone : 418-766-2758
Fax : 418-766-8711

BAIE-COMEAU - CENTRE DE SERVICES TC

337, boul. Lasalle, bureau 212
Baie-Comeau (Québec)
G4Z 2Z1

Tél. : 418-296-3524
Téléc. : 418-296-6680

337 Lasalle Blvd, suite 212
Baie Comeau, Quebec
G4Z 2Z1

Phone : 418-296-3524
Fax : 418-296-6680

DORVAL – SÛRETÉ MARITIME

Sûreté maritime
700, Leigh-Capreol, 3e étage
Dorval, Québec H4Y 1G7

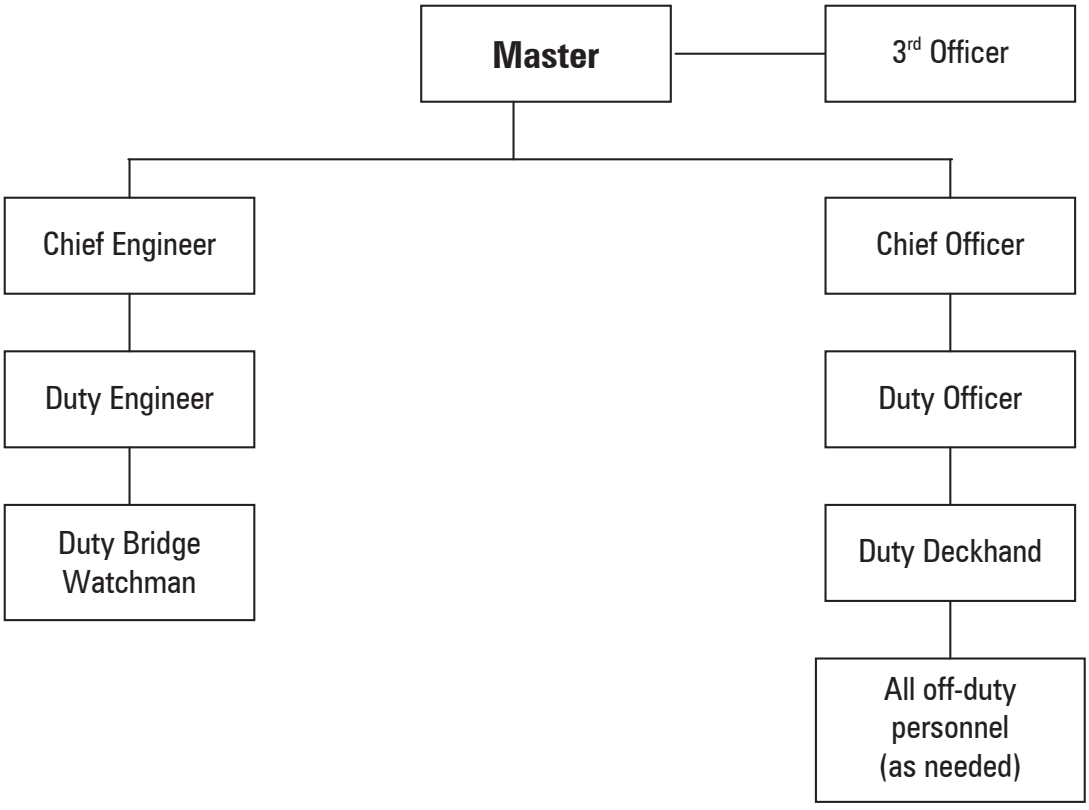
Olivier Vigneault, Gestionnaire
Tél. : 514-633-2930

Marine Security
700 Leigh-Capreol
Dorval, Quebec H4Y 1G7

Olivier Vigneault, Manager
Phone : 514-633-2930

Appendix 4
Oil Pollution Prevention Team

1. Shipboard Oil Pollution Prevention Team Organisation Chart



2. Shipboard Oil Pollution Prevention Team General Responsibilities

The following crew members are in charge in the event of a spill – actual or probable – to bring the accident under control, limit outflows, organize onboard clean-up procedures and determine the additional manpower needed.

2.1 Master

Overall in charge of operation on board dealing with a spill; responsible for all steps to be taken especially for the two main categories – reporting and action. Report incident as required (Chapt. 2,2). Remains as owner's senior representative until relieved by the Fleet Manager, Superintendent or Head Office Representative.

2.2 3rd Officer

Secretary to Master. Transmit and receive reports as requested by Master. Keep log of all events and progress.

2.3 Chief Officer

In charge of deck operation. Keep Master informed and updated on the situation and the results from actions taken to limit outflow.

2.4 Chief Engineer

In charge of bunker operation; should keep the Master informed and updated on the situation and the results from action taken to limit oil outflow.

2.5 Duty Officer

Mobilise deckhands to the best position for keeping escaping oil from running over the vessel's sides. Mobilise fire fighting squad as needed.

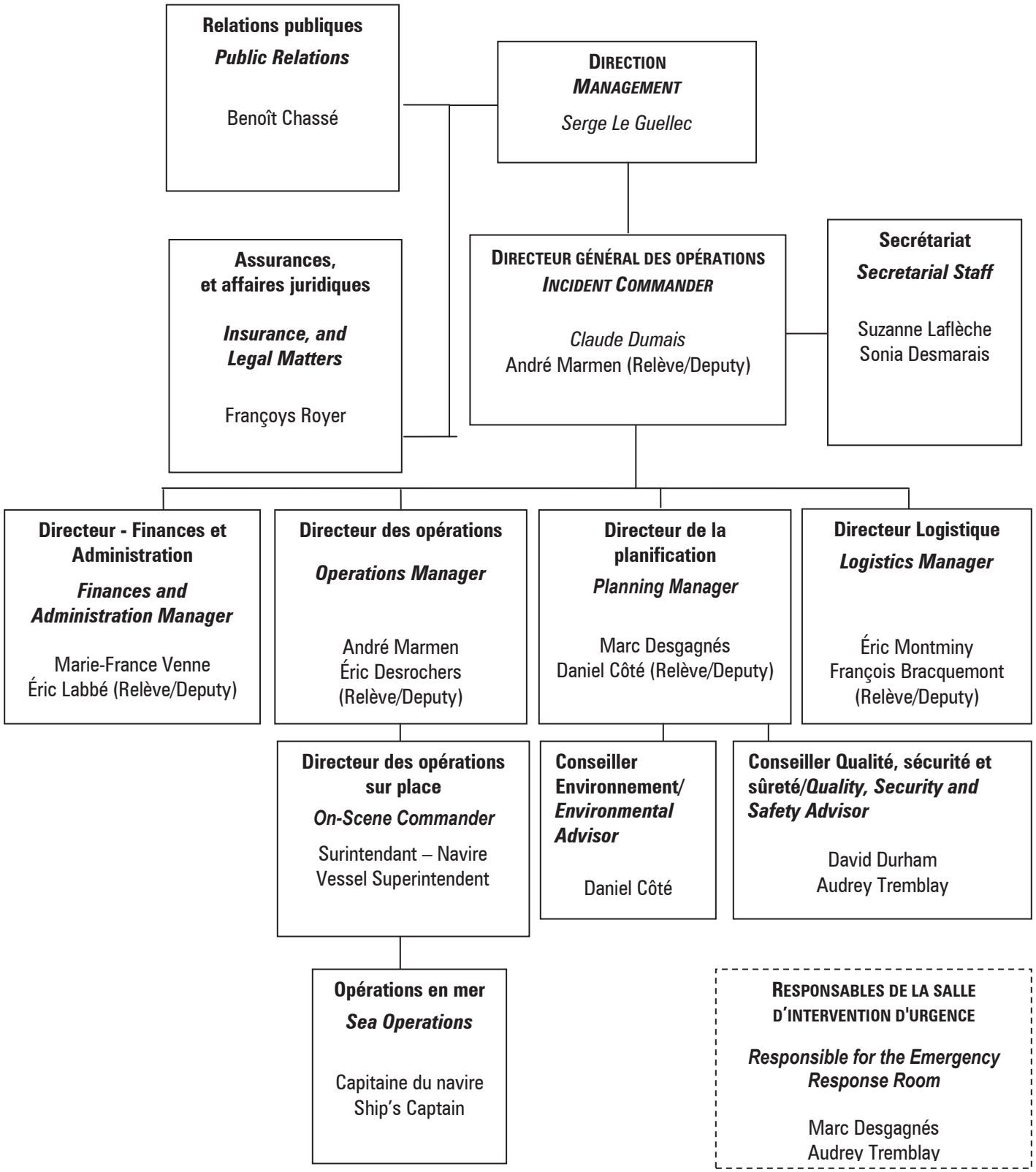
2.6 Duty Engineer

Assist Chief Engineer. Prepare for fire fighting. Ensure sufficient power and water to deck; organize on board clean-up equipment.

2.7 Duty Deckhand

Position sorbent material to prevent any oil from reaching the railing. Commence clean-up by using the on board spill clean-up equipment.

3. Shore Oil Pollution Prevention Team Organisation Chart



4. Shore Oil Pollution Prevention Team General Responsibilities

4.1 Incident Commander

He is the leader of the team and responsible for co-ordination between all parties. He is the main interlocutor of the Master, authorities and various entities. Contacts classification Societies & Shipyards.

4.2 On-Scene Commander

The Shore Operation Manager arranges and provides information for emergency, medical assistance as needed. He provides additional personnel and equipment as required.

4.3 Planning Manager

He is the adviser for safety, security and environmental matters.

He communicates with relatives or manning agency in case of casualties amongst officers and crew members.

4.4 Insurance and Finance Manager

The insurance manager advises on liability and insurance matters. He confers with underwriters and local agents. He consults and requires the advice of P & I Club average adjusters and salvage interface. He is also responsible for all matters relating to finance.

4.5 Logistics Manager

In charge to deliver to the ship the fire fighting and the pollution control equipment as well as the other spares and materials as required by circumstances.

4.6 Public Relations Coordinator

The Public Relation Coordinator as official media spokesman, will maintain a constructive dialogue with the news media, make available to the press relevant information about any on-going operation, supply additional relevant background information, prepare and distribute press releases, arrange press conferences as appropriate and assess the need to contact a public relations firm.

4.7 Secretaries

The secretaries and the operators are on duty during working hours. They are responsible for the ship documentation and will provide the Emergency Response Team with any necessary plans, notices and so forth.

5. Organisation

5.1 Permanence

The Emergency Response Team is operational on a non-stop 24-hour basis.

5.1 Emergency Response Room

A fully-equipped Emergency Response Room is at the disposal of the Emergency Response Team.

5.2 Communication equipment

The equipment listed below is available in the main office or in the emergency response room:

- Main switchboard phone lines plus dedicated phone lines
- Fax machines
- Computers with access to Internet
- Electronic board, flip charts, etc.

5.3 Documentation

- Vessels detailed plans
- Nautical documentation
- Company Contingency Plans
- SOPEP
- VRP
- SERS
- Emergency Response Team Handbook

Appendix 5
Operational Spills Check list

A. Operational oil/NLS spill response check list

This check list is intended for response guidance when dealing with an oil/NLS spill during bunkering operations. Responsibility for action to deal with other emergencies which result from the oil/NLS spill will be as laid down in existing plans, such as the Emergency Muster List.

ACTION TO BE CONSIDERED	ACTION TAKEN		PERSON RESPONSIBLE
IMMEDIATE ACTION			
Sound emergency alarm	Yes ❑	No ❑	Person discovering incident
Initiate vessel emergency response procedures	Yes ❑	No ❑	Officer on duty
INITIAL RESPONSE			
Cease bunkering operations	Yes ❑	No ❑	Chief engineer
Close manifold valves	Yes ❑	No ❑	Chief engineer
Stop air intake to accommodation	Yes ❑	No ❑	Officer on duty
Stop non-essential air intake to engine room	Yes ❑	No ❑	Engineer on duty
Locate source of leakage	Yes ❑	No ❑	Chief engineer
Commence clean-up procedures using absorbents and permitted solvents	Yes ❑	No ❑	Chief officer
Comply with reporting procedures	Yes ❑	No ❑	Master
SECONDARY RESPONSE			
Assess fire risk from release of flammable substances	Yes ❑	No ❑	Chief officer
Reduce oil level in relevant tank by dropping oil into an empty of slack tank	Yes ❑	No ❑	Chief engineer
Drain affected line to empty or slack tank	Yes ❑	No ❑	Chief engineer
Prepare pumps for transfer of oil, to other tanks or to shore or lighter	Yes ❑	No ❑	Chief engineer
FURTHER RESPONSE			
Pump water into leaking tank to create water cushion and prevent further oil loss	Yes ❑	No ❑	Chief engineer
If leakage is below waterline, arrange divers for further investigation	Yes ❑	No ❑	Master
Calculate stresses/stability. If necessary, request shore assistance with this	Yes ❑	No ❑	Chief officer
Transfer bunkers to alleviate high stresses	Yes ❑	No ❑	Chief officer
Stow residues from clean-up carefully prior to disposal			Officer on duty

B. Casualty oil/NLS spill response check list

This check list is intended for response guidance when dealing with an oil/NLS spill following a casualty. Responsibility for action to deal with the casualty itself will be as laid down in existing plans, such as the Emergency Muster List.

The term "navigator" refers to the officer responsible for passage planning and voyage analysis, usually the second officer.

ACTION TO BE CONSIDERED	ACTION TAKEN		PERSON RESPONSIBLE
IMMEDIATE ACTION			
Sound emergency alarm	Yes ❑	No ❑	Officer on duty
Initiate vessel emergency response procedures	Yes ❑	No ❑	Officer on duty
INITIAL RESPONSE			
Stop air intake to accommodation	Yes ❑	No ❑	Officer on duty
Stop non-essential air intake to engine room	Yes ❑	No ❑	Engineer on duty
Assess further danger to ship or personnel such as capsize or immediate sinking	Yes ❑	No ❑	Master
Cease all cargo and other non-essential operations	Yes ❑	No ❑	Officer on duty
Assess whether oil/NLS has actually been spilt	Yes ❑	No ❑	Chief officer
Is there a probability that it will be spilt	Yes ❑	No ❑	Master
Comply with reporting procedures	Yes ❑	No ❑	Chief engineer
Sound oil/NLS compartments			Chief officer
Sound around vessel if aground			Master
Request outside assistance	Yes ❑	No ❑	Chief officer
Counter excessive list	Yes ❑	No ❑	Officer on duty
Contain spilt oil/NLS	Yes ❑	No ❑	Chief officer
Commence clean-up procedures using absorbents and permitted solvents	Yes ❑	No ❑	Chief officer
FURTHER RESPONSE			
Assess fire risk from release of flammable substances	Yes ❑	No ❑	Chief officer
Consider evacuation of non-essential crew	Yes ❑	No ❑	Master
Assess likelihood of further damage to vessel of cargo	Yes ❑	No ❑	Master
Calculate stresses/stability. If necessary, request shore assistance with this	Yes ❑	No ❑	Chief officer
Transfer cargo or bunkers to alleviate high stresses	Yes ❑	No ❑	Chief officer
Request assistance or escort to port of refuge	Yes ❑	No ❑	Master
Manoeuvre upwind of spill/away from land	Yes ❑	No ❑	Master
Assess whether tide will worsen situation	Yes ❑	No ❑	Navigator
Obtain weather forecast and assess effect	Yes ❑	No ❑	Navigator
Prepare pumps for transfer of oil/NLS to other tanks or to shore or lightening vessel	Yes ❑	No ❑	Chief Engineer

Appendix 6
Contingency Documents
M/T *Dara Desgagnés*

List of Contingency Documents enclosed hereafter:

- Main particulars of vessel;
- Drawings
    - Cargo Piping, sheet 1 of 2 (996.51.31)
    - Schematic Cargo and Stripping Lines, sheet 2 of 2 (996.51.31)
    - Diagram of Fuel Bunkering (996.41.13)
    - General Arrangement Plan, Side (996.31.01)
    - General Arrangement Plan, Stowage (996.31.02)
    - General Arrangement Plan, Upper Deck (996.31.05)
    - Tank Plan (100.25.01b)
    - Vessel Capacity Plan (996.24.04)
- Salvage Agreement (LOF 2000, US Open Form))

Appendix 6
Contingency Documents
M/T *Dara Desgagnés*

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- Main particulars of vessel;
- Drawings
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    - Schematic Cargo and Stripping Lines, sheet 2 of 2 (996.51.31)
    - Diagram of Fuel Bunkering (996.41.13)
    - General Arrangement Plan, Side (996.31.01)
    - General Arrangement Plan, Stowage (996.31.02)
    - General Arrangement Plan, Upper Deck (996.31.05)
    - Tank Plan (100.25.01b)
    - Vessel Capacity Plan (996.24.04)
- Salvage Agreement (LOF 2000, US Open Form))

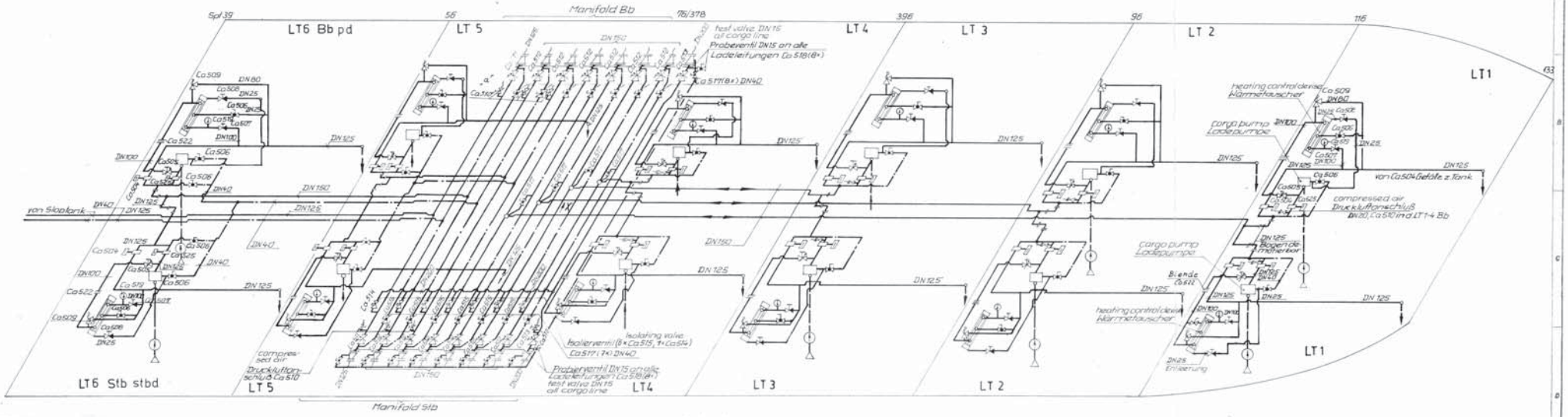
VESSEL PARTICULARS

GENERALITIES

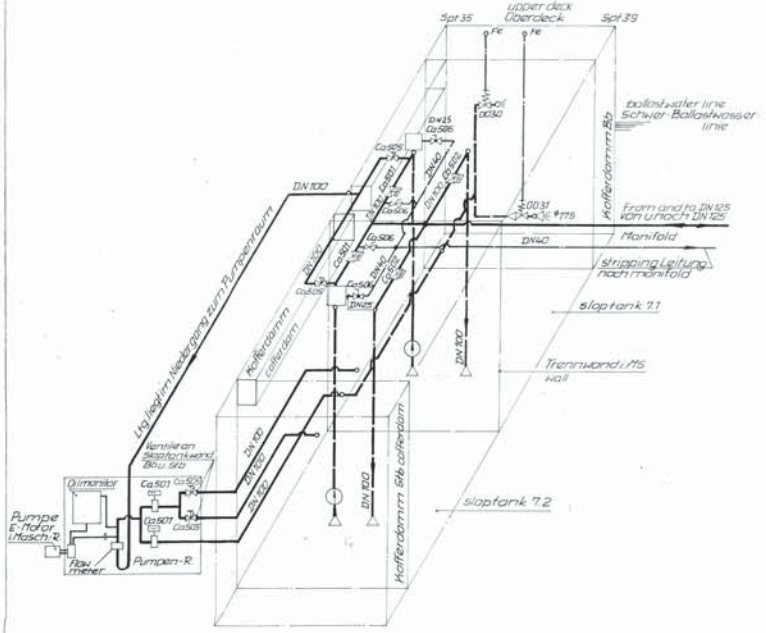
1. SHIP'S NAME :	M/V Dara *Desgagnés*
2. SHIP TYPE:	Oil/Chemical Tanker
3. PORT OF REGISTRY:	Québec
4. OWNER:	Transport Desgagnés inc.
5. INTERNATIONAL CALL SIGN:	VCBW
6. FLAG:	Canadian
7. GROSS TONNAGE/ Deadweight:	6,262 / 10,511
8. IMO NUMBER:	9040089
9. VESSEL DIMENSIONS:	
Length Overall:	123.72 M.
Breadth (Moulded):	17.70 M.
Draft – Summer DWT:	8.36 M.
10. KEEL LAID:	July 24th, 1992
11. DELIVERY:	January 1st, 1993

This plan should be kept available for inspection on request by a port state control officer or by a port state quarantine officer.

Cargotanks 1-6 Bb.u.Stb.
Schaltung auf Oberdeck
upper deck pd and stbd



Sloptanks Bb u. Stb



3.8

56 4

Niro-Leitungen

DN 25	33,7 x 1,6
40	44,5 x 2,0
50	60,3 x 2,0
80	88,9 x 2,0
100	114,3 x 2,0
125	139,7 x 2,3
150	168,3 x 2,6
200	219,1 x 2,9
250	273 x 4,0

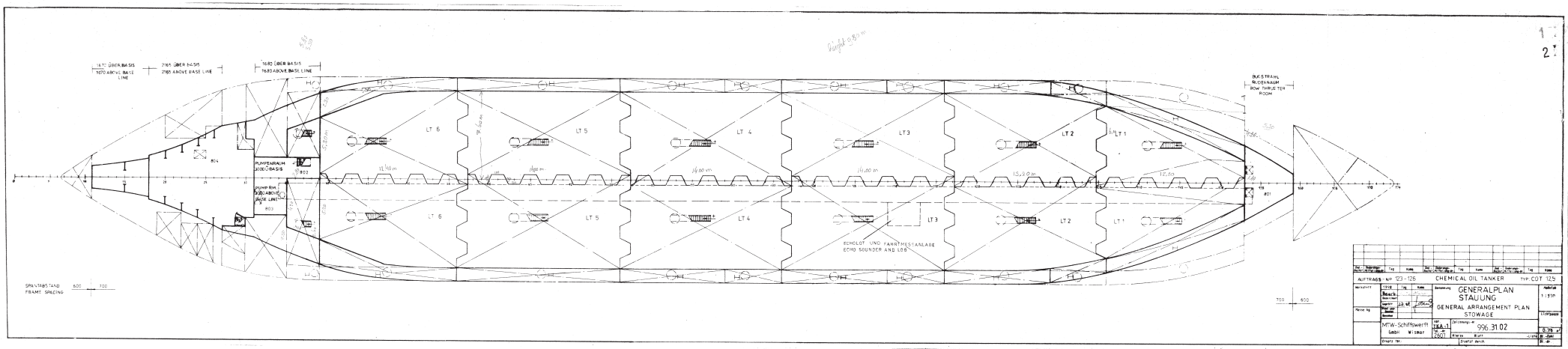
——— Ladeleitung - cargo line
—·—·— Restlenzleitung (strippingleitung)
——— Leitungen in den Tanks-pipe line to tanks and cofferdam
bzw. Kofferdamm

Bemerkungen u. Zeichenerklärungen siehe Bl. 1 PTD 1

0	1.4.2	24.9.82	Mü/F																
Änd.-Index	Änderungen-Nr.	Tag	Name	Änd.-Index	Änderungen-Nr.	Tag	Name	Änd.-Index	Änderungen-Nr.	Tag	Name								

COT 12,5 Chem. Tanker Auftr. Nr. 123-126

Werkstoff: Niro 1.4571	1992	Tag	Name	Benennung: Schema der Lade- und Strippingleitungen cargo-and stripping line	Maßstab: ohne
	Gezeichnet	12.8.	Mü/F		
	Gepr.	12.8.	Bartl		
	Norm	12.8.	Rößle		
	Freig.				Listplatz
Phase kg:	Übertrag	0.4.	1.8.8		
	MTW Schiffswerft GmbH Hamburg	Kz. TM12	Zeichnungs-Nr. 996.51.31		
		Tel.-Nr. 2853	Werft Blatt	Liste	Bl.-Zahl 2
	Ersatz für:		Ersetzt durch:		Bl.-Nr. 2

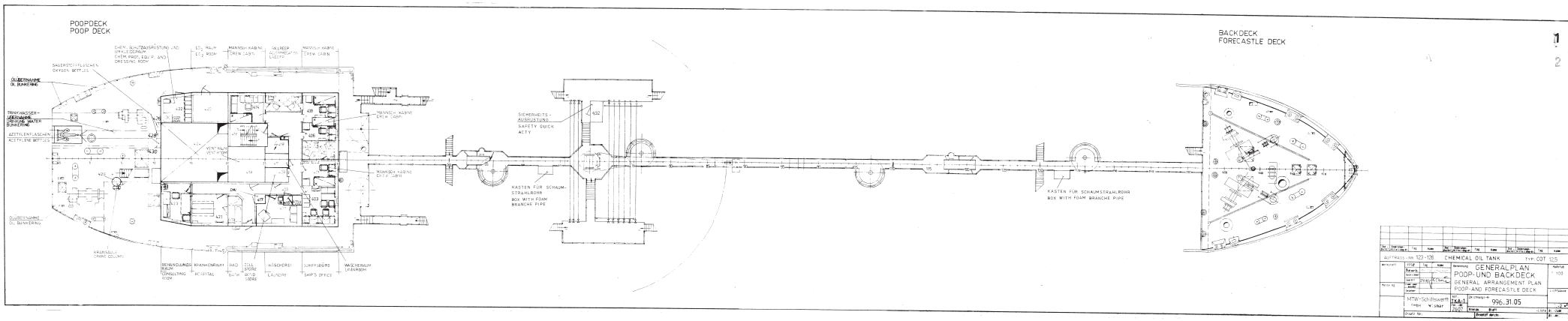


AUFTRAGS-NR. 123-126 CHEMICAL OIL TANKER TYP: COT 125

GENERALPLAN
STAUUNG
GENERAL ARRANGEMENT PLAN
STOWAGE

MTW-Schiffswerft GmbH Wismar

996.31.02


POOPDECK
POOP DECK
BACKDECK
FORECASTLE DECK
CHEM. SCHUTZAUSRÜSTUNG UND DRUCKDOCK
CHEM. PROT. EQUIP. AND DRESSING ROOM
ÖL RAUM
OIL ROOM
MANNSCH. KABINE
CREW CABIN
SAUERSTOFFFLASCHEN
OXYGEN BOTTLES
ÖLÜBERNAHME
OIL BUNKERING
TRINKWASSER-
ÜBERNAHME
DRINKING WATER
BUNKERING
ACETYLENFLASCHEN
ACETYLENE BOTTLES
VENT RAUM
VENT SPACE
SICHERHEITS-
AUSRÜSTUNG
SAFETY QUICK
ACTY
KASTEN FÜR SCHAUM-
STRAHLROHR
BOX WITH FOAM
BRANCHE PIPE
KASTEN FÜR SCHAUMSTRAHLROHR
BOX WITH FOAM BRANCHE PIPE
ÖLÜBERNAHME
OIL BUNKERING
KRANSÄULE
CRANE COLUMN
BEHANDLUNGS
RAUM
CONSULTING
ROOM
KRANKENRAUM
HOSPITAL
BAD
BATH
COLD
STORE
WÄSCHEREI
LAUNDRY
SCHIFFSBÜRO
SHIP'S OFFICE
WASCHERAUM
LAVATORY
1
2
AUFTRAGS-NR 123-126
CHEMICAL OIL TANK
TYP COT 125
GENERALPLAN
POOP- UND BACKDECK
GENERAL ARRANGEMENT PLAN
POOP- AND FORECASTLE DECK
MTW-Schiffswerft
996.31.05

LLOYD'S STANDARD FORM OF SALVAGE AGREEMENT

(Approved and Published by the Council of Lloyd's)

NO CURE – NO PAY

1 Name of the salvage Contractors: (referred to in this agreement as "the Contractors")	**2** Property to be salved: The vessel: her cargo freight bunkers stores and any other property thereon but excluding the personal effects or baggage of passengers master or crew (referred to in this agreement as "the property")
3 Agreed place of safety:	**4** Agreed currency of any arbitral award and security (if other than United States dollars)
5 Date of this agreement	**6** Place of agreement
7 Is the Scopic Clause incorporated into this agreement? State alternative: Yes/No	
8 Person signing for and on behalf of the Contractors Signature:	**9** Captain or other persons signing for an on behalf of the property Signature:

A **Contractors' basic obligation:** The Contractors identified in Box 1 hereby agree to use their best endeavours to salve the property specified in Box 2 and to take the property to the place stated in Box 3 or to such other place as may hereafter be agreed. If no place is inserted in Box 3 and in the absence of any subsequent agreement as to the place where the property is to be taken the Contractors shall take the property to a place of safety.

B **Environmental protection:** While performing the salvage services the Contractors shall also use their best endeavours to prevent or minimise damage to the environment.

C **Scopic Clause:** Unless the word "No" in Box 7 has been deleted this agreement shall be deemed to have been made on the basis that the Scopic Clause is not incorporated and forms no part of this agreement. If the word "No" is deleted in Box 7 this shall not of itself be construed as a notice invoking the Scopic Clause within the meaning of sub-clause 2 thereof.

D **Effect of other remedies:** Subject to the provisions of the International Convention on Salvage 1989 as incorporated into English law ("the Convention") relating to special compensation and to the Scopic Clause if incorporated the Contractors services shall be rendered and accepted as salvage services upon the principle of "no cure - no pay" and any salvage remuneration to which the Contractors become entitled shall not be diminished by reason of the exception to the principle of "no cure - no pay" in the form of special compensation or remuneration payable to the Contractors under a Scopic Clause.

E **Prior services:** Any salvage services rendered by the Contractors to the property before and up to the date of this agreement shall be deemed to be covered by this agreement.

F **Duties of property owners:** Each of the owners of the property shall cooperate fully with the Contractors. In particular:

- **i** the Contractors may make reasonable use of the vessel's machinery gear and equipment free of expense provided that the Contractors shall not unnecessarily damage abandon or sacrifice any property on board;
- **ii** the Contractors shall be entitled to all such information as they may reasonably require relating to the vessel or the remainder of the property provided such information is relevant to the performance of the services and is capable of being provided without undue difficulty or delay;
- **iii** the owners of the property shall co-operate fully with the Contractors in obtaining entry to the place of safety stated in Box 3 or agreed or determined in accordance with Clause A.

G. **Rights of termination:** When there is no longer any reasonable prospect of a useful result leading to a salvage reward in accordance with Convention Articles 12 and/or 13 either the owners of the vessel or the Contractors shall be entitled to terminate the services hereunder by giving reasonable prior written notice to the other.

H **Deemed performance:** The Contractors' services shall be deemed to have been performed when the property is in a safe condition in the place of safety stated in Box 3 or agreed or determined in accordance with clause A. For the purpose of this provision the property shall be regarded as being in safe condition notwithstanding that the property (or part thereof) is damaged or in need of maintenance if (i) the Contractors are not obliged to remain in attendance to satisfy the requirements of any port or habour authority, governmental agency or similar authority and (ii) the continuation of skilled salvage services from the Contractors or other salvors is no longer necessary to avoid the property becoming lost or significantly further damaged or delayed.

I **Arbitration and the LSSA Clauses:** The Contractors remuneration and/or special compensation shall be determined by arbitration in London in the manner prescribed by Lloyds Standard Salvage and Arbitration Clauses ("the LSSA Clauses") and Lloyd's Procedural Rules. The provisions of the LSSA Clauses and Lloyd's Procedural Rules are deemed to be incorporated in this agreement and form an integral part hereof. Any other difference arising out of this agreement or the operations hereunder shall be referred to arbitration in the same way.

J **Governing law:** This agreement and any arbitration hereunder shall be governed by English law.

K **Scope of authority:** The Master or other person signing this agreement on behalf of the property identified in Box 2 enters into this agreement as agent for the respective owners thereof and binds each (but not the one for the other or himself personally) to the due performance thereof.

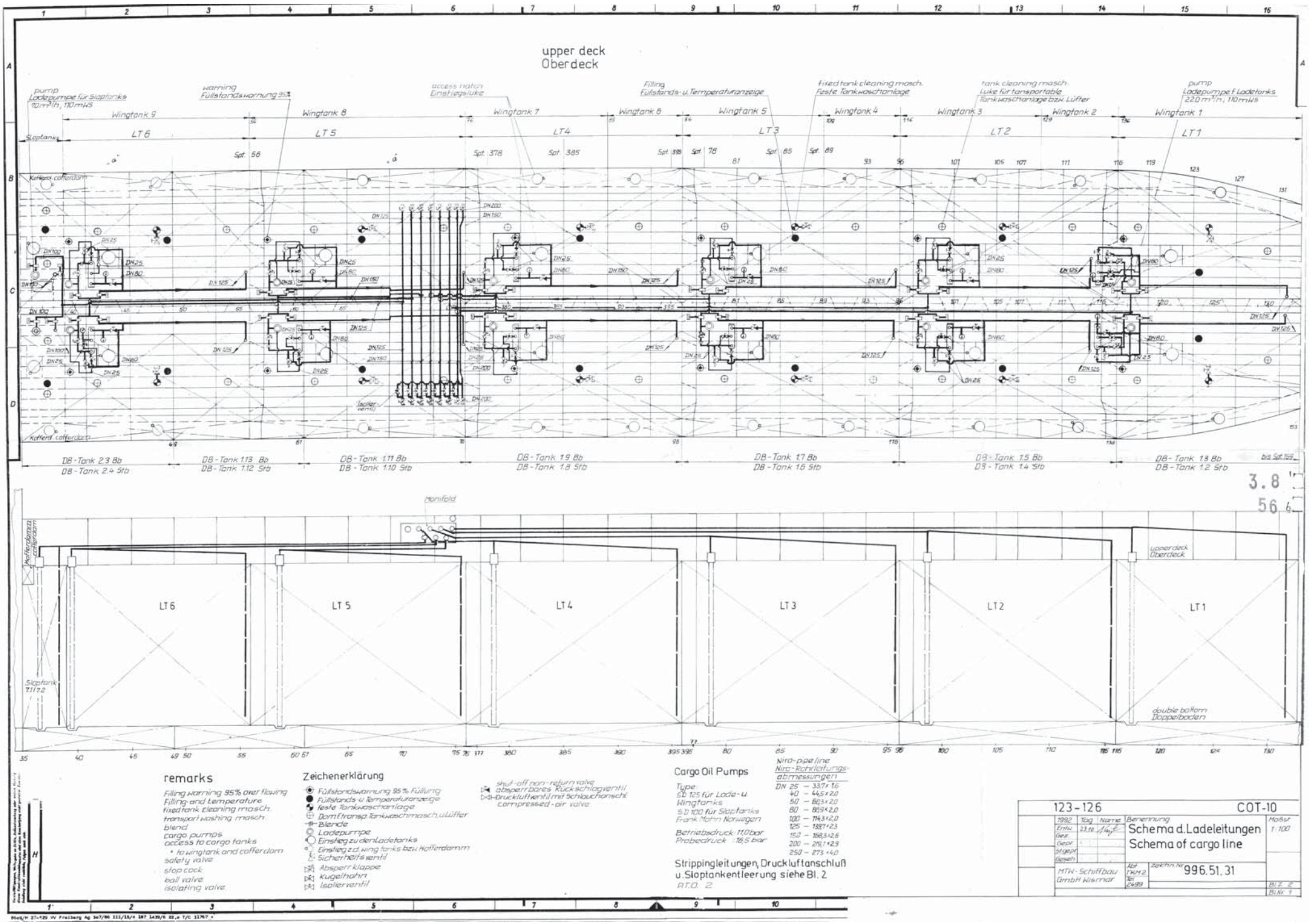
L **Inducements prohibited:** No person signing this agreement or any party on whose behalf it is signed shall at any time or in any manner whatsoever offer provide make give or promise to provide or demand or take any form of inducement for entering into this agreement.

IMPORTANT NOTICES

1 **Salvage security.** As soon as possible the owners of the vessel should notify the owners of other property on board that this agreement has been made. If the Contractors are successful the owners of such property should note that it will become necessary to provide the Contractors with salvage security promptly in accordance with Clause 4 of the LSSA Clauses referred to in Clause I. The provision of General Average security does not relieve the salved interests of their separate obligation to provide salvage security to the Contractors.

2 **Incorporated provisons.** Copies of the Scopic Clause; the LSSA Clauses and Lloyd's Procedural Rules may be obtained from (i) the Contractors or (ii) the Salvage Arbitration Branch at Lloyd's, One Lime Street, London EC3M 7HA.

Telephone + 44(0)20 7327 5408
Fax +44(0)20 7327 6827
Email lloyds-salvage@lloyds.com
www.lloydsagency.com



remarks

Filling warning 95% over flowing
Filling- and temperature
fixed tank cleaning masch.
transport washing masch.
blend
cargo pumps
access to cargo tanks
* to wingtank and cofferdam
safety valve
stop cock
ball valve
isolating valve

Zeichenerklärung

- Füllstandswarnung 95% Füllung
- Füllstands- u. Temperaturanzeige
- feste Tankwaschanlage
- Dom f. transp. Tankwaschmasch. u. Lüfter
- Blende
- Ladepumpe
- Einstieg zu den Ladetanks
- Einstieg z.d. wing tanks bzw. Kofferdamm
- Sicherheitsventil
- Absperrklappe
- kugelhahn
- Isolierventil
- shut-off non-return valve
- absperrbares Rückschlagventil
- Druckluftventil mit Schlauchanschl.
- compressed-air valve

Cargo Oil Pumps

Type:
SD 125 für Lade- u. Wingtanks
SD 100 für Sloptanks
Frank Mohn Norwegen

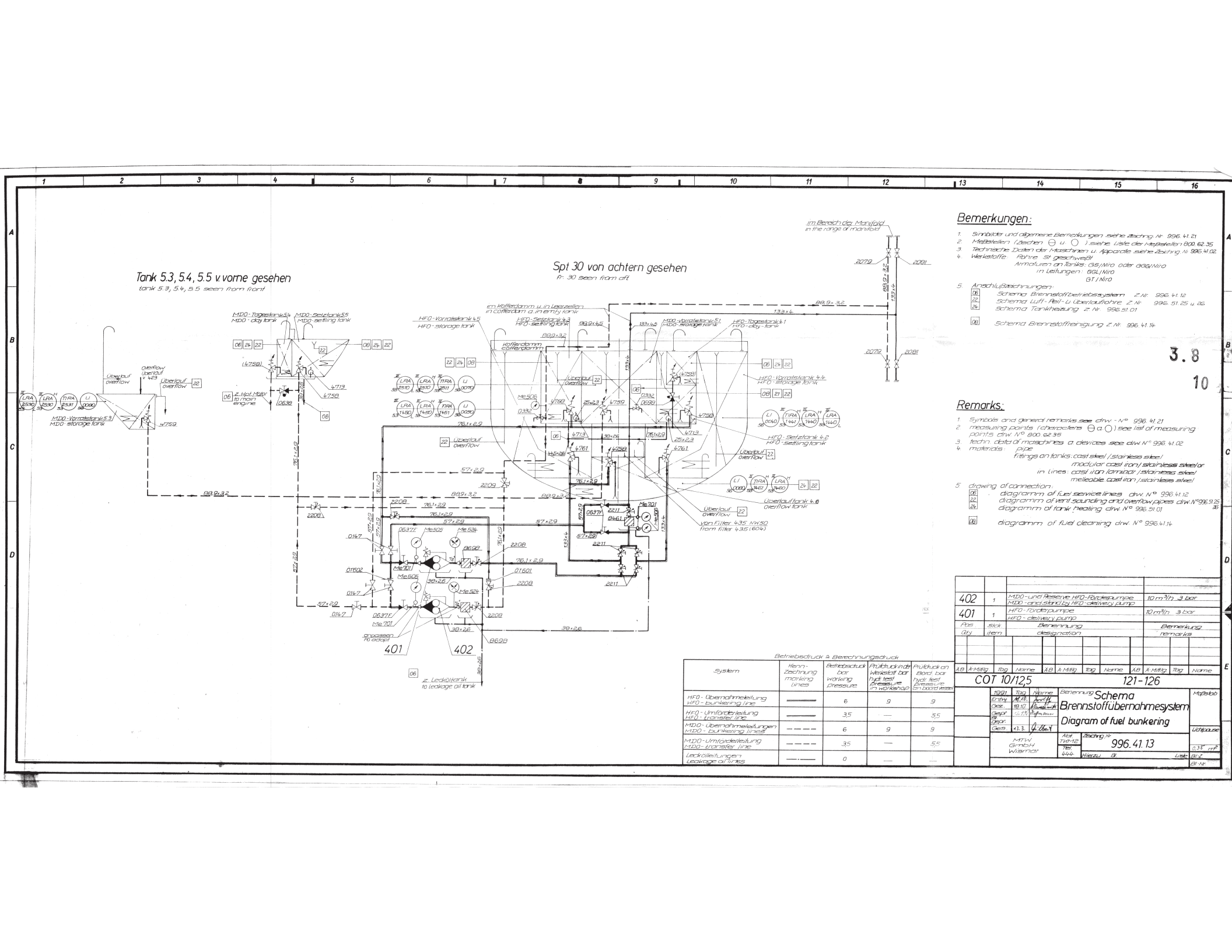
Betriebsdruck: 11,0 bar
Probedruck: 18,5 bar

Strippingleitungen, Druckluftanschluß u. Sloptankentleerung siehe Bl. 2.
P.T.O. 2

Nitro-pipe line / Nitro-Rohrleitungs-abmessungen

DN 25	33,7 x 1,6
40	44,5 x 2,0
50	60,3 x 2,0
80	88,9 x 2,0
100	114,3 x 2,0
125	139,7 x 2,3
150	168,3 x 2,6
200	219,1 x 2,9
250	273 x 4,0

123 - 126					COT-10
1992	Tag	Name	Benennung		Maßst.
Entw.	23.10		Schema d. Ladeleitungen		1:100
Gez.			Schema of cargo line		
Gepr.					
Stgepr.					
Genehm.					
MTW - Schiffbau GmbH Wiesmar			Abt. TKM 2	Zeichn. Nr. 996.51.31	
			Tel. 2499		Bl. Z. 2
					Bl. Nr. 1



Bemerkungen:

1. Sinnbilder und allgemeine Bemerkungen siehe Zeichng. Nr. 996.41.21
2. Meßstellen (Zeichen ⊖ u. ◯) siehe Liste der Meßstellen 800.62.35
3. Technische Daten der Maschinen u. Apparate siehe Zeichng. Nr. 996.41.02
4. Werkstoffe: Rohre St geschweißt
   Armaturen an Tanks: GS/NiRo oder GGG/NiRo
   in Leitungen: GGL/NiRo
   GT/NiRo
5. Anschlußbezeichnungen:
   06 Schema Brennstoffbetriebssystem Z.Nr. 996.41.12
   22 Schema Luft-/Rel-/u. Überlaufrohre Z.Nr. 996.51.25 u. 26
   24 Schema Tankheizung Z.Nr. 996.51.01

   08 Schema Brennstoffreinigung Z.Nr. 996.41.14

3.8

10

Remarks:

1. Symbols and general remarks see drw. - N° 996.41.21
2. measuring points (characters ⊖ a. ◯) see list of measuring points drw. N° 800.62.35
3. techn. data of masschines a. devices see drw. N° 996.41.02
4. materials: pipe
   Fittings on tanks: cast steel / stainless steel
   modular cast iron / stainless steel or
   in lines: cast iron (armatur) / stainless steel
   malleable cast iron / stainless steel
5. drawing of connection:
   06 diagramm of fuel service lines drw. N° 996.41.12
   22 diagramm of vent, sounding and overflow pipes drw. N° 996.51.25
   24 diagramm of tank heating drw. N° 996.51.01

   08 diagramm of fuel cleaning drw. N° 996.41.14

Betriebsdruck & Berechnungsdruck

System	Kenn-Zeichnung marking lines	Betriebsdruck bar working pressure	Prüfdruck in der Werkstatt bar hydr. test pressure in workshop	Prüfdruck an Bord bar hydr. test pressure on board vessel
HFO-Übernahmeleitung HFO-bunkering line	———	6	9	9
HFO-Umförderleitung HFO-transfer line	———	3,5	—	5,5
MDO-Übernahmeleitungen MDO-bunkering lines	– – – –	6	9	9
MDO-Umförderleitung MDO-transfer line	– – – –	3,5	—	5,5
Leckölleitungen Leakage oil lines	—·——·—	0	—	—

Pos. Qty.	Stck. Item	Benennung designation	Bemerkung remarks
402	1	MDO- und Reserve HFO-Förderpumpe MDO- and standby HFO-delivery pump	10 m³/h 3 bar
401	1	HFO-Förderpumpe HFO-delivery pump	10 m³/h 3 bar

	AB	Ä-Mitt'g	Tag	Name
bearb.			10.91	M. Th.
Entw.			10.91	Kerstin
Gez.			10.10	Wendt
Gepr.			13.11	Hoffmann
Gepr.				
Ges.			13.3.	

COT 10/12,5

121-126

MTW GmbH Wismar

Benennung: Schema Brennstoffübernahmesystem
Diagram of fuel bunkering

Maßstab

Abt. TM-12

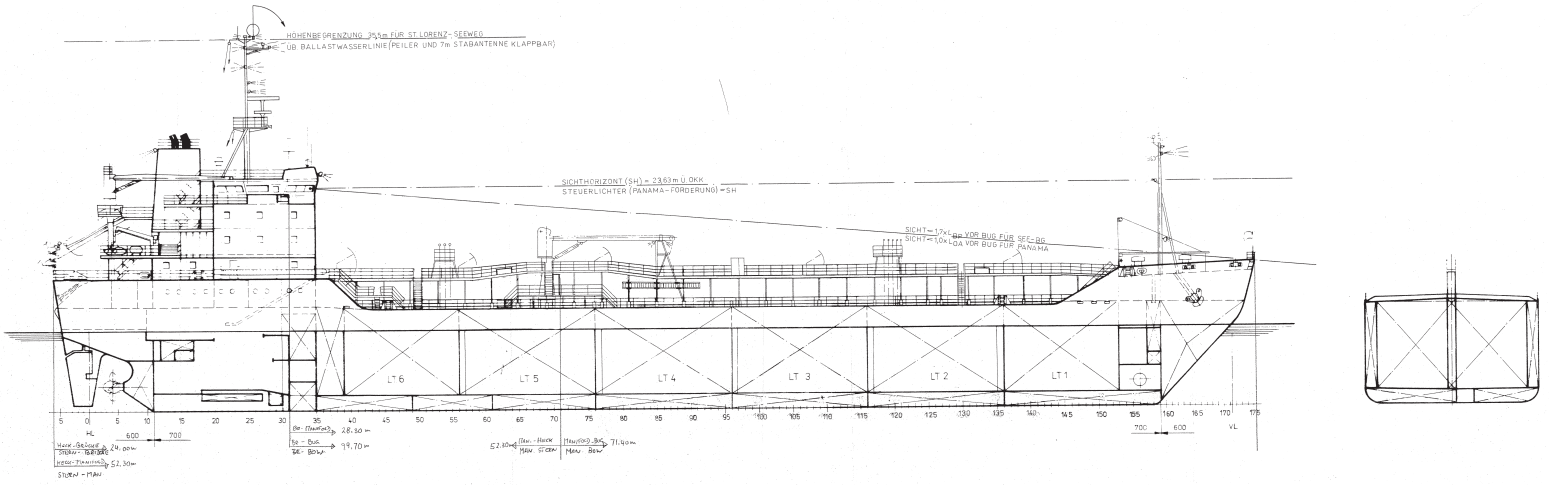
Tel. 444

Zeichng. Nr. 996.41.13

Liste Bl.

Bl.-Nr.

Lichtpause 0,35 mm



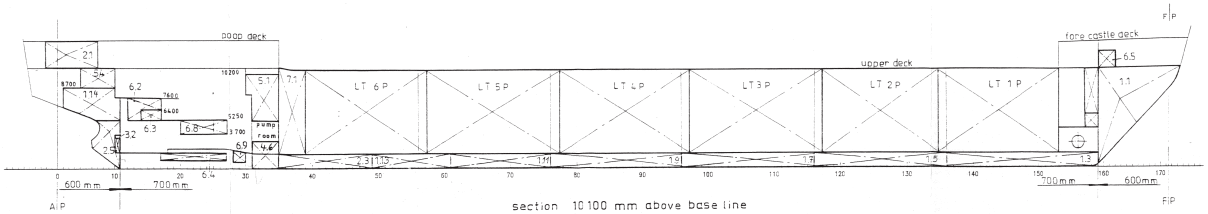
HAUPTDATEN / MAIN PARTICULARS

- LÄNGE ÜBER ALLES LENGHT OVERALL	ca. 124,00 m abt.
- LÄNGE ZWISCHEN DEN LOTEN LENGHT BETWEEN PERPENDICULARS	117,60 m
- BREITE AUF SPANTEN MOULDED BREADTH	17,70 m
- SEITENHÖHE OBERDECK ÜBER BASIS DEPTH TO UPPER DECK ABOVE BASE LINE	10,60 m
- TIEFGANG ENTWURF DRAUGHT DESIGNED	8,36 m
- FREIBORDTIEFGANG (SOMMER OKK) SUMMER FREEBOARD DRAUGHT REP. TO BL.	8,36 m
- TRAGFÄHIGKEIT BEI FREIBORDTIEFGANG DEADWEIGHT AT FREEBOARD DRAUGHT	ca. 10500 tdw abt.
- LADETANKS / NETTOKAPAZITÄT CARGO OIL TANKS / NET LOADING CAPACITY	ca. 10810 m^3 abt.
- HAUPTMASCHINENLEISTUNG MAIN ENGINE OUTPUT	ca. 3700 kW, 210 min^{-1} abt.
- GESCHWINDIGKEIT SERVICE SPEED	12,5 kn
- BESATZUNG CREW - EIGNER OWNER - LOTSE PILOT	16 PERSONEN PERSONS 2 PERSONEN PERSONS 1 PERSON

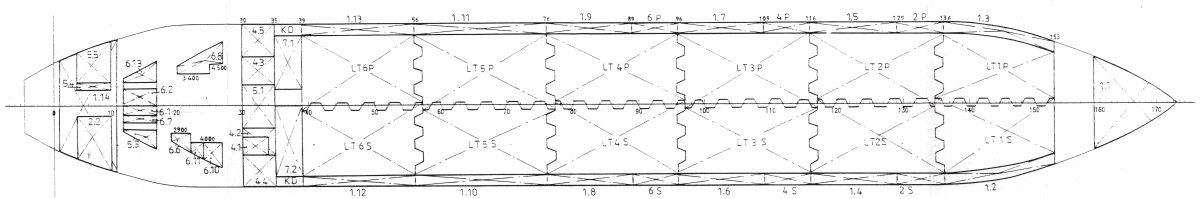
1
2

| | | |

section on centre line

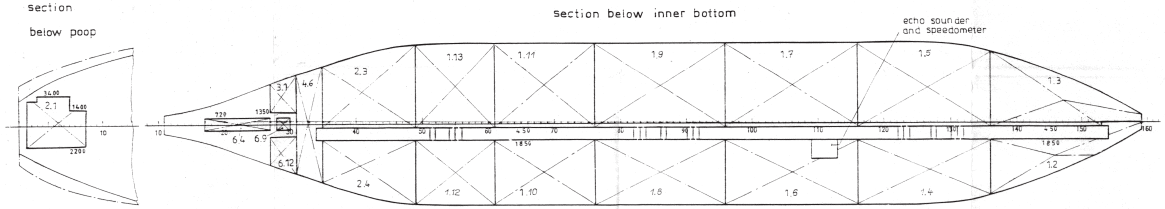


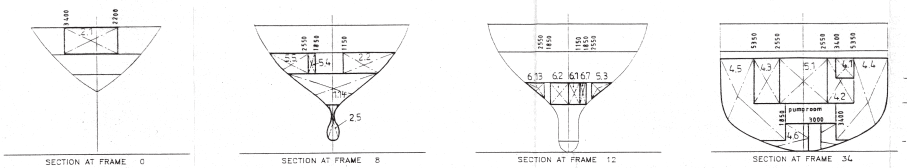
section 10100 mm above base line

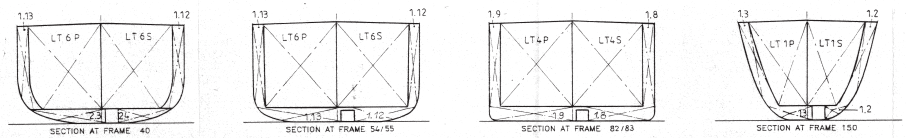


section below poop

section below inner bottom







Tankprüfung:

- Alle LT für jedes Schiff mit Wasserdruck entsprechend Tabelle.
- Alle Ballasttanks mit Luftdruck 0, 2 bar. Nach Fertigstellung Prüfung mittels Überlauf durch Wasser.
- Alle Betriebstanks mit Luftdruck 0, 2 bar. Endprüfung durch Befüllen mit Medium während der Bebunkerung des Schiffes.

tank test:

- With water pressure corresponding to the table for all cargo tanks for each ship.
- With 0. 2 bar compressed air for all ballast water tanks.
  After completion tank test by means of overflow with water.
- With 0. 2 bar compressed air for all service tanks. During bunkering of the ship the final tank test will be done tank filling with medium.

TANK NO.	DESIGNATION	MEDIUM	POSITION	RANGE OF FRAME	GROSS VOLUME m³	NET VOLUME m³	CENTRE OF GRAVITY ABOVE BASE LINE ⊗ m	LONGITUDINAL CENTRE OF GRAVITY ⊗ m	TANK TEST: OVERFLOW ABOVE TANK TOP (MM)	TANK TEST: W-WATER LEVEL ABOVE TANK TOP (MM)
LT1P/LT1S	CARGO OIL TANK 1P/1S	CHEMICAL OIL	PORT/STBD	136 - 153	688 / 688	693 / 693	6.42	99.2	——	W 3875
LT2P/LT2S	CARGO OIL TANK 2P/2S	CHEMICAL OIL	PORT/STBD	116 - 136	921 / 921	914 / 914	6.18	87.1	——	W 3875
LT3P/LT3S	CARGO OIL TANK 3P/3S	CHEMICAL OIL	PORT/STBD	96 - 116	988 / 988	980 / 980	6.17	73.6	——	W 3875
LT4P/LT4S	CARGO OIL TANK 4P/4S	CHEMICAL OIL	PORT/STBD	76 - 96	988 / 988	980 / 980	6.17	59.6	——	W 3875
LT5P/LT5S	CARGO OIL TANK 5P/5S	CHEMICAL OIL	PORT/STBD	56 - 76	988 / 988	980 / 980	6.17	45.6	——	W 3875
LT6P/LT6S	CARGO OIL TANK 6P/6S	CHEMICAL OIL	PORT/STBD	39 - 56	667 / 867	860 / 860	6.19	32.4	——	W 3875
1.1	FOREPEAK	BALLAST WATER	CENTRE LINE	159 - 174	193	184	8.08	112.6	3500	W 3500
1.2	BALLAST WATER TANK	BALLAST WATER	STBD	136 - 159	197	193	4.51	99.9	2500	W 2500
1.3	BALLAST WATER TANK	BALLAST WATER	PORT	136 - 159	240	235	3.84	100.0	2500	W 2500
1.4	BALLAST WATER TANK	BALLAST WATER	STBD	116 - 136	241	236	2.98	85.9	2500	W 2500
1.5	BALLAST WATER TANK	BALLAST WATER	PORT	116 - 136	289	284	2.61	86.1	2500	W 2500
1.6	BALLAST WATER TANK	BALLAST WATER	STBD	96 - 116	242	237	2.97	72.0	2500	W 2500
1.7	BALLAST WATER TANK	BALLAST WATER	PORT	96 - 116	299	293	2.55	72.3	2500	W 2500
1.8	BALLAST WATER TANK	BALLAST WATER	STBD	76 - 96	251	246	2.89	58.1	2500	W 2500
1.9	BALLAST WATER TANK	BALLAST WATER	PORT	76 - 96	299	293	2.55	58.3	2500	W 2500
1.10	BALLAST WATER TANK	BALLAST WATER	STBD	56 - 76	265	260	3.84	45.9	2500	W 2500
1.11	BALLAST WATER TANK	BALLAST WATER	PORT	56 - 76	301	295	3.47	46.0	2500	W 2500
1.12	BALLAST WATER TANK	BALLAST WATER	STBD	39 - 61	219	214	3.94	34.3	2500	W 2500
1.13	BALLAST WATER TANK	BALLAST WATER	PORT	39 - 61	248	243	3.57	34.7	2500	W 2500
1.14	BALLAST WATER TANK	BALLAST WATER	CENTRE LINE	1 - 11	85	82	7.44	4.1	5650	W 5650
2.1	DRINKING WATER TANK	DRINKING WATER	CENTRE LINE	-4 - 7	95.7	93.8	12.37	0.7	500	W 2500
2.2	CONDENSATE TANK	FRESH WATER	STBD	4 - 10	34.5	33.8	9.88	4.3	3500	W 3500
2.3	TECHNICAL FRESH WATER TANK	TECHNICAL FRESH WATER	PORT	35 - 49	105.3	103.2	0.85	28.8	10220	W 10220
2.4	TECHNICAL FRESH WATER TANK	TECHNICAL FRESH WATER	STBD	35 - 49	71.7	70.3	0.90	29.0	10220	W 10220
2.5	AFTERPEAK	TECHNICAL FRESH WATER	CENTRE LINE	6 - 11	12.2	12.0	3.07	5.6	9150	W 9150
3.1	COOLING WATER TANK	COOLING WATER	PORT	27 - 31	5.5	5.4	1.18	18.9	12335	W 12335
3.2	COOLING WATER TANK	COOLING WATER	CENTRE LINE	10 - 11	1.5	1.5	2.90	6.3	10700	W 10700
4.1	H.F.O. DAILY SUPPLY TANK	HEAVY FUEL OIL	STBD	30 - 34	12.0	11.8	9.10	21.3	500	W 2500
4.2	H.F.O. SETTLING TANK	HEAVY FUEL OIL	STBD	30 - 35	31.1	30.5	7.38	22.0	-50	W 2500
4.3	H.F.O. SETTLING TANK	HEAVY FUEL OIL	PORT	30 - 35	48.5	47.5	7.73	21.7	-50	W 2500
4.4	H.F.O. STORAGE TANK	HEAVY FUEL OIL	STBD	30 - 35	110.3	108.1	5.86	21.7	-50	W 2500
4.5	H.F.O. STORAGE TANK	HEAVY FUEL OIL	PORT	30 - 35	130.4	128.0	5.47	21.7	-50	W 2500
4.6	H.F.O. OVERFLOW TANK	HEAVY FUEL OIL	CENTRE LINE	31 - 35	51.4	50.4	1.46	22.0	11400	W 11400
5.1	M.D.O. STORAGE TANK	MARINE DIESEL FUEL OIL	CENTRE LINE	30 - 35	78.5	77.0	7.86	21.8	-50	W 2500
5.3	M.D.O. STORAGE TANK	MARINE DIESEL FUEL OIL	STBD	12 - 17	16.8	16.5	6.86	9..	1000	W 2500
5.4	M.D.O. DAILY SUPPLY TANK	MARINE DIESEL FUEL OIL	PORT	4 - 10	5.5	5.4	9.80	4.2	1000	W 2500
5.5	M.D.O. SETTLING TANK	MARINE DIESEL FUEL OIL	PORT	4 - 10	23.4	22.9	9.32	4.4	-50	W 2500
6.1	CYLINDER OIL TANK	CYLINDER OIL	STBD	12 - 17	9.5	9.3	6.43	9.1	2800	W 2800
6.2	LUBRICATING OIL TANK	LUBE OIL	PORT	12 - 17	12.4	12.2	6.60	8.9	2800	W 2800
6.3	LUBR. O.T. AUX.ENG.DIESEL	LUBE OIL	PORT	14 - 17	2.8	2.7	5.83	9.8	4000	W 4000
6.4	LUBRICATING OIL CIRCUL. TANK	LUBE OIL	CENTRE LINE	18 - 27	6.6	6.5	1.36	14.3	9230	W 10000
6.5	HYDRAULIC OIL DRAIN TANK	HYDRAULIC OIL	CENTRE LINE	159 -162	4.5	4.4	11.50	111.1	2500	W 2500
6.6	USED OIL TANK	USED OIL	STBD	19 - 22	6.3	6.2	4.59	13.4	9150	W 9150
6.7	SEPARATED OIL TANK	LUBE OIL	STBD	12 - 17	5.8	5.6	6.43	9.1	2800	W 2800
6.8	SLUDGE OIL TANK	OIL RESIDUE	PORT	20 - 27	16.7	16.3	4.56	15.6	9150	W 9150
6.9	LEAKAGE OIL TANK	LEAKING OIL	CENTRE LINE	28 - 30	1.9	1.9	1.18	19.2	12630	W 12630
6.10	THERMICAL OIL TANK	THERMICAL OIL	STBD	24 - 27	8.4	8.3	4.55	16.8	9150	W 9150
6.11	THERMICAL OIL TANK	THERMICAL OIL	STBD	22 - 24	3.8	3.7	4.59	15.1	9150	W 9150
6.12	BILGE WATER TANK	BILGE WATER	STBD	27 - 31	8.1	7.9	1.22	19.2	12335	W 12335
6.13	BILGE WATER SETTLING TANK	BILGE WATER	PORT	12 - 17	16.8	16.5	6.86	9.3	6800	W 6800
7.1	SLOP TANK	WATER/OIL RESIDUE	PORT	35 - 39	140	137	6.49	24.8	——	W 2500
7.2	SLOP TANK	WATER/OIL RESIDUE	STBD	35 - 39	189	185	6.42	24.8	——	W 2500
2P / 2S	EMPTY COMPARTMENT	——	PORT /STBD	129 -136	53 / 53	52 / 52	6.14	91.7	——	W 2500
4P / 4S	EMPTY COMPARTMENT	——	PORT /STBD	109 -116	53 / 53	52 / 52	6.14	77.7	——	W 2500
6P / 6S	EMPTY COMPARTMENT	——	PORT /STBD	89 - 96	53 / 53	52 / 52	6.14	63.7	——	W 2500

2.1
7.

TKM1 (Progress)
TKM5/2 (Hahn)
FAL(TA)
TKA (Rohr)
TKA (Power) abgestimmt ≠ 3.94.92
TKM2x
TK54 FLV2-3x FLV9, FAL-TR/TM
FAL, FLV, TRB, LOS (Hahn) -
(W) 2A-H2x 2A6-7x 2A9-7x

b	151	26.5.93	Hi/Ge	Auft.-Nr.	123-126	Schiff:	COT 12.5
a	120	22.5.92	Hi/Ge	Bearb.	284	Benennung:	tank plan
Änderung	Tag	Name		Gez.	284		
				Gepr.	284		
				N.Gepr.			
				Gen.	Hinrichs		

MTW Schiffswerft GmbH Wismar

Abt. 123-3 Tel. 385

Z.-Nr.: 100.25.01 b

Maßstab: 1:200

LP

0.32 m²

Bl.-Nr. 1

The Society of Maritime Arbitrators, Inc.

U.S. OPEN FORM SALVAGE AGREEMENT

Codename -- MARSALV®

This **SALVAGE AGREEMENT** ("The Agreement"), between _____, Master and/or Owner and/or Underwriter of the vessel _____ ("The Vessel") and _____("The Salvor"), is for salvage services rendered or to be rendered to the Vessel, her cargo and other property currently lying at or near _____, under the following terms and conditions:

FIRST: The Salvor shall use his best endeavors to salve the Vessel, her cargo and other property and deliver same safely afloat, hauled or drydocked at or near _____, at which place and time the Salvor's services will terminate unless otherwise mutually agreed.

SECOND: The Master and crew of the Vessel agree to lend their aid and assistance to the Salvor, who shall be entitled, free of expense, to the reasonable use of the Vessel's equipment.

THIRD: The Salvor's services are to be performed on the following basis (check and initial):

☐ **No Cure-No Pay** (Compensation to be conditioned upon successful salvage of the Vessel and/or her cargo and/or other property. In such case, the Salvor's compensation shall be pursuant to the criteria and other provisions of Article 13 of the 1989 International Convention on Salvage shown on the reverse of this Agreement).

☐ **No Cure-No Pay, Fixed Fee $_____**

☐ **Per Diem/Hourly at $_____ per day/hour pro rata**

☐ **Other** _____

_____

FOURTH: Notwithstanding the election(s) made in Paragraph THIRD, the Salvor shall in any event be entitled to compensation for actions he takes to prevent or minimize damage to the environment, pursuant to Articles 13 and 14 of the 1989 International Convention on Salvage shown on the reverse of this Agreement.

FIFTH: The Salvor shall have a lien upon the Vessel, her cargo and other property for services rendered pursuant to Paragraphs THIRD and FOURTH, and his statement for services rendered shall be submitted as promptly as possible after completion or termination of such services. In lieu of arrest or attachment of the Vessel the Salvor may demand reasonable security for such services from the Vessel and cargo interests as a condition for releasing same.

SIXTH: This Agreement shall be governed by and construed in accordance with the Federal Maritime Law of the United States. Any dispute arising out of this Agreement shall be referred to arbitration in the United States in accordance with the applicable Arbitration Rules of the Society of Maritime Arbitrators, Inc. The Arbitrator(s) shall be familiar with maritime salvage. Any award made hereunder may include interest, attorney's fees and costs, and shall be final and binding. For the purpose of enforcement the Award may be entered for judgment in any court of competent jurisdiction.

Dated this ____ day of _____, 20___

For: **SALVOR**	For: **VESSEL, CARGO and/or PROPERTY**
_____	_____
(authorized signature)	(authorized signature)
_____	_____
(print name and title)	(print name and title)

White: Salvor; Yellow: Master/Owner; Pink: Underwriter

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INTERNATIONAL CONVENTION ON SALVAGE, 1989

Article 13

Criteria for Fixing the Reward

1. The reward shall be fixed with a view to encouraging salvage operations, taking into account the following criteria without regard to the order in which they are presented below:

(a) the salved value of the vessel and other property;
(b) the skill and efforts of the salvors in preventing or minimizing damage to the environment;
(c) the measure of success obtained by the salvor;
(d) the nature and degree of the danger
(e) the skill and efforts of the salvors in salving the vessel, other property and life;
(f) the time used and expenses and losses incurred by the salvors;
(g) the risk of liability and other risks run by the salvors or their equipment;
(h) the promptness of the services rendered;
(i) the availability and use of vessels or other equipment intended for salvage operations;
(j) the state of readiness and efficiency of the salvor's equipment and the value thereof.

2. Payment of a reward fixed according to paragraph 1 shall be made by all of the vessel and other property interests in proportion to their respective salved values. However, a State Party may in its national law provide that the payment of a reward has to be made by one of these interests, subject to a right of recourse of this interest against the other interests for their respective shares. Nothing in this article shall prevent any right of defence.

3. The rewards, exclusive of any interest and recoverable legal costs that may be payable thereon, shall not exceed the salved value of the vessel and other property.

Article 14

Special Compensation

1. If the salvor has carried out salvage operations in respect of a vessel which by itself or its cargo threatened damage to the environment and has failed to earn a reward under article 13 at least equivalent to the special compensation assessable in accordance with this article, he shall be entitled to special compensation from the owner of that vessel equivalent to his expenses as herein defined.

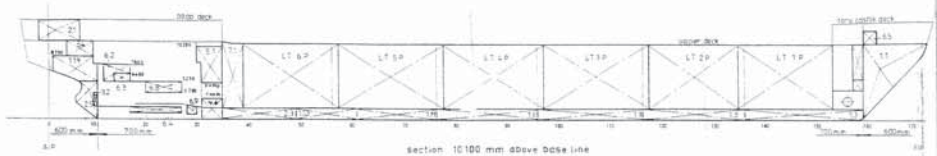
2. If, in the circumstances set out in paragraph 1, the salvor by his salvage operations has prevented or minimized damage to the environment, the special compensation payable by the owner to the salvor under paragraph 1 may be increased up to a maximum of 30% of the expenses incurred by the salvor. However, the tribunal, if it deems it fair and just to do so and bearing in mind the relevant criteria set out in article 13, paragraph 1, may increase such special compensation further, but in no event shall the total increase be more than 100% of the expenses incurred by the salvor.

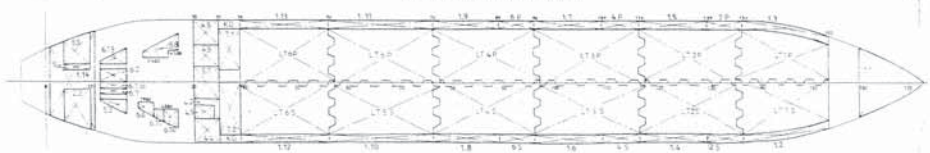
3. Salvor's expenses for the purpose of paragraphs 1 and 2 means the out-of-pocket expenses reasonably incurred by the salvor in the salvage operation and a fair rate for equipment and personnel actually and reasonably used in the salvage operation, taking into consideration the criteria set out in article 13, paragraph 1(h), (i) and (j).

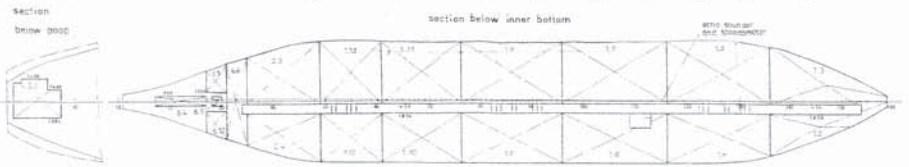
4. The total special compensation under this article shall be paid only if and to the extent that such compensation is greater than any reward recoverable by the salvor under article 13.

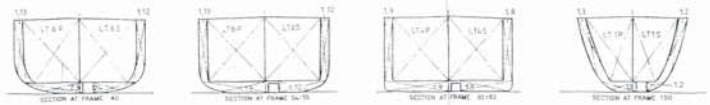
5. If the salvor has been negligent and has thereby failed to prevent or minimize damage to the environment, he may be deprived of the whole or part of any special compensation due under this article.

6. Nothing in this article shall affect any right of recourse on the part of the owner of the vessel.

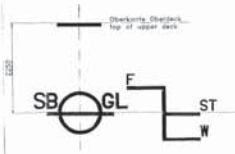


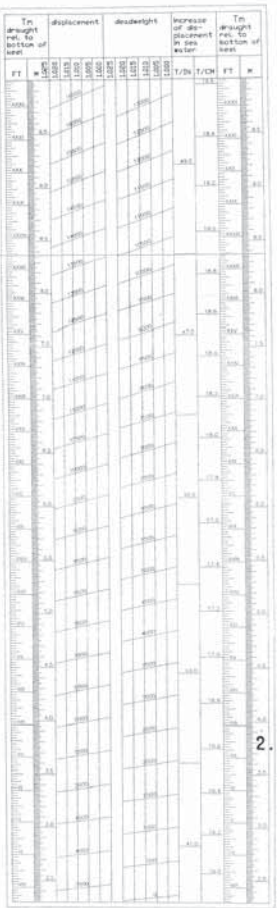






TANK NO.	DESIGNATION	MEDIUM	POSITION	RANGE OF FRAME	GROSS VOLUME m³	NET VOLUME m³	CENTRE OF GRAVITY ABOVE BASE LINE h m	LONGITUDINAL CENTRE OF GRAVITY lcg m
LT1P/LT1S	CARGO OIL TANK 1P/1S	CHEMICAL OIL	PORT/STBD	126 - 152	668 / 668	651 / 651	6.42	99.7
LT2P/LT2S	CARGO OIL TANK 2P/2S	CHEMICAL OIL	PORT/STBD	116 - 126	821 / 821	814 / 814	6.18	87.1
LT3P/LT3S	CARGO OIL TANK 3P/3S	CHEMICAL OIL	PORT/STBD	96 - 116	988 / 988	980 / 980	6.17	73.6
LT4P/LT4S	CARGO OIL TANK 4P/4S	CHEMICAL OIL	PORT/STBD	76 - 96	988 / 988	980 / 980	6.17	58.6
LT5P/LT5S	CARGO OIL TANK 5P/5S	CHEMICAL OIL	PORT/STBD	56 - 76	988 / 988	980 / 980	6.17	43.6
LT6P/LT6S	CARGO OIL TANK 6P/6S	CHEMICAL OIL	PORT/STBD	29 - 56	867 / 867	860 / 860	6.19	22.4
1.1	FOREPEAK	BALLAST WATER	CENTRE LINE	158 - 174	193	184	8.88	112.6
1.2	BALLAST WATER TANK	BALLAST WATER	STBD	136 - 158	387	382	4.51	88.8
1.3	BALLAST WATER TANK	BALLAST WATER	PORT	136 - 158	348	335	3.84	88.8
1.4	BALLAST WATER TANK	BALLAST WATER	STBD	116 - 136	741	734	3.98	85.8
1.5	BALLAST WATER TANK	BALLAST WATER	PORT	116 - 136	289	284	3.61	86.1
1.6	BALLAST WATER TANK	BALLAST WATER	STBD	96 - 116	242	237	2.97	52.0
1.7	BALLAST WATER TANK	BALLAST WATER	PORT	96 - 116	286	281	2.55	52.3
1.8	BALLAST WATER TANK	BALLAST WATER	STBD	76 - 96	251	246	2.09	58.1
1.9	BALLAST WATER TANK	BALLAST WATER	PORT	76 - 96	298	293	2.33	58.3
1.10	BALLAST WATER TANK	BALLAST WATER	STBD	56 - 76	293	288	3.84	43.9
1.11	BALLAST WATER TANK	BALLAST WATER	PORT	56 - 76	389	385	3.47	44.0
1.12	BALLAST WATER TANK	BALLAST WATER	STBD	29 - 47	319	314	2.94	34.0
1.13	BALLAST WATER TANK	BALLAST WATER	PORT	29 - 47	248	243	3.27	34.7
1.14	BALLAST WATER TANK	BALLAST WATER	CENTRE LINE	5 - 15	85	83	7.44	4.5
2.1	DRINKING WATER TANK	DRINKING WATER	CENTRE LINE	4 - 5	85.7	83.8	13.17	5
2.2	CONDENSATE TANK	FRESH WATER	STBD	4 - 19	58.5	57.9	9.69	4.1
2.3	TECHNICAL FRESH WATER TANK	TECHNICAL FRESH WATER	PORT	20 - 49	489.3	483.7	8.83	28.8
2.4	TECHNICAL FRESH WATER TANK	TECHNICAL FRESH WATER	STBD	20 - 49	73.7	73.1	8.88	29.8
2.5	ATTAPSAN	TECHNICAL FRESH WATER	CENTRE LINE	6 - 10	12.2	12.0	3.67	5.4
3.1	COOLING WATER TANK	COOLING WATER	PORT	17 - 21	5.5	5.4	1.16	18.9
3.2	COOLING WATER TANK	COOLING WATER	CENTRE LINE	18 - 19	9.5	9.3	0.99	4.2
4.1	H.F.O. DAILY SUPPLY TANK	HEAVY FUEL OIL	STBD	23 - 24	12.9	11.8	8.18	21.0
4.2	H.F.O. SETTLING TANK	HEAVY FUEL OIL	STBD	24 - 25	21.1	20.0	7.28	22.8
4.3	H.F.O. SETTLING TANK	HEAVY FUEL OIL	PORT	24 - 25	48.5	47.1	7.73	23.2
4.4	H.F.O. STORAGE TANK	HEAVY FUEL OIL	STBD	25 - 33	138.5	138.1	5.86	27.7
4.5	H.F.O. STORAGE TANK	HEAVY FUEL OIL	PORT	26 - 35	128.4	128.0	5.47	31.7
4.6	H.F.O. OVERFLOW TANK	HEAVY FUEL OIL	CENTRE LINE	31 - 35	31.4	30.9	3.68	32.8
5.1	M.D.O. STORAGE TANK	MARINE DIESEL FUEL OIL	CENTRE LINE	23 - 25	79.1	77.8	7.55	21.8
5.2	M.D.O. OVERFLOW TANK	MARINE DIESEL FUEL OIL	CENTRE LINE	23 - 24	19.8	19.3	8.48	9.8
5.3	M.D.O. DAILY SUPPLY TANK	MARINE DIESEL FUEL OIL	PORT	4 - 10	5.5	5.4	9.03	4.1
5.3	M.D.O. SETTLING TANK	MARINE DIESEL FUEL OIL	PORT	4 - 10	23.4	22.8	8.93	8.4
6.1	CYLINDER OIL TANK	CYLINDER OIL	STBD	13 - 17	6.5	6.3	6.43	8.1
6.2	LUBRICATING OIL TANK	LUBE OIL	PORT	13 - 17	13.4	13.2	6.64	6.8
6.3	LUBE OIL ANK (INCL.DIESEL)	LUBE OIL	PORT	15 - 17	2.8	2.7	5.83	5.8
6.4	LUBRICATING OIL CARGO TANK	LUBE OIL	CENTRE LINE	18 - 21	9.6	9.3	1.26	14.5
6.5	HYDRAULIC OIL DRAIN TANK	HYDRAULIC OIL	CENTRE LINE	129 - 142	4.1	4.0	11.08	137.1
6.6	USED OIL TANK	USED OIL	STBD	19 - 23	6.3	6.2	6.59	12.4
6.7	SEPARATED OIL TANK	LUBE OIL	STBD	13 - 17	5.9	5.8	6.43	8.1
6.8	SLUDGE OIL TANK	OIL RESIDUES	PORT	23 - 27	19.1	18.7	9.38	19.4
6.9	LEAKAGE OIL TANK	LEAKING OIL	CENTRE LINE	28 - 29	1.9	1.9	1.18	19.2
6.10	CHEMICAL OIL TANK	CHEMICAL OIL	STBD	24 - 27	8.4	8.2	9.55	16.8
6.11	CHEMICAL OIL TANK	CHEMICAL OIL	STBD	22 - 24	3.8	3.7	9.53	15.1
6.12	BILGE WATER TANK	BILGE WATER	STBD	31 - 37	8.1	7.9	1.37	19.1
6.13	BILGE WATER SETTLING TANK	BILGE WATER	PORT	13 - 17	15.8	15.5	5.84	8.2
7.1	SLOP TANK	WATER/OIL RESIDUES	PORT	31 - 38	140	137	0.49	24.5
7.2	SLOP TANK	WATER/OIL RESIDUES	STBD	31 - 38	140	140	9.43	24.8
DP / 25	EMPTY COMPARTMENT	———	PORT /STBD	125 - 126	53 / 53	52 / 52	6.19	81.2
DP / 45	EMPTY COMPARTMENT	———	PORT /STBD	102 - 116	52 / 56	50 / 52	6.19	77.2
DP / 93	EMPTY COMPARTMENT	———	PORT /STBD	89 - 96	56 / 56	52 / 52	6.19	82.3





2.1
2

Loading informations

To comply with the requirements of damage stability, vessel's cargo has depending on cargo's density, to be distributed as mentioned hereinafter:

Transportation of clean oil products and lightweight chemicals of category C:

-Cargo density from 0.65 t/m³ to 0.932 t/m³
The cargo has to be homogenic distributed over the central tanks port and starboard.

-Cargo density from 0.932 t/m³ to 1.55 t/m³
The cargo to be equally distributed to all central tanks.

To ensure damaged stability, ballast water in double bottom tanks is required (see damage stability).

In correspondance with the material list the dimensions of members of tank bulkheads are designed for :
-In case of central and slop tanks
density 1.31 to 1.55 t/m³ ; ps = 0 bar (without gas pressure)
density 0.65 to 1.30 t/m³ ; ps = 0.2 bar

In connection with this :
Transverse tanks bulkheads unable to resist loading to on side and the centre longitudinal tank bulkhead to both sides only.

More cargo informations see "TRIM AND STABILITY CALCULATION" drawing No. 996.25.06 .

main engine

1 slow-speed two-stroke marine Diesel engine „type 6 L 35 MC „
M A N B & W Alpha Diesel A/S „5600 kW „210 rpm

auxiliary Diesel engine set

3 marine sets „type TBD 604 BV 8 „
Rolf Janssen GmbH „560 kW „1200 rpm

emergency Diesel engine set

1 emergency diesel engine set „type 7 A L 413 FR „
Rolf Janssen GmbH „95 kW „1800 rpm

PTO

1 PTO „type SPL 75 inst 12 „
The Newbrook engineering Co Ltd. „315 kW

ballast pump

2 ballast pumps „190 m³/h „3 bar

controlable pitch propeller

D=3,1 m p=4 n=64,5 1

bow thruster

fixed-pitch propeller with hydraulic propulsion „410 kW

rudder and steering engine

1 semi-balanced underhung rudder area 16 m²
1 elektr.-hydr.standard cylinder steering engine max. moment 254 kNm

anchor gear

2 bow anchors 5,04 t stud link anchor chains diam. 48 mm
length of chains ach 275,0 m particle 247,5 m
1 stern anchor 1,29 t hawser: diam. 34 mm
length of hawsers: 150,0 m

rescue equipment

1 free fall lifeboat (in tankers condition 19 persons with slip way
1 life rafts 25 persons each
2 accident boat 6 persons

nautical instruments

gyro compass „Anschuetz-Kiel
magnetic compass „Clasen und Poth
hand control and autopilot steering system „Anschuetz-Kiel
echo sounder „Furuno-Japan
log „Den-France
2 radar unit „Racal Decca
wireless direction finder „Debeg-Hamburg
receiver for nautical notices "Navtex"
satellite navigator (GPS) „Decca navigator

TONNAGE

	gross	net
International measurement 1969	8262	3154
panama	6501.79 RT	4782.68 RT
suez	6494.14 RT	5177.34 RT

CLASS

Germanischer Lloyd

✠ 100 A5 E3 Chemical Tanker Type 2/Oil Tanker
✠ MC AUT E3 INERT

MAIN PARTICULARS

length overall	123.70 m
length between perpendiculars	117.60 m
breadth moulded	17.76 m
summer freeboard draught rel.to top of keel	8.56 m
depth moulded to main deck	10.80 m
displacement at drought T=+0.36m (top of keel)	13863 t
deadweight T=+8.56m (top of keel)	10591 t (T=+0m)
speed at drought T=+8.36m (top of keel)	12,5 knots
operating range 8000 nautical miles	

| | | | | | | | |

Appendix 7
Spill Kit Inventory
M/T *Dara Desgagnés*

Item	Size	Min Quantity	Quantity Onboard	Location Onboard
Portable Pumps and hoses	Sets	2	4	1 Main Deck 1 Dog House 1 Pump Room 1 Spare
Absorbent pads	Bales	5	10	5 in chemical locker 5 distributed between spill kits and stbd rop locker
Absorbent – particulate	Bales	5	30+	Boat Deck Local spill kits
Hand scoops, buckets and shovels	Each	3	3+	
Waste container	55 gal drum	2	3	2 at aft end gangway 1 in chemical locker
Emulsifiers	1 gal	5	5	White box at crane
Tyvec coveralls	Various	12	30	Chemical locker Spill kit drum
Boots, oil resistant	Various	12 pairs	12+	7 in chemical locker drum 5+ in change room
Gloves, oil resistant	Various	12 pairs	12	Chemical locker drum
Rags	Lbs	20	100+	Stbd rope locker

RIGEL SHIPPING CANADA Inc.	SAFETY FORMS Oil Spill Response Equipment Inventory

Ref: SMPEP Section 5.1 ONBOARD RESPONSE CAPABILITIES

Vessel: **Dara Desgagnes** Date Posted: October 31 2012

Item	Size	Min Quantity	Quantity Onboard	Location Onboard
Portable Pumps and hoses	Sets	2	4	1 main deck, 1 dog house, 1 pump room, 1 spare
Absorbent pads	Bales	5	10	5 in chemical locker, 5 distributed between spill kits and stbd rope locker
Absorbent – particulate	Bales	5	30+	boat deck, local spill kits
Hand scoops, buckets and shovels	Each	3	3+	
Waste container	55 gal drum	2	3	2 at aft end gangway, 1 in chemical locker
Emulsifiers	1 gal	5	5	white box at crane
Tyvec coveralls	Various	12	30	chemical locker spill kit drum
Boots, oil resistant	Various	12 pr	12+	7 pair in chemical locker drum, 5+ in change room
Gloves, oil resistant	Various	12 pr	12	in chemical locker drum
Rags	Lbs	20	100+	stbd rope locker

Appendix 8

Foam and water extinguishing lines on cargo deck

- See drawing #996.51.35

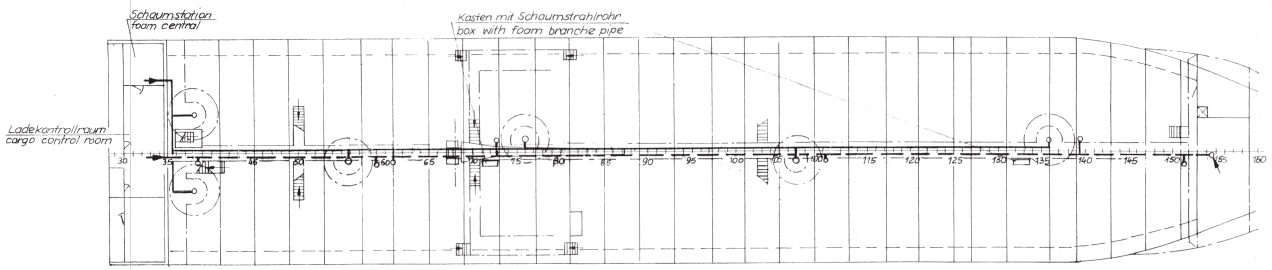
Procedures for Oil Spill Air Pump

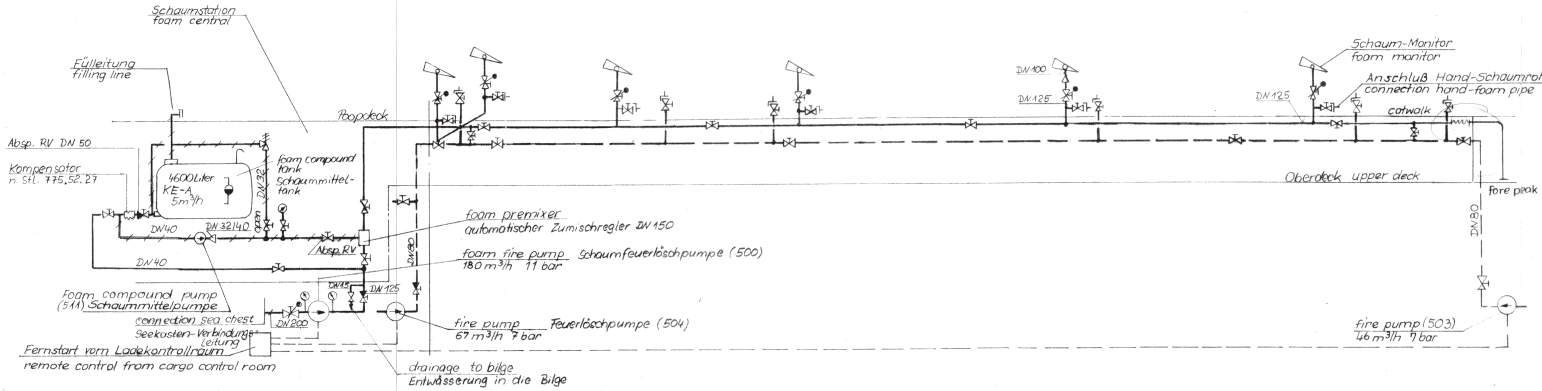
- Procedure to pump out Driptrays Manifolds:

  1. Connect suction hose from air driven 1□pump to connections A, B, C and D as desired.
  2. Connect discharge hose of air driven 1□pump to either the port dropline E or STBD dropline F on deck. This will usually be the Port dropline E.
  3. Open valves as needed and pump contents to the connected sloptank (E or F).
  4. Close valves and continue with other drip trays using above procedure.
  5. When completed drain/purge hoses to slop tank and disconnect.

- Procedure to pump liquid from the Deck:

  1. Connect suction hoses to Y-section of air driven 2□pump.
  2. Connect port side hose with valve G and STBD side hose with valve H to Y-section.
  3. Connect discharge hose of air driven 2□pump to either the Port dropline E or STBD dropline F on deck. This will usually be the Port dropline E.
  4. Open valves as needed and pump liquids to the connected sloptank (E or F).
  5. When finished pumping liquids drain/purge hoses and close valves and disconnect.





Änd.	Änd. Buch./Mitteilg Nr.	Tag	Name

COT-12,5 123-126

	Tag	Name
1992		
Entw.	10.10	B. Weber
Gez.	13.10	Brunken
Oberr.	13.10	Knöfler
St. gep.		
Ges.	13.10	i. A. Ka.

MTW Schiffswerft GmbH

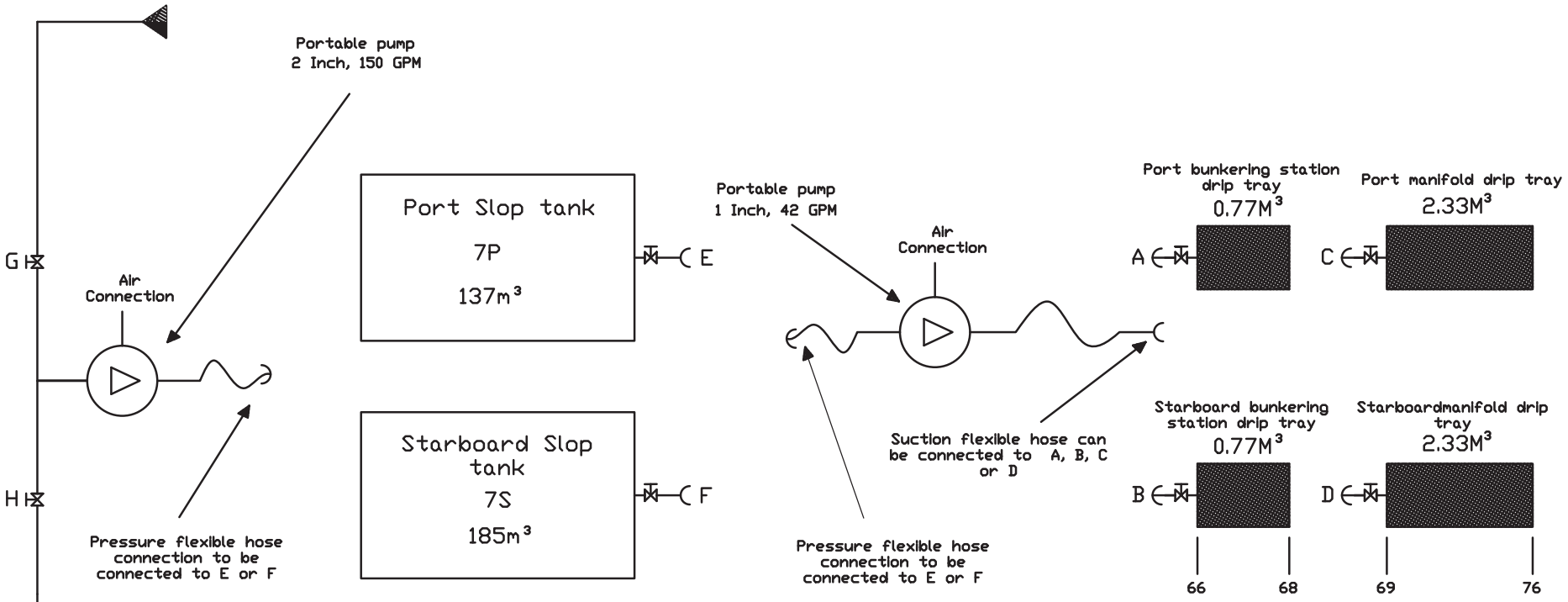
Benennung: Prinzipschema Schaum-u. Wasserfeuerlösch Ladetank

block diagram foam- and water-extinguishing cargo deck

Abt. TKM-2

Zeichng.-Nr. 996.51.35

Tel. 2499


Portable pump
2 Inch, 150 GPM
G
H
Air
Connection
Pressure flexible hose
connection to be
connected to E or F
Port Slop tank
7P
137m³
E
Starboard Slop
tank
7S
185m³
F
Portable pump
1 Inch, 42 GPM
Air
Connection
Pressure flexible hose
connection to be
connected to E or F
Suction flexible hose can
be connected to A, B, C
or D
Port bunkering station
drip tray
0.77M³
A
Port manifold drip tray
2.33M³
C
Starboard bunkering
station drip tray
0.77M³
B
Starboardmanifold drip
tray
2.33M³
D
66
68
69
76

APPENDIX B - Transfer Conduit Annual Pressure Test

ONTARIO HOSE & COUPLINGS LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Quebec	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Street Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-8214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	SBQ	Size:	4"
Number:	PNV00034	Length:	400FT
Part Number:		HAWP (PSI):	200
Order:	Q51378	Temperature Range:	
PO:	11942	Rating:	4/5 ☆☆☆☆☆
Unit Number:	32019-07	This is in excellent condition and is ok to be in service	
Location:	Jana	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
Cam Arm Damaged			

Repairs conducted by: sbq
Printed: Monday, June 18, 2018
To view as PDF click here

This report was created by HoseTracker.
Please refer to all instruction manuals, technical drawings and documents before using the above equipment.
All products have been tested and inspected in accordance with the appropriate ANSI stanad.

ONTARIO HOSE & COUPLINGS LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Quebec	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Street Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-8214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	SBQ	Size:	4"
Number:	PNV00055	Length:	400'
Part Number:		HAWP (PSI):	200
Order:	108223	Temperature Range:	
PO:	11939	Rating:	4/5 ☆☆☆☆☆
Unit Number:	26025-03	This is in excellent condition and is ok to be in service	
Location:	marla small	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
Cam Arm Damaged			

Repairs conducted by: sbq
Printed: Monday, June 18, 2018
To view as PDF click here

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ONTARIO HOSE & COUPLINGS LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Quebec	Maritimes
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Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-8214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(AL)MxF (Aluminum Male x Female Camlock)
Hose Type:	Goodyear	Size:	4"
Hose Number:	PNV00132	Length:	390'
Part Number:		HAWP (PSI):	200
Order:		Temperature Range:	
PO:	12995	Rating:	3/5 ☆☆☆☆☆
Unit Number:	2012	This Hose is acceptable for use in service	
Location:	Jana Small	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
		Tube Leaked	

Repairs conducted by: sbq
Printed: Monday, June 18, 2018
To view as PDF click here

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ONTARIO HOSE & COUPLINGS LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Quebec	Maritimes
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Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-8214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00170	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:	2014	Rating:	4/5 ☆☆☆☆☆
Unit Number:		This is in excellent condition and is ok to be in service	
Location:	marla	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
			Damaged

Repairs conducted by: sbq
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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00171	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:	2014	Rating:	4/5 ☆☆☆☆☆
Unit Number:		This is in excellent condition and is ok to be in service	
Location:	marla	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
Cam Arm Damaged			

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00174	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:		Rating:	4/5 ☆☆☆☆☆
Unit Number:	2014	This is in excellent condition and is ok to be in service	
Location:	Jana	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
Cam Arm Damaged			

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00175	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:		Rating:	4/5 ☆☆☆☆☆
Unit Number:	2014	This is in excellent condition and is ok to be in service	
Location:	Jana	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover
Cam Arm Damaged			

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00177	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:		Rating:	4/5 ☆☆☆☆☆
Unit Number:	2014	This is in excellent condition and is ok to be in service	
Location:	Jana	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	floater hose	Size:	4
Number:	PNV00177	Length:	400'
Part Number:	GOODYEAR FITTINGS	HAWP (PSI):	200
Order:		Temperature Range:	
PO:		Rating:	4/5 ☆☆☆☆☆
Unit Number:	2014	This is in excellent condition and is ok to be in service	
Location:	Jana	CRN:	N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Type:	Goodyear	Size:	4"
Number:	PNV00226	Length:	220'
Part Number:		HAWP (PSI):	200
Order:		Temperature Range:	
PO:		Rating:	4/5 ☆☆☆☆☆
Unit Number:	Cut in half from # 212	This is in excellent condition and is ok to be in service	
Location:	Quebec		N/A
Colour:	Orange		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Hose Type:	Floater Hose	Size:	4"
Hose Number:	PNV00230	Length:	400'
Part Number:	Continental Floater Hose	HAWP (PSI):	200
Order:	1139497	Temperature Range:	
PO:	12560	Rating:	5/5 ☆☆☆☆☆
Unit Number:	2016	This is a brand new Hose and is OK to be in service	
Location:	Quebec		N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

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TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Hose Type:	Floater Hose	Size:	4"
Hose Number:	PNV00230	Length:	400'
Part Number:	Continental Floater Hose	HAWP (PSI):	200
Order:	1139497	Temperature Range:	
PO:	12560	Rating:	5/5 ☆☆☆☆☆
Unit Number:	2016	This is a brand new Hose and is OK to be in service	
Location:	Quebec		N/A
Colour:	-		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	6/18/2018	Hydro-Pressure:	6/18/2019
Static:	6/18/2018	Static:	6/18/2019
Visual:	6/18/2018	Visual:	6/18/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

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TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00265	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
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TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00267	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
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TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00267	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
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TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00269	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
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Mississauga	Sarnia	Stoney Creek	Kingston	Montreal	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Stree Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-6214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00270	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
Printed: 6/15/2018

This report was created by HoseTracker.
Please refer to all instruction manuals, technical drawings and documents before using the above equipment.
All products have been tested and inspected in accordance with the appropriate ANSI standards.

ONTARIO HOSE & COUPLINGS LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Quebec	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Street Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-8214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	Fittings:	(SS)MxF (Stainless Steel Male x Female Camlock)
Hose Type:	floater hose	Size:	4"
Hose Number:	PNV00272	Length:	400'
Part Number:	GMFH4X400orangeRT	HAWP (PSI):	200
Order:	1173960	Temperature Range:	
PO:	12884	Rating:	5/5 ☆☆☆☆☆
Unit Number:	Fab:2018	This is a brand new Hose and is OK to be in service	
Location:	Quebec		N/A
Colour:	Orange		

Last Test Date		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	Hydro-Pressure:	4/30/2019
Static:	4/30/2018	Static:	4/30/2019
Visual:	4/30/2018	Visual:	4/30/2019

Test PSI:	300	Length of Pressure Test:	

Reasons for Repair

Fittings	Clamp/Ferrule	Tube	Cover

Repairs conducted by:
Printed: Monday, June 18, 2018
To view as PDF click here

This report was created by HoseTracker.
Please refer to all instruction manuals, technical drawings and documents before using the above equipment.
All products have been tested and inspected in accordance with the appropriate ANSI stanad.

ONTARIO HOSE SPECIALTIES LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Montreal	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Stree Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-6214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	floater hose	**Size:**	4"
Hose Number:	PNV00274	**Length:**	400'
Part Number:	GMFH4X400orangeRT	**HAWP (PSI):**	200
Order:	1173960	**Temperature Range:**	
PO:	12884	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	Fab:2018	**CRN:**	N/A
Location:	Quebec	**Colour:**	Orange

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	4/30/2018	**Hydro-Pressure:**	4/30/2019
Static:	4/30/2018	**Static:**	4/30/2019
Visual:	4/30/2018	**Visual:**	4/30/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
Printed: 6/15/2018

This report was created by HoseTracker.
Please refer to all instruction manuals, technical drawings and documents before using the above equipment.
All products have been tested and inspected in accordance with the appropriate ANSI standards.

ONTARIO HOSE SPECIALTIES LTD.

HOSETRACKER

Mississauga	Sarnia	Stoney Creek	Kingston	Montreal	Maritimes
6295 Kestrel Road Mississauga, Ontario L5T 1Z4	480 Polymoor Drive Corunna, Ontario N0N 1G0	263 Barton Stree Stoney Creek, Ontario L8E 2K4	639 Justus Drive Kingston, Ontario K7M 4H5	1900 Hymus Blvd Dorval, Quebec H9P 1J7	10 Akerley Blvd U#25 Dartmouth, Nova Scotia B3B 1J4
Tel: 905-670-0113 Fax: 905-670-4958	Tel: 519-336-8541 Fax: 519-336-8543	Tel: 905-662-0276 Fax: 905-662-0542	Tel: 613-549-7316 Fax: 613-549-6214	Tel: 514-685-1266 Fax: 514-685-1606	Tel: 902-465-5220 Fax: 902-465-5296

www.ontariohose.com

TEST CERTIFICATE

Customer:	Petro-Nav	**Fittings:**	Stainless Steel Male x Female Camlock
Hose Type:	Goodyear	**Size:**	4"
Hose Number:	PNV00286	**Length:**	400'
Part Number:	GMFH4x400-ORANGE-F	**HAWP (PSI):**	200
Order:	1176561	**Temperature Range:**	
PO:	12894	**Rating:**	5/5 This is a brand new Hose and is OK to be in service
Unit Number:	14/06/18	**CRN:**	N/A
Location:	Dara	**Colour:**	-

Last Test Date(s)		Scheduled Retest Date(s)	
Hydro-Pressure:	6/14/2018	**Hydro-Pressure:**	6/14/2019
Static:	6/14/2018	**Static:**	6/14/2019
Visual:	6/14/2018	**Visual:**	6/14/2019

Test PSI: 300 **Length Of Pressure Test:** N/A

No repair reasons listed

Test last conducted by: N/A
Printed: 6/15/2018

This report was created by HoseTracker.
Please refer to all instruction manuals, technical drawings and documents before using the above equipment.
All products have been tested and inspected in accordance with the appropriate ANSI standards.

DARA - AEM Following Testing and Load			
Main Reel # 3			
#	Hose #		Feet
1	34	2007	400
2	55	2007	400
3	175	2014	400
4	174	2014	400
5	177	2014	400
6	171	2014	400
7	170	2014	400
8	274	2018	400
9	270	2018	400
10	272	2018	400
11	265	2018	400
12	267	2018	400
13	269	2018	400
14	230	2016	400
15	226	2016	220
16	132	2016	390
17	286	2018	400
18			
19			
20			
	Sub-Total main reel		6610
	6610		

APPENDIX C - MEL-ENV-0029: Agnico Pre-discharge and Spill Response Sea Can checklists & OHF Ship to Shore Fuel Discharge Procedure

OHF / Ship to Shore Fuel Discharge

		PROCEDURE NUMBER:	**MEL-ENV-0029**
People concerned	• **Environment** • **Site Services** • **Procurement and Logistics** • **Health and Safety**	**Prepared by**	**Environment Department**
		Authorized by	**Erika Voyer – Environment General Supervisor**
Effective :	**July 12, 2017**	***"Safety First, Safety Last … Safety Always!"*** ***"No Repeats" – Our Stepping Stone to ZERO HARM***	
This procedure corresponds to the required minimum standard. Each and every one also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

- To ensure that prior to the discharge of any fuel into the Agnico Eagle Rankin Inlet Tank Farm or Agnico Eagle Rankin Inlet Oil Handling Facility (OHF) that all proper steps are in place to ensure compliance with Canadian Shipping Act, as well as Nunavut Water Board License, Nunavut Impact Review Board Certificate and other laws and regulations.

Concerned departments:

Environment

Health & Safety

Site Services

Procurement and Logistics

Risks/ Impacts Legend

Health & Safety

Process/quality

Legal Requirement

Environment

Prior to the beginning of the annual fuel discharge the following must be completed.

Procedure	Risks/ Impacts
1. The Oil Pollution Emergency Plan (OPEP) must be reviewed on an annual basis and updated prior to the first annual discharge. This will include but not limited to: a) Reviewing the Phone numbers for emergency's b) Updating maps c) Review and if necessary update equipment lists d) Review roles and responsibilities e) Update Declaration This is the responsibility of the Environment department.	
2. Contact Canadian Coast Guard and Transport Canada Pollution Prevention and make them aware of plans for transferring of fuel into our OHF for that season. This is the responsibility of the Environment department.	
3. Complete *Inventory report for Spill Response Sea Can at AEM's Oil Handling Facility in Rankin Inlet.* (*Inventory Checklist found on Page 6) This is the responsibility of the Environment Department.	
4. Ensure Shipping Company has provided Hose Testing Annual certification. This is the responsibility of the Environment Department.	
5. All personnel who will be a part of the fuel transfer (including Rankin Inlet Supervisor and third part contractor Intertek) must review the OPEP and be familiar with preventive measures to take and with the steps to take in the case of a spill event while fueling. This is the responsibility of the Department of Procurement and Logistics.	
6. Install secondary containment underneath each connection of conduit on land. This is the responsibility of the Environment Department	

7. Monitor secondary containment underneath each connection of conduit on land. This is the responsibility of the Department of Procurement and Logistics.	
8. Ensure there is two way functional communications between the OHF and the off-loading Vessel. This is the responsibility of the Department of Procurement and Logistics.	
9. Ensure there is lighting in place at the transfer flange to provide illumination during any transfers taking place during the low to no light hours. This is the responsibility of the Department of Procurement and Logistics.	
10. Prior to any discharge Agnico Eagle must receive a copy of the Ship/Shore checklist completed by the shipping company. Agnico Eagle should also verify this has been completed (as much as realistically possibly without boarding the ship). This is the responsibility of the Department of Procurement and Logistics.	
11. Contact must be made with both the H&S and Environmental Departments prior to the discharge of fuels. Meliadine Health & Safety meliadine.healthandsafety@agnicoeagle.com Meliadine Environment meli.environment@agnicoeagle.com This is the responsibility of the Department of Procurement and Logistics.	
12. The *Pre-discharge Checklist for AEM's Oil Handling Facility in Rankin Inlet* must be completed, signed and provided to the Environment Department prior to discharge. (*Checklist found on Page 5) This must be done for each fuel tanker for each campaign. This is the responsibility of the Department of Procurement and Logistics.	
Transfer	
1. Once the above points are completed, the ship to shore transfer can commence.	

2. Photos of the complete fuel transfer process should be taken, visually proving that all above procedures have been reached. This is the responsibility of Environment and Procurement and Logistics Departments.	
3. During the ship-to-shore transfer, Agnico Eagle will have competent personnel on location at all times to monitor the fuel transfer and maintain contact with the tanker's crew. This is the responsibility of the Department of Procurement and Logistics.	
4. Monitor the fuel transfer at the beginning of each transfer and after that on an hourly basis checking the manifold, conduit, tank, and any connection points on land for spills and/or leaks. Communication between shore and ship should take place on an hourly basis. This is the responsibility of the Department of Procurement and Logistics.	
5. We are required by law to have a fuel spill scenario every two years. However, since we have shift work at Meliadine, to ensure adequate training annually we will do mock spill/training and switch shifts each year. This way each shift completes every second year. This is the responsibility of the Environment Department in conjunction with the Emergency Response Team to plan and execute.	

OHF / Ship to Shore Fuel Discharge

Pre-discharge Checklist for Agnico Eagle's Oil Handling Facility in Rankin Inlet

Date :

Inspected By :

Time :

Vessel Unloading :

Pre-Discharge Check List	Conform	Non-conform	Comments
Is there two way communications between the OHF and the off-loading Vessel?			
Has a review of response material checklist been completed?			
Current Copy of OPEP and Declaration at the OHF.			
Prior to discharge, have the certification of the transfer conduits been received?			
Has there been secondary containment placed underneath each connection of Conduit?			
Is lighting in place at the transfer flange to provide illumination during any transfers taking place during the low to no light hours.			
Prior to discharge, has the Vessels' Ship/Shore checklist been reviewed and a completed copy received by Agnico Eagle?			
Prior to discharge inform H&S and Environment Departments that fuel transfer will commence.			
Has the emergency response equipment been reviewed with all personnel and contractors on shore?			

Comments / Recommendations

Signature :

Inventory report for Spill Response Sea Can at Agnico Eagle's Oil Handling Facility in Rankin Inlet

Date :

Inspected By :

Time :

Vessel Unloading :

Subject	Conform	Non-conform	Comments
Is the material and PPE stored in a manner that is organized and accessible in order to easily respond to spill?			
Are the sea cans in physically good shape? Easy to open?			
Are the sea cans identified as "Environmental Emergency Sea Can"?			
Is all the spill material in place?			
6 x Anchor sets (25 kg anchor, chain ballast, rode line and marker buoy)			
4 x Tow bridles with bullet float			
32 x 8" float x 12" skirt Optimax 2 Boom – 25' Sections			
1 x mini Max hydraulic skimmer with pump, power pack			
1 x Aluminum boat with 15 hp prop motor			
10 x 1/2" polyester yacht braid rope (600' rolls)			
5 x Drive pin anchors			
5 x slater anchors			
5 x wing anchors			
30 x sorbent boom, 5" x 4 per bag			
4 x mustang floater suit			

8 x personal floatation devices			
12 x oil resistant gloves			
12 x leather gloves			
2 x sledge hammer with fiberglass handle			
2 x spade – long handle			
2 x Fire extinguisher – 20 lb ABC with brackets			
20 x Tyvex Suit XL			
1 x Alberta standard #3 First aid kit			
4 x Storage totes for small items			
1 x quick tank (500 gallon / 1893 ltrs.)			

Comments / Recommendations

Signature :

APPENDIX D – MSDS for P-50 Diesel

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DIESEL FUEL
Synonyms	:	Seasonal Diesel, #1 Diesel, #2 Heating Oil, #1 Heating Oil, D50, Arctic Diesel, Farm Diesel, Marine Diesel, Low Sulphur Diesel, LSD, Ultra Low Sulphur Diesel, ULSD, Mining Diesel, Naval Distillate, Dyed Diesel, Marked Diesel, Coloured Diesel, Furnace special, Biodiesel blend, B1, B2, B5, Diesel Low Cloud (LC). Marine Gas Oil
Product code	:	101802, 100107, 100668, 100658, 100911, 100663, 100652, 100460, 100065, 101796, 101793, 101795, 101792, 101794, 101791, 100768, 100643, 100642, 100103, 101798, 101800, 101797, 101788, 101789, 101787, 102531, 100734, 100733, 100640, 100997, 100995, 100732, 100731, 100994

Manufacturer or supplier's details

Petro-Canada
P.O. Box 2844, 150 - 6th Avenue South-West
Calgary Alberta T2P 3E3
Canada

Emergency telephone number		Suncor Energy: +1 403-296-3000; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining diesels, marine diesels, MDO and naval distillates may have a higher flash point requirement.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Bright oily liquid.
Colour	Clear to yellow (This product may be dyed red for taxation purposes).
Odour	Mild petroleum oil like.

GHS Classification

Flammable liquids	:	Category 3
Acute toxicity (Inhalation)	:	Category 4

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Skin irritation	:	Category 2
Carcinogenicity	:	Category 2
Specific target organ toxicity - single exposure	:	Category 3 (Central nervous system)
Specific target organ toxicity - repeated exposure	:	Category 2 (Liver, thymus, Bone)
Aspiration hazard	:	Category 1

GHS Label element

Hazard pictograms :

Signal word : Danger

Hazard statements : H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H332 Harmful if inhaled.
H336 May cause drowsiness or dizziness.
H351 Suspected of causing cancer.
H373 May cause damage to organs (Liver, thymus, Bone) through prolonged or repeated exposure.

Precautionary statements : **Prevention:**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ eye protection/ face protection.
P281 Use personal protective equipment as required.
Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312 IF INHALED: Remove victim to fresh air

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and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.

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P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Storage:
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact Skin Absorption
Target Organs	:	Skin Eyes Respiratory Tract
Inhalation	:	May cause respiratory tract irritation. Inhalation may cause central nervous system effects. Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness.
Skin	:	Causes skin irritation.
Eyes	:	Causes eye irritation.
Ingestion	:	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Aspiration hazard if swallowed - can enter lungs and cause damage.
Aggravated Medical Condition	:	None known.

Carcinogenicity:

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

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equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
kerosine (petroleum), hydrodesulfurized	64742-81-0	70 - 100 %
kerosine (petroleum)	8008-20-6	
fuels, diesel	68334-30-5	
fuel oil no. 2	68476-30-2	
Alkanes, C10-20-branched and linear	928771-01-1	0 - 25 %
Soybean oil, Methyl ester	67784-80-9	0 - 5 %
Rape oil, Methyl ester	73891-99-3	
Fatty acids, tallow, Methyl esters	61788-61-2	

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

Most important symptoms : First aider needs to protect himself.

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and effects, both acute and delayed

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Dry chemical Carbon dioxide (CO2) Water fog. Foam
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation.

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In case of insufficient ventilation, wear suitable respiratory equipment

Avoid spark promoters. Ground/bond container and

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equipment. These alone may be insufficient to remove static electricity.
Avoid contact with skin, eyes and clothing.
Do not ingest.
Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
kerosine (petroleum), hydrodesulfurized	64742-81-0	TWA	200 mg/m3	ACGIH
kerosine (petroleum)	8008-20-6	TWA	100 mg/m3	NIOSH REL

Engineering measures : Use only in well-ventilated areas.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

Hand protection
Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for

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wear and tear. At the first signs of hardening and cracks, they should be changed.

Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Bright oily liquid.
Colour	:	Clear to yellow (This product may be dyed red for taxation purposes).
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	No data available
Boiling point/boiling range	:	150 - 371 °C (302 - 700 °F)
Flash point	:	> 40 °C (104 °F) Method: closed cup
Auto-Ignition Temperature	:	225 °C (437 °F)
Evaporation rate	:	No data available
Flammability	:	Flammable in presence of open flames, sparks and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite.
Upper explosion limit	:	6 %(V)
Lower explosion limit	:	0.7 %(V)
Vapour pressure	:	7.5 mmHg (20 °C / 68 °F)

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Relative vapour density	:	4.5
Relative density	:	0.8 - 0.88
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	1.3 - 4.1 cSt (40 °C / 104 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Runoff to sewer may create fire or explosion hazard.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents and acids.
Hazardous decomposition products	:	May release COx, NOx, SOx, H2S, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Eye contact
Ingestion
Inhalation
Skin contact
Skin Absorption

Acute toxicity

Product:

Acute oral toxicity	Remarks: No data available
Acute inhalation toxicity	Remarks: No data available
Acute dermal toxicity	Remarks: No data available

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Components:

kerosine (petroleum), hydrodesulfurized:

Acute oral toxicity LD50 (Rat): > 5,000 mg/kg

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Acute inhalation toxicity	LC50 (Rat): > 5.2 mg/l Exposure time: 4 hrs Test atmosphere: dust/mist
Acute dermal toxicity	LD50 (Rabbit): > 2,000 mg/kg

kerosine (petroleum):

Acute oral toxicity	LD50 (Rat): > 5,000 mg/kg
Acute inhalation toxicity	LC50 (Rat): > 5 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	LD50 (Rabbit): > 2,000 mg/kg

fuels, diesel:

Acute oral toxicity	LD50 (Rat): 7,500 mg/kg
Acute dermal toxicity	LD50 (Mouse): 24,500 mg/kg

fuel oil no. 2:

Acute oral toxicity	LD50 (Rat): 12,000 mg/kg
Acute inhalation toxicity	LC50 (Rat): 4.1 mg/l Exposure time: 4 h Test atmosphere: dust/mist

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

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No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.
Contaminated packaging	:	Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulation

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IATA-DGR

UN/ID No.	:	1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	3
Packing instruction (cargo aircraft)	:	366

IMDG-Code

UN number	:	1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

49 CFR

UN/ID/NA number	:	1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

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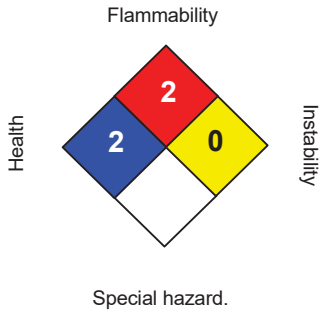
Further information

NFPA:



HMIS III:

HEALTH	2
FLAMMABILITY	2
PHYSICAL HAZARD	0
PERSONAL PROTECTION	H

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet 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 guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered 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 materials or in any process, unless specified in the text.

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APPENDIX E –Ship to shore checklist and cargo pre arrival - Coastal Shipping LTD

Ship / Shore Cargo Checklist

Vessel: _____
Port: _____
Date: _____
Operation: ❒ Discharge ❒ Load

Letter Codes

A Any procedures and agreements should be in writing in the remarks column of this checklist or other mutually acceptable form. In either case, the signature of both parties is required

P In the case of a negative answer, the operation should not be carried out without the permission of the port authority.

R Items to be rechecked regularly, not exceeding the time specified in the declaration

General cargo considerations: (check (•) under Ship/Shore if OK, otherwise provide comment)

Item	Ship	Shore	Code	Comments
Is the vessel securely moored?			**R**	Stop Cargo at_____knts wind velocity Disconnect at_____knts wind velocity Unberth at_____knts wind velocity
Are emergency towing wires correctly positioned?			**R**	
Is there safe access between the ship and the shore?			**R**	
Is the ship ready to move under it's own power?			**P R**	
Is there an effective deck watch in attendance on the ship and adequate supervision on shore?			**R**	
Is the agreed ship/shore communication system operative?			**A R**	Method:
Has the emergency signals to be used by the ship and shore been explained and understood?			**A**	
Have the procedures for cargo, bunkering and ballast been agreed upon?			**A R**	
Have the hazards associated with toxic substances within the cargo being handled been identified and understood?				
Has the emergency shutdown procedure been agreed?			**A**	
Are fire-hoses and fire fighting equipment on board and ashore positioned and ready for immediate use?			**R**	
Are cargo and bunker hoses/arms in good condition, properly rigged and appropriate for intended use?				
Are scuppers effectively plugged drip tray valves closed both on board and ashore?			**R**	
Are unused cargo and bunker connections properly secured with blank flanges fully bolted?				
Are Sea and overboard discharge valves closed when not in use?				
Are all cargo and bunker tank lids closed?			**A R**	
Is the agreed tank venting system being used?				
Has the operation of P/V valves been verified?				
Are flashlights in use of an approved type?				
Are portable VHF/UHF radios of an approved type?				
Are the ships MF/HF radios grounded, VHF radios set to low power and 10 cm radars shut off?				
Is any portable electrical equipment disconnected?				
Are all external doors and ports in the accommodation closed?			**R**	
Are air intakes, which may permit the entry of cargo vapours, closed?				
Is the galley staff informed of loading/discharged operations?				
Are Smoking regulations being observed?			**R**	
Are naked light rules being observed?			**R**	
Is there provision for an emergency escape?				

Are there sufficient personnel on board and ashore to deal with an emergency?			**R**	
Are adequate insulating means in place in the ship shore connection?				
Is the pumproom ventilation adequate?			**R**	
Have the requirements for closed loading been agreed?				
Has a vapour return line been connected?				
If so, have the operating parameters been agreed?				
Are ship emergency fire control plans located externally?				
Are appropriate signals being displayed?				

Inert Gas Systems (if in use):

Item	Ship	Shore	Code	Comments
Is the Inert Gas System operational and in good working order?			**P**	
Are deck seals in good working order?			**R**	
Are Liquid levels in P/V breakers Correct? Have O^2 Analysers been calibrated and are working properly?			**R** **R**	
Are IG pressure and Oxygen recorders working properly? Are all Cargo tanks at positive pressure with O^2content of <8%?			**R** **P R**	
Are all IG Tank valves correctly set and locked?			**R**	
Are all the persons in charge of cargo operations aware that in the case of failure of the Inert Gas Plant, discharge operations should cease and the terminal be advised?			**R**	

Tank Cleaning (if planned while ship is at berth):

Item	Ship	Shore	Code	Comments
Has the port authority approved any tank-cleaning operations planned during the ships stay?			**P**	

Operations:

Item	Value	Ship	Shore
Initial cargo transfer rate to be used (m^3/hr, bbls/hr, etc)			
Maximum cargo transfer rate to be used (m^3/hr, bbls/hr, etc)			
Topping off rate to be used (m^3/hr, bbls/hr, etc)			
Maximum hose pressure to be used (bar)			
Quantity of cargo to be transferred (m3, bbls of each grade)			
Hose to be drained after transfer complete	❒ Ashore ❒ Back to vessel		
Hose to be cleared by	❒ Gravity ❒ Comp. Air ❒ Pig		
Emergency stop button located	❒ On Ship ❒ Ashore		

Declaration:

We the undersigned have checked, where appropriate jointly the items on this checklist and are satisfied that the entries made are to the best of our knowledge correct.We have also made arrangements to carry out repetitive checks as necessary and agreed that those items with the letter **R** in the column **Code** should be rechecked at intervals not exceeding_____hours.

Signatures:

For Vessel	**For Shore**
Name: _____	Name: _____
Rank: _____	Position: _____
Signature: _____	Signature: _____
Date & Time: _____	Date & Time: _____

Cargo Preparation Checklist

Vessel: __
Port: __
Date: __

Prior to entering a port or terminal:

Item	Completed
Emergency towline, anchor releasing mechanism, and mooring lines and winches are inspected to determine that the equipment is ready for use and in good condition.	

Prior to cargo transfer operations an examination and testing of the following items:

Item	Completed
All external doors, ports, and similar openings, which lead directly from the tank deck to the accommodation or machinery spaces, are closed.	
P/V valves and the venting system have been inspected and properly set for the transfer operation and the high-level alarm system has been tested. A High Level and PV Valve Checks form has been completed	
Pumproom strainer covers, inspection plates, and drain plugs are properly positioned and secure.	
Flange connections are all fully bolted and tightened with no improvised arrangements in place.	
Visual examination of all hoses and verification of hose certificate before use.	
Sea and overboard discharge valves, when not in use, are securely closed, lashed and sealed.	
Fire extinguishing and pollution control equipment is in place and ready for immediate deployment.	
Scupper plugs have been inspected and are in place and secured.	
Bondable drip trays are available for each manifold connection to be made.	
Tools for deploying, connecting blowing, pigging, disconnecting and recovering cargo hose are prepared as required.	
All cargo transfer valves are operational and positioned as be required. Closed valves are lashed as appropriate.	
When loading multiple grades, sufficient segregation is in place and ship personnel are made aware.	
Manifold(s) to be used are fitted with the correct reducers or adaptors for expected connection and all unused manifolds are drained and blanked.	
All pressure and temperature gauges on manifolds to be used are functioning correctly and calibrated.	
Emergency shut down mechanism has been tested and ship personnel are familiar with its use.	
Fire wires are positioned correctly, if required by terminal.	
Sufficient auxiliary machinery is running to ensure adequate electrical power is available during cargo operations.	
Compressed air is available on deck to run SOPEP pumps and blow/pig hoses are required.	
A list of responsible officers on duty during transfer is posted and readily available. Crew are familiar with their watches during cargo operations.	
Arrangements have been made to ensure the Master and/or the Chief Officer will be on board and available at all times during cargo operations.	

Additional comments or conditions:

Signatures:

Name: _____ Name: _____

Rank: _____ Rank: Chief Officer

Signature: _____ Signature: _____

APPENDIX F – The Central and Arctic Regional Response Plan (2008)

Canadian Coast Guard
Central & Arctic Region

Regional Response Plan

December 2008

LETTER OF PROMULGATION

The *Central & Arctic Regional Response Plan (2008)* replaces the *Central & Arctic Region Contingency Chapter (2006)* and the *Arctic Response Strategy (1999)*. This plan is a component of the *Canadian Coast Guard Nationa Response Plan* which is the responsibility of the Director of Safety and Environmental Response Systems, Ottawa. It establishes the framework and the procedures by which Central & Arctic Region will prepare for, assess, respond to and document actions taken in response to pollution incidents in this Region.

The saving of life is of paramount consideration and the Plan is subordinate to the operational requirements of marine search and rescue.

The Plan has been reviewed by the internal partners identified in Section 3.3 in context to the services they may provide and by the external partners identified in Sections 3.4 and 3.5 to confirm their mandated response authorities.

Responsibility for the *Regional Response Plan* lies with the Assistant Commissioner Coast Guard Central & Arctic Region. The Central & Arctic Region Environmental Response branch is the custodian of the plan. The responsibility for specific sections is identified in Section 7 - Plan Maintenance and Custodians. Comments, recommendations and communications relating to the various sections are clearly identified in this section.

REVISION RECORD

CENTRAL & ARCTIC REGIONAL RESPONSE PLAN			
Section	Replace	Transmittal No.	Description of Changes
Entire Plan	All	December 1, 2005	Complete revision of Central & Arctic Regional Response Plan
Entire plan	All	April 1, 2006	Complete revision of Central & Arctic Regional Response Plan
7.1 Maintenance Process	Page 7-1	May 8, 2007	Update address to 520 Exmouth Street
8.3 CCG ER Phone List	Page 8-1	June 4, 2007	Update address to 520 Exmouth Street
Entire Plan	All	December 2008	Complete revision of Central & Arctic Regional Response Plan

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Section 1 - INTRODUCTION

1.1. Authority

This plan is based upon the policy and guiding principles set forth in the *National Response Plan* of the *Canadian Coast Guard National Response Strategy*.

1.2. Purpose

The *Central and Arctic Regional Response Plan* is designed as a guide to Canadian Coast Guard staff and relevant stakeholders involved in marine spill responses. It outlines the Regional application of the various roles of On-Scene Commander (OSC) (active response), Federal Monitoring Officer (FMO) (ensuring the Responsible Party fulfills their obligations), and as a Resource Agency (in assistance to other Lead Agencies).

It contains the specific information and activities that are pertinent to all spill response activities within Central & Arctic Region (C&A Region).

1.3. Area of Responsibility

For the purposes of marine pollution response Central & Arctic Region is defined geographically as:

- The contiguous waters of the Canadian Arctic (North of 60^{o} Latitude) to the limits of the International Boundary, including the North Slope Area of the Yukon Territories, and internal waters of the Northwest Territories and the Territory of Nunavut; and

- The waterways contained within the provinces of Alberta, Saskatchewan, Manitoba, Ontario, and a western portion of Quebec commencing at the east wall of the Beauharnois Lock in the St. Lawrence River.

(see Figure 1-1 Fisheries and Oceans Central & Arctic Region)

Significant waterways include the Canadian Great Lakes and interconnecting waterways to the international Boundary with the United States, Hudson and James Bays, Lake Winnipeg, Lake Athabasca and interconnecting waterways, Great Slave Lake, Mackenzie River and the Northwest Passage in the Canadian Arctic.

There are also a number of specific geographic locations which, although not excluded from Canadian Coast Guard's mandate, require coordination between the managing authorities and this plan. These areas include the waters associated with

the various Port Authorities (Hamilton, Thunder Bay, Toronto and Windsor) and the St. Lawrence Seaway Authority (Welland Canal, St. Lawrence Locks) as defined by the *Canada Marine Act, 1998*.

Figure 1-1: Fisheries and Oceans Central & Arctic Region

1.4. Safety Policy

Safety is the first and foremost consideration in any pollution response in Central & Arctic Region. This commitment is expressed throughout this and other documents as well as in the programs relied on by the Environmental Response (ER) branch to prepare for such spills (i.e. training and exercising programs). General safety procedures and considerations to be followed by all members of the Regional Response Team are identified in Section 5.7 of this plan.

1.5. Links to the National Response Plan

The Guiding Principles and Mandate (including legislative, interdepartmental, intergovernmental and international agreements) as well as designation of Lead and Resource Agency roles are contained in the *National Response Plan Section 1 – Introduction.* The mechanism for activating the Environmental Response National Response Team is also defined in the *National Response Plan*.

1.6. Regional Response Plan Structure

The Regional Response Plan is structured to reflect the three fundamental phases of Environmental Response activities. These are:

1) Preparedness - through the regional application of Contingency Planning (resulting in specific response strategies), Training (state of personnel readiness), Exercising (state of system readiness) and Inventory Maintenance and Management (state of mechanical/equipment readiness).

2) Response Operations - identifying the mechanisms for:
   - *Initiating* (through a dedicated Duty Officer and Assessment process),
   - *Sustaining* (Operational functions as Lead or Resource Agency),
   - *Controlling* (using the Response Management System), and
   - *Finalizing* the response activity (decommissioning and reporting).

3) Claims, Recovery and After-action activities - for the documentation and recovery of spent resources from the polluter, their agents, national or international funding conventions.

Surrounding these fundamentals are the specifics of the Environmental Response Program in Central and Arctic Region that are too cumbersome to be included in the main text of this Response Plan. They include: Regional Agreements and Memoranda of Understanding, Regional Organization and the specific Annexes which support the program. Finally, the Response Plan includes the preliminary and supplementary matter such as Letter of Promulgation, Record of Revision and the Identification of Custodians and the Plan Maintenance process.

1.7. Linkages to other Response Plans in the Region

When a pollutant is spilled into the water, the Canada Shipping Act is not the only legislation that applies. Recognizing that being designated Lead Agency for pollution response to mystery spills and spills from vessels does not preclude other agencies from completing their mandate CCG acknowledges that the Internal and External Partners listed in Sections 3.4 and 3.5 have plans that are active within Central & Arctic Region.

1.8. Linkages to International Joint Plans

International Joint Plans and agreements affecting Central & Arctic Region include:

- Canada-United States Joint Marine Pollution Contingency Plan
- Canada-Denmark Agreement for Co-operation Relating to the Marine Environment, Annex B (Joint Marine Contingency Plan concerning Incidents resulting from Shipping Activities)
- Great Lakes Water Quality Agreement, Annex 9
- International Boundary Waters Treaty Act

The Canadian Coast Guard Environmental Response Branch also provides technical support for the Emergency Prevention, Preparedness and Response (EPPR) Working Group of the Arctic Council. The EPPR Working Group exchanges information on best practices for preventing spills, preparing to respond to spills should they occur, and practical response measures for use in the event of a spill.

The Arctic Council is an intergovernmental forum of the eight circumpolar countries (Canada, Denmark, Finland, Iceland, Norway, Sweden, the Russian Federation and the United States of America) that provides a mechanism to address the common concerns and challenges faced by the Arctic governments and the people of the Arctic.

Some work has been initiated with the Russian Federation for the development of a Joint Pollution Response Plan. To date no agreements have been signed.

Section 2 - AGREEMENTS AND MEMORANDA OF UNDERSTANDING

2.1 Overview

The Canadian Coast Guard (CCG), both Central & Arctic and National Headquarters, maintain numerous memoranda and letters of understanding and agreement between other government departments which outline shared responsibilities in pollution response. A brief description of the major agreements is listed below.

- Letter of Agreement between Canadian Coast Guard, Environmental Response Branch and Canadian Coast Guard, Operational Services and Canadian Coast Guard, Technical Services regarding the use of Environmental Response First Response Units (FRUs) by non-environmental response staff. This agreement concerns the use of FRUs at the various CCG facility sites (bases, sub-bases and search and rescue stations).

- Northwest Territories/Nunavut Spills Working Agreement. This agreement formalizes procedures whereby spill investigation and monitoring in the Northwest Territories (NT) and Nunavut (NU) can be coordinated.

- Fisheries & Oceans (DFO) and Environment Canada (EC) Letter of Agreement respecting transfer of responsibility as lead agency for mystery spills from Environment Canada (EC) to the Canadian Coast Guard/Fisheries & Oceans Canada (July 1996)

- Transport Canada (TC) and Fisheries & Oceans (DFO) Memorandum of Understanding respecting Marine Transportation Safety & Environmental Protection (May 1996). This MOU outlines the responsibilities transferred from TC to DFO in accordance with the *Public Service Rearrangement and Transfer of Duties Act*. Those pertinent to this plan include:
    a) The responsibility for ensuring the provision of pollution clean up services
    b) The authority to take actions to mitigate or prevent pollution from ships

- Letter of Understanding between the Canadian Coast Guard and the Hamilton Port Authority to outline the roles that the CCG and the HPA will

play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Thunder Bay Port Authority to outline the roles that the CCG and the TBPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Toronto Port Authority to outline the roles that the CCG and the TPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Windsor Port Authority to outline the roles that the CCG and the WPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

Some memoranda of understanding and letters of agreement have been rendered defunct by virtue of the dissolution or reorganization of the entities that signed the original document. It is the Region's intent to assess the need for an MOU and in those cases where renewal is needed, to draft a new MOU and submit to the partner organization the request for re-entry into that agreement. For further information on these memoranda, please contact the Environmental Response Planning Section.

Section 3 - ORGANIZATION

3.1 General Application

This section describes the primary working relationships between Fisheries and Oceans (DFO), Canadian Coast Guard, Environmental Response branch (CCG/ER) and the various internal and external partners, clients and external resources.

Internal partners include: Other DFO sectors, directorates and branches, and other federal departments which provide direct assistance or have specific mandates which directly affect response activities.

External partners include those entities that share the burden of pollution response for their specific area of responsibility. These agencies include the provincial and territorial government ministries with the generic mandate of pollution response.

Clients include those entities that are specifically identified by the *Canada Shipping Act (CSA)* and have direct involvement in the response regime; they include Oil Handling Facilities (OHF), Legislated Ships and Non-legislated Ships.

External resources are those resources outside of the government that the Canadian Coast Guard may engage while conducting spill response activities. These include the Response Organizations (RO) certified by Transport Canada and other independent contractors which may perform more specific functions.

3.2 Fisheries and Oceans, Canadian Coast Guard - Environmental Response Branch (CCG/ER)

The Assistant Commissioner, Canadian Coast Guard through the Maritime Services Directorate and the Superintendent of Environmental Response (ER) directs the Regional Environmental Response Team. This team represents one facet of the overall crisis management structure within Central and Arctic Region and performs the function of the Lead Response Agency for pollution incidents as defined in the *National Response Plan – Section 1* of the *Canadian Coast Guard National Response Strategy.* The branch consists of approximately seventeen (17) full time employees (FTEs).

Internally, the Environmental Response Branch is made up of five (5) distinct but integrated functions:

1) *Direction and Administration* - providing the overall guidance, management and liaison with Headquarters. The Superintendent holds the responsibility for escalating a response and/or dedicating resources.
2) *Planning* - providing the design and management of plans and procedures to facilitate the preparedness posture of the Region (responsible for developing and maintaining intradepartmental, interdepartmental, client and regime stakeholder relationships).

3) *Operations and Inventory Maintenance & Management* - provide the management and maintenance of equipment to ensure the operational response readiness of the Region.
4) *Training* - provides the coordination and delivery of educational materials, to internal as well as external partners and clients, in support of the overall preparedness posture of the Region.
5) *Exercising* - provides the management and coordination of internal and external partners and clients to validate, practice and reinforce all aspects of the Response readiness of the Region.

In addition to these core functions, each staff member is required to actively participate in the operational aspects of the response regime based upon their skill and ability levels. This includes assuming various roles within the Response Management Structure acting as Duty Officer (DO) and supporting the overall emergency preparedness structure within the Region (not necessarily related exclusively to oil spills or pollution).

In the context of this Plan, the Environmental Response Branch is tasked to:

- Fulfill the Canadian Coast Guard's obligations as Lead Agency in an OSC or FMO posture in responding to marine pollution incidents from ships in waters of Canadian interest as well as from unknown sources.
- Act as a Resource Agency in support of a response led by another agency when requested.
- Staff a Duty Officer position on a 24/7 basis which, together with other agency representatives, will assess or direct the assessment of spill reports.
- Ensure that an appropriate response to pollution incidents is initiated on a timely basis.
- Provide initial response capabilities throughout the region.
- Monitor response and clean-up priorities when polluter has accepted responsibility.
- Ensure international commitments in spill preparedness and response are fulfilled.
- Provide a pollution response capability for lightering, salvage and offshore recovery operations.
- Provide Regional and HQ briefings on status of emergency operations.
- Evaluate, acquire and maintain specialized marine emergency countermeasures equipment and develop deployment techniques.
- Develop, distribute and maintain the *Central and Arctic Regional Response Plan* of the *Canadian Coast Guard National Response Strategy* (including area annexes) on behalf of Fisheries and Oceans.
- Review and comment on other government as well as industry pollution response plans upon request.
- Provide pollution response related training to Canadian Coast Guard and civilian personnel.

- Conduct spill response exercises according to the Canadian Coast Guard National Exercise Program (NEP) standards.
- Provide detailed explanations of response operations and policies to representatives of the media, interest groups, industry, police and Provincial and Municipal governments.
- Provide a centre of expertise for pollution concerns.
- Develop and foster a good working relationship with other authorities, shipping and oil/chemical handling communities.
- Working with Environmental Response Headquarters and the Chemical Industry to develop, implement and maintain a corresponding and complimentary regional capability for spills of hazardous and noxious substances other than oil.

3.3 Internal Partners – Fisheries and Oceans

Other branches and directorates within Fisheries and Oceans which directly and in a continuous active way support preparedness and response activities include:

Marine Traffic and Communications Branch (MTCS) – CCG/Marine Programs Directorate

Marine Traffic and Communications Services operates a marine VHF/MF/HF communications system (depending on location) primarily for the provision of marine safety information, distress coordination and marine traffic regulation. MCTS will support Environmental Response (ER) activities by:

- Establishment of Movement Restriction Areas (MRA's) or exclusion zones as directed by the Federal Monitoring Officer (FMO) or On Scene Commander (OSC).
- Providing communications/radio equipment operators in support of off-site ER operations.
- Dissemination of marine information and issuing marine Notices to Shipping (NOTSHIPS).
- Providing vessel tombstone information including, but not limited to, vessel name, call sign, nationality, tonnage, dangerous cargo type and quantity.

Regional Operations Centre (ROC) and Fleet Resources – CCG/Operational Services Directorate

Regional Operations Centre

The ROC provides notification to the Environmental Response Duty Officer (ERDO) when notified of a spill or an occurrence which may result in a spill. Upon receiving information regarding a spill, the ROC confirms the report using reliable resources and agencies. When the incident has been confirmed the Operation Centre begins the alerting and notification procedure. A schedule of ERDOs, approved by the Superintendent Environmental Response Canadian Coast Guard, will be maintained by the ER Regional Emergency Operations Officer (REOO) and forwarded to ROC for distribution.

The Regional Operations Centre will support the Environmental Response Branch during a marine pollution incident by:

- Maintaining up to update contact lists for Canadian Coast Guard and other government agencies for use as incidents progress.
- Coordinating the allocation of CCG resources as required by the FMO or the OSC to respond to a marine pollution incident.
- Provide communications support (when necessary).

Fleet Resources

Fleet Resources may be called upon to provide a host of support and/or lead services depending upon the type and severity of the situation and limitations or constraints of the vessel. Commanding Officers maintain full responsibility for the operation and safety of their vessel and personnel and therefore, will/may:

- Be called upon to be interim On-scene Commander.
- Be the principal point of contact aboard ship for the Environmental Response Duty Officer or On Scene Commander.
- Investigate spill reports for the purpose of confirmation.
- Provide surveillance and monitoring of third party (or pollutant) as required.
- Initiate early spill response; containment, boom or sorbent material deployment, clean up and recovery procedures.
- Provide site safety, (i.e. fire fighting, first aid and crowd control).

Fleet does maintain their own limited capabilities to respond to their needs as required.

Canadian Coast Guard Bases

In preparation for and during a pollution incident, CCG bases may also provide resources for response. These resources are generally within the scope of normal base activities and include:

- Small vessel use
- Base facilities (boardrooms, workshops)
- Helicopter landing pads
- Boat launch and docking slips
- Staging areas

Safety, Security and Emergency Services Branch – DFO Corporate Services

For large spills of a significant nature the Regional Manager of Safety, Security & Emergency Services may provide the following:

- Advice and recommendations to the On Scene Commander on issues of site and employee safety and the application of departmental security policy measures.
- General occupational health & safety and security advice to the On-Scene Commander/Deputy On-Scene Commander as per the departmental Loss Control Manual.

- A Health & Safety Officer to perform the functions of the Heath & Safety Officer described in the Response Management System User Guide. This person will report directly to the OSC or FMO throughout the duration of the response.

On occasions when the Regional Manager of Safety & Security (or delegate) is not available, or when spills are of a minor nature, the On-Scene Commander shall appoint a member of the response team to fulfill the general duties required.

Communications Branch – DFO Communications
Communications team manages the media (external) handling inquiries from print, radio, television and internet news organizations through the application of *Fisheries & Oceans Crisis Communications Plan*. Communications branch coordinates all aspects of information being released to ensure the public is getting the most relevant, accurate information as soon as practicable.

Legal Services
The DFO Legal Services in CCG Headquarters section will provide legal advice and guidance in the event of a marine pollution incident where CCG may or has been engaged. This especially includes advice on the issuance of Letters of Undertaking (LOUs) and in situations where Canadian Coast Guard may have to take command and control of an incident away from the Polluter.

Other DFO Resources
Indirectly, but just as significant in the event of a spill, is the availability of other DFO resources. This includes any and all appropriate functions including, but not limited to the following:

- Trenton Joint Rescue Coordination Centre – CCG, Maritime Services Directorate, Search and Rescue Branch (SAR)
- Finance and Administration – Human Resources and Corporate Services Directorate
- Human Resources - Human Resources and Corporate Services Directorate
- Facilities – Real Property
- Other Technical Resources – CCG, Integrated Technical Services Directorate
- Fish Habitat Branch – Habitat Fisheries and Oceans Management

3.4 Internal Partners – Other Government Departments

Other federal departments which provide direct assistance or have specific mandates which directly affect response activities include:

Environment Canada (EC)
There are two (3) Environment Canada regions located within Central & Arctic region. They are Ontario, Prairie and Northern and Pacific and Yukon Regions.

The Environmental Emergencies Section provides:

- In Ontario, the Co-chair (with the Ontario Ministry of the Environment (MOE)) of the Regional Environmental Emergencies Team (REET).
- In the Arctic (consisting of the three Territories), the Co-chair (with the relevant Territorial Government, Department of Environment) for the Arctic Regional Environmental Emergencies Team.
- Coordination of the Shoreline Cleanup and Assessment Teams (SCAT).
- Advice concerning environmental impacts associated with vessel source spills, resource sensitivity and prioritization, environmental forecasting, spill and cleanup monitoring and clean up techniques and priorities
- Sampling assistance, identification and characterization of materials

The REET serves as a mechanism for the provision of consolidated, coordinated and comprehensive environmental information and advice concerning the fate and effects of hazardous and noxious substances, spill trajectories, resources and shoreline protection strategies, clean up priorities, physical and chemical counter measures, remedial endpoints, damage assessment, and the management of hazardous wastes generated during a spill and other matters which arise while planning and responding to emergency events which affect or risk environmental quality. In the planning mode REET members meet to improve contingency plans, resolve regional preparedness issues and exchange new scientific and response ideas.

In Ontario Region, Environment Canada has divided the province into eighteen (18) REET areas and plans to hold one (1) REET meeting per area per year, consolidating some areas where possible and maintaining annual meetings in the higher risk areas (Windsor, Sarnia, Sault Ste. Marie).

Two of three primary Arctic REET (AREET) areas are in Prairie and Northern Region: the Northwest Territories and Nunavut Territory. There is no REET established in Alberta, Saskatchewan and Manitoba.

The Meteorological Service of Canada (part of EC and REET) provides:

- Meteorological forecasting

The Canadian Wildlife Service (part of EC and REET) provides

- Advice on wildlife protection, rescue and rehabilitation
- Permits for wildlife hazing and capture

Transport Canada (TC)

The Environmental Response Systems Division in Ottawa is responsible for Canada's Marine Oil Spill Preparedness and Response Regime. It:

- works with other federal agencies and departments, such as Fisheries and Oceans Canada, the Canadian Coast Guard and Environment Canada to establish guidelines and regulatory framework for preparedness and response to oil spills and spills of noxious and hazardous substances into Canada's marine environment.

- Manages the National Aerial Surveillance Program

There are two Transport Canada regions located within Central & Arctic region. They are Ontario and Prairie and Northern regions.

The Aircraft Services Directorate provides:

- Aerial surveillance as part of the Prevention mandate within Transport Canada, and can provide aerial spill tracking, recording, and personnel transport.

The Marine Safety Branch provides:

- Technical advice and recommendations to the On-Scene Commander or the Ship Owner regarding, but not limited to, lightering, damage assessment and salvage.

  Note: The MOU between Transport Canada and Fisheries & Oceans Respecting Marine Transportation Safety & Environmental Protection (May 1996) Annex D – E-5 states that "Transport Canada and Fisheries and Oceans will jointly approve salvage operations, emergency lightering or discharge of cargo." After discussing this clause with two senior surveyors, they both agree – Marine Safety does not approve salvage plans. Marine Safety advises and recommends only.
- Restriction of transit or movement of a vessel following a damage assessment.
- Spill investigation and enforcement of the various aspects of the pollution prevention conventions and legislation in Canada
- Regional planning, in conjunction with EC and CCG, for the selection of Places of Refuge. Note: in the Great Lakes and connecting channels, selection of a place of refuge will be determined in conjunction with the USCG and USEPA.
- Monitoring of the spill preparedness activities of Oil Handling Facilities (OHFs) and certified Response Organizations (ROs) through a review and audit process.

Indian and Northern Affairs Canada (INAC)

Canadian Coast Guard (CCG) works most closely with INAC in Nunavut (NU) and the Northwest Territories (NT). INAC has lead responsibilities in the Arctic for spills on water which do not originate at federal facilities, exploration facilities or from ships and barges. INAC also, by letter of agreement, will investigate ship-source spills on behalf of CCG. INAC is also a member of the Beaufort Sea Emergency Preparedness Working Group, along with CCG/DFO, EC, TC and other appropriate agencies.

National Energy Board (NEB)

Based in Calgary, Alberta, the National Energy Board is an independent Agency that reports to parliament through the Ministry of Natural Resources. The NEB is the

Lead Agency for spills that occur at offshore and nearshore oil and gas exploration and production facilities.

In the event of a marine pollution incident where CCG is requested for assistance as a resource agency, CCG is available to provide pollution response expertise as indicated under Section 7.2 of the *National Response Plan* as it relates to NEB.

Public Safety Canada

Public Safety Canada is the federal coordinating department responsible for engaging relevant federal departments in an integrated Government of Canada response to an emergency.

For emergencies requiring an integrated Government of Canada response, federal support is based on a regional "single- window" concept. This concept is intended to facilitate regional interdepartmental and intergovernmental coordination, while not unduly restricting operations. Coordination includes sharing of pertinent information in order to maintain situational awareness.

The Government Operations Centre (GOC) is a 24/7facility where an integrated Government of Canada response is managed. It is the focal point of information management flow and provides strategic-level activities. It's permanent staff includes watch officers, duty officers specializing in national communications as well as a geomatics team to map incidents.

Indirect support from other federal departments in the form of advice or resources also comes from: Heritage Canada (Parks Service) in the form of support to REET, National Defense regarding assistance and resources, RCMP with respect to investigations and those sections or departments specifically identified in the various Memorandums of Understanding (MOU) as outlined in Section 2 of this chapter.

3.5 External Partners - Provincial and Territorial Ministries and Departments

In general, liaison with provincial and territorial concerns is facilitated through REET (Regional Environmental Emergencies Team), which is chaired by Environment Canada (EC) or, in the case of the Province of Ontario, is co-chaired by Environment Canada and the Ontario Ministry of the Environment (MOE). The following agencies have the primary mandate for marine or freshwater pollution response in their province or territory of jurisdiction:

Territory or Province	Department
Northwest Territories	Environment and Natural Resources
Nunavut	Department of Environment
Alberta	Alberta Environment
Saskatchewan	Saskatchewan Environment

Manitoba	Manitoba Conservation
Ontario	Ontario Ministry of the Environment

In emergency situations conflicts sometimes arise with respect to legal and administrative jurisdiction and application of standards and common practices. To facilitate these issues the various Ministries related to emergency measures are usually contacted to provide coordination and clarify where necessary the concerns. These include:

- Government of Nunavut – Department of Community of Government Services, Emergency Management Division
- Government of the Northwest Territories – Department of Municipal and Community Affairs – Emergency Services Division
- Government of the Yukon Territories – Department of Community Services, Emergency Measures Organization
- Government of Ontario - Ministry of the Community Safety & Correctional Service, Emergency Measures Ontario
- Government of Manitoba –Manitoba Emergency Measures Organization
- Government of Saskatchewan – Resource Management and Corrections & Public Safety, Saskatchewan Emergency Measures Organization
- Government of Alberta – Ministry of Municipal Affairs, Public Safety Division, Emergency Management Alberta

Provincial Governments can provide consolidated access to local, municipal and provincial resources.

Central & Arctic Region recognizes that First Nations have a vested interest in response operations that may occur in their territory and will ensure that they are represented on the REET or have access to the Federal Monitoring Officer or On Scene Commander through the CCG Liaison Officer.

3.6 Clients

With respect to ship-source pollution incidents, there are three major groups the Canadian Coast Guard will be directly engaged with. These are Oil Handling Facilities, Legislated Ships and Ships as defined in *Part XV* of the *Canada Shipping Act.*

Oil Handling Facilities (OHF)

Operators of facilities that transfer oil to or from oil tankers over 150 gross registered tonnes or other vessels over 400 gross registered tonnes are required by the Canada Shipping Act (2001) to:

- Have an Oil Pollution Emergency Plan (OPEP) on site.
- Have a declaration conforming to the regulations on site.
- Take reasonable measures to implement their required oil pollution emergency plan in the event of an oil pollution incident.

- Have on site the resources required to contain a spill of oil equal to the facility's rated capability within one hour.
- Begin recovery/cleanup operations of oil equal to the facility's rated capability within 6 hours.
- Have an arrangement with a certified Response Organization (RO) that permits the handling of spills beyond the rated capabilities of the Oil Handling Facility.[1]

Legislated Ships

In Canadian waters, ships over 400 gross registered tonnes and oil tankers over 150 gross registered tonnes are required to have a Shipboard Oil Pollution Emergency Plan (SOPEP) and an arrangement with a certified Response Organization (RO) to respond to an oil pollution incident of an amount equivalent to the maximum amount of product that the vessel can carry as fuel and/or as cargo up to a maximum of 10,000 tonnes.[1]

Other ships as defined by Part XV of the Canada Shipping Act (CSA)

Any ship that is less than 400 GRT or any tanker less than 150 GRT is still covered by the *Canada Shipping Act (2001)* in that it must report the potential or actual pollution incident to a Pollution Response Officer, or in the case of an incident in Canadian Arctic Waters as defined by the Arctic Waters Pollution Prevention Act to a Pollution Prevention Officer. The ship must take immediate steps to mitigate or remedy the situation. These ships are not required to have a Shipboard Oil Pollution Emergency Plan nor an arrangement with a certified Response Organization.

3.7 External Resources

There are two main categories of external resources that the Canadian Coast Guard (CCG) will engage. These are the Response Organizations certified by Transport Canada under the *Canada Shipping Act (2001)* and other contractors.

Response Organizations (ROs)

Response Organizations are privately established pollution response companies certified by Transport Canada. These companies hold a certificate of designation to handle oil spills of up to 10,000 tonnes (T). Response Organizations can provide the polluter or any lead agency with the resources, trained personnel and operational management structure to deal with a marine oil pollution incident within its identified Geographical Area of Response (GAR).

The Eastern Canada Response Corporation (ECRC) is the only certified response organization in Central & Arctic Region. The company is certified to ten thousand tonnes (10 000T) and two of its three regions cover Central & Arctic Region.

[1] There is no requirement for an Oil Handling Facility nor a Legislated Ship to have an arrangement with a Response Organization certified by Transport Canada in Canadian waters north of 60° North Latitude

1) ECRC Great Lakes Region is managed from the Response Centre in Corunna, Ontario. Its area of coverage includes all waters
   - south of 60 degrees north in the provinces of Alberta, Saskatchewan, Manitoba and Ontario to that portion of the St. Lawrence River in the Province of Ontario
   - to a line drawn between Butternut Bay (Latitude 44 31' 12" north and Longitude 75 46' 54" west) on the Canadian side
   - to Oak Point (Latitude 44 30' 48" north and Longitude 75 45' 20" west) on the US side of the St. Lawrence River.

2) ECRC Quebec Region (also known as Societé d'Intervention Maritime Est du Canada - SIMEC) is managed from the Response Centre in Quebec City, Quebec and has staffed Response Centres in Verchères, Quebec and in Sept-Iles, Quebec. Their coverage includes:
   - James Bay, Ungava Bay and in Hudson Bay south of the sixtieth parallel North and that portion of the St. Lawrence River in the Province of Ontario
   - to a line drawn between Butternut Bay (Latitude 44 31' 12" North and Longitude 75 46' 54" West) on the Canadian side to Oak Point (Latitude 44 30' 48" north and Longitude 75 45' 20" West) on the US side of the St. Lawrence River.

There are no certified response organizations established north of 60° N latitude.

Although resources from the Response Organizations in the south may be made available for use north of 60°, they must obtain the necessary approvals to move equipment from their designated area of response.

Contractors

Private sector contractors may be engaged by the CCG as required. All standard government contracting rules apply.

Section 4 – PREPAREDNESS

4.1 Overview

Oil spill preparedness is defined by the advanced planning used to create systems to effectively and efficiently combat the range of spills likely to be encountered.

In Central and Arctic Region, preparedness involves:

- The development of regional procedures to be followed in the event of an incident, coordinated by the Planning section.
- The implementation, training and maintenance of the Response Management System (RMS) to manage and combat the incident.
- The identification of priorities, development of strategies, logistics and tactics necessary to fulfill those priorities, lead by the Planning section.
- The liaising with internal and external partners, clients and resources that may be involved in pollution response activities, lead by the Planning section.
- The training and continued maintenance and upgrading of skills, coordinated through the Training specialist.
- The exercising and quality assurance activities required to continuously reinforce the training and contingency planning activities, facilitated through the Exercise specialist.
- The asset management including the acquisition, lifecycle maintenance, operational readiness and storage of equipment lead by the Operations section and Inventory specialist.
- The integration of other Canadian Coast Guard Assets and Human Resources, when necessary, through the Training and Exercising processes.

The Memorandum of Understanding (MOU) between the Director General/Maritime Services (MS) and the Director General/Integrated Technical Support (ITS) of the Canadian Coast Guard (March 2004) specifies that the ITS Directorate will be the single CCG focus for the life cycle management of all CCG physical assets and for the development of all technical solutions. It is unknown when ITS will assume the services of design, procurement, in-service support and disposal of all equipment and systems required to satisfy ER's mandate. In the interim, ER will remain the focal point.

4.2 Response Management System (RMS)

The Canadian Coast Guard uses the Response Management System (RMS) as its emergency management system. It is based on, and operates under the same principles as the Incident Command System (ICS) which was developed in the U.S. to coordinate multi-agency responses to large forest fires. The system was adjusted to reflect the current marine oil spill response regime and Canadian law. The Canadian Coast Guard does not implement the ICS principle of unified command, but will participate in any command structure used by the Polluter or Other Lead Agency.

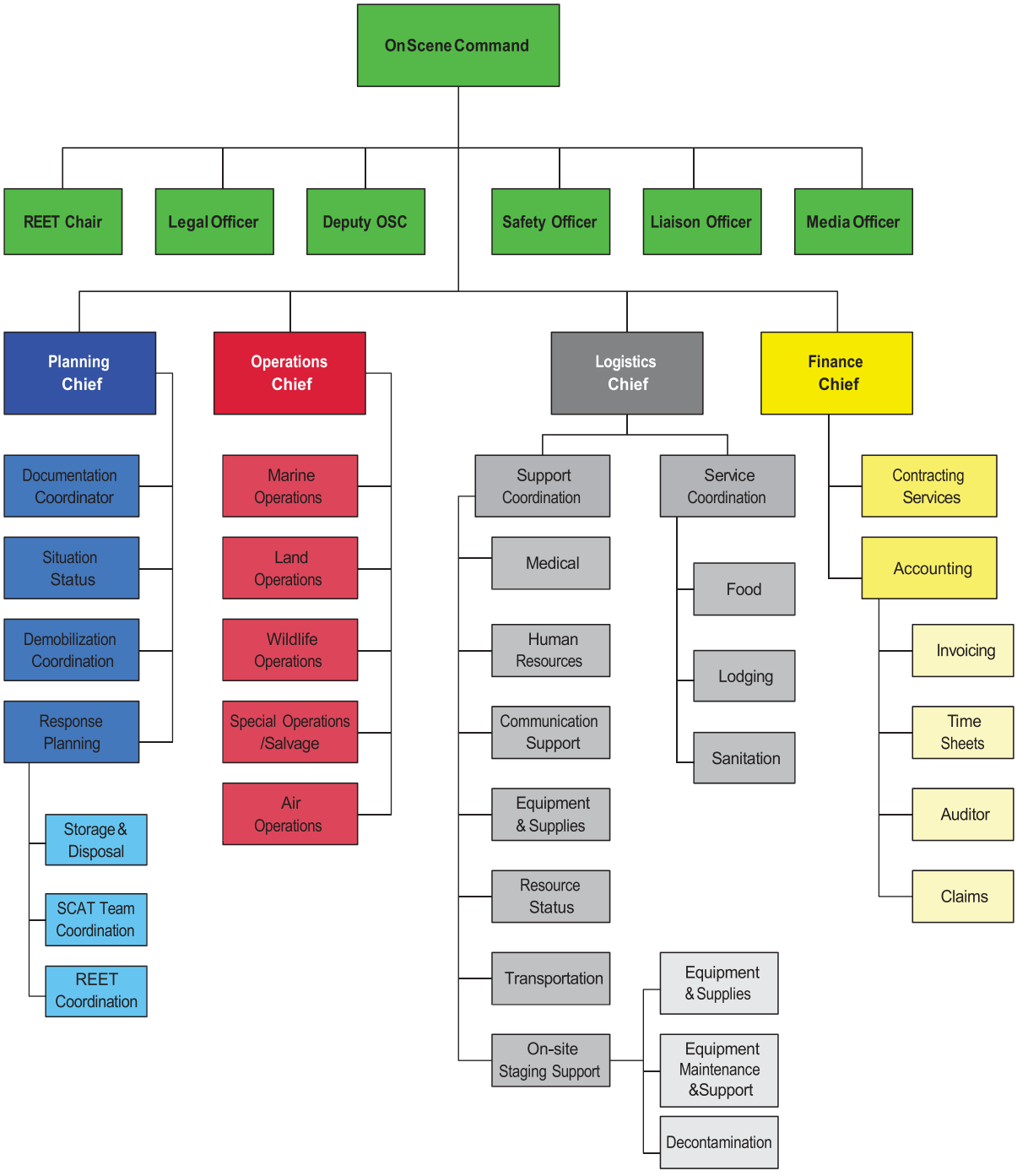
The RMS uses a “management by objectives” approach. It outlines the roles and responsibilities of individual positions, identifies the reporting structure, establishes a common set of terminology and uses standardized forms and paperwork. The central document in the RMS process is the Incident Action Plan, which documents the existing conditions and outlines objectives and strategies for recovery and response.

The system structure is designed to expand or contract to best fit the specific circumstances of the incident. Not all positions within the system will be staffed for every incident; in those cases the supervising position shall be responsible for all subordinate tasks/roles. Regional staff members have been designated as members of the Regional Response Team and may be called upon to fill specified roles in this management system (see Figure 4.1 for a fully expanded system design).

The system also contains management tools that can be used by the On Scene Commander and response personnel to better manage the system and the spill incident. These tools include a field operations guidebook, forms, reports, established meeting schedules and agendas. The RMS will also be used by the Federal Monitoring Officer and their Incident Monitoring Team while monitoring the Polluter’s response to an incident.

The detailed RMS process is contained in a separate document referenced in Section 9.1 of this plan (Response Management Systems User’s Guide, Version 3.0 (May 2006)).

Figure 4.1 - CCG RMS Command Structure



4.3 Planning

Area Plans

To facilitate an effective and efficient response, Canadian Coast Guard administers 16 area plans as an annex to the Central & Arctic Regional Response Plan. They are Keewatin, Baffin, Beaufort Sea & Amundsen Gulf, Great Slave Lake, Hudson & James Bay, Kitikmeot, Mackenzie River & Delta, Inland Waters S of 60, Lake Erie, Lake Huron, Lake of the Woods, Lake Ontario, Lake Superior, St. Lawrence, St. Mary's and St. Clair & Detroit areas. These plans incorporate detailed response information for specific manageable geographic areas or response communities. The normal operating period for an area plan is the first 12-24 hours of a spill response.

They are developed and maintained as follows:

1) Risk Analysis
   The risk analysis determines which communities or areas are most likely to be endangered by a potential oil spill and why, their associated environmental sensitivities, plus the typical type of spill that could be expected. When considering the environmental sensitivities, the focus is on what is most likely to be impacted and to consider as many factors as are applicable. A single factor discovered in the risk assessment is just one of many layers in the decision to make a site a priority.

2) Priority Identification/Verification
   Current priorities are discussed with members of the Regional Environmental Emergencies Team (REET) at planning meetings. It provides the opportunity for additions, deletions or modifications. Where there are no REET meetings held, community consultations are organized by the Planning section.

3) Strategy and Tactics Development
   Canadian Coast Guard determines RMS objectives for the agreed upon priorities. Strategies are designed, that name the activities relative to those objectives. Those activities may be response actions to be implemented, or may be the type of resources that could be affected by the spill. For area plan development, tactics provide the detail for implementing the selected strategies. Tactics then specify the resources, both human and equipment, to facilitate, to install or to maintain the strategy.

4) Updating
   Area plans are reviewed and updated annually.

Regional Procedure Development

Regional procedures for notification, verification, activation and cost recovery of a response are all described in the *Central & Arctic Regional Response Plan* of the *Canadian Coast Guard National Response Plan*. Supporting documentation in the

form of Standard Operating Procedures and supplementary plans (e.g. Health & Safety Plan and Media Relations Plan) are not included in the Regional Response Plan but are referenced in Section 9.

Liaison with External and Internal Partners, Clients and Resources

To ensure that all partners, clients and resources are aware of the Canadian Coast Guard's mandate and responsibilities as they pertain to pollution preparedness and response, the Environmental Response Planning Section takes the initiative to:

- Work with Internal Partners within Fisheries & Oceans to communicate the branch's needs in the event of a pollution incident.

  Exception: Coordination of the Duty Officer (DO) function between Environmental Response (ER) and the Regional Operations Centre (ROC) is coordinated by the Regional Emergency Operations Officer REOO).
- Work with other government departments that have a mandate for pollution response within their jurisdiction to communicate the role that Canadian Coast Guard plays in marine and freshwater pollution incidents and to share what resources Canadian Coast Guard maintains for pollution response activities and the mechanism to access these resources in the event that another Lead Agency may require them for a non-CCG mandated spill or other type of emergency.
- Liaise with potential clients (oil handling facilities, shipping companies and other operators) so that CCG expectations in the event of an incident are understood.
- Provide copies of area plans to CCG vessels that are relevant to their area of operations. CCG ER will brief Operations at the pre and post season conferences on any changes to the plans and/or to the captain and/or crew's responsibilities.
- Maintain a network of contractors that can provide services to Canadian Coast Guard in the event of a pollution incident that exceeds the resource capability of the region.
- Upon request of the Regional Advisory Councils (RACs) or Secretariat (Transport Canada) on Marine Oil Spill Response, provide information on Central & Arctic Region's preparedness and spill response activities.

Arctic Community Emergency Plans

The Canadian Coast Guard is committed to assisting Arctic communities in the development of the marine pollution component of their Community Emergency Plans. This commitment was made in 1999 when the CCG Arctic Response Strategy (ARS) was published. The Arctic Response Strategy has since been re- assessed and viable components have been incorporated into the text of this Plan.

4.4 Training Program and Curriculum

Introduction

The Training Curriculum of the Environmental Response Branch is focused on providing the necessary skills and knowledge for responders to function effectively during a spill response operation. As the competencies required for an effective spill response are described and organized within the Response Management System (RMS), so too can the training curriculum be described in the context of RMS.

With RMS as the framework for spill response, all response team members will be trained in theory and application of RMS. The level of training complexity will vary by level of individual responsibility, but all members will have fundamental knowledge of the structure and processes that drive the RMS.

In addition to the training curriculum described in this section, it is understood that there are competencies and certifications required that are not specific to ER or spill response. These would include driver's licenses, radio operator's licenses, and familiarity with basic electronic equipment such as phones, fax machines, cell phones and laptop computers.

Training Curriculum

Command Staff

During a spill response operation, the command staff will vary depending on the size and complexity of the spill.
On a smaller spill, senior ER staff members may be appointed to command positions with few subordinate or supporting positions.
On larger scale spills, the OSC may be the Director of Maritime Services, or Assistant Commissioner Canadian Coast Guard, with multiple support positions from ER staff, CG fleet, base personnel and contractors.

To adequately prepare personnel for the management functions of spill response, the following curriculum has been identified:

On Scene Command Course (OSC)
This course trains participants in all aspects of spill response including planning, implementation, and supervision. Other topics include legislation, legal issues, financial responsibilities, and media relations. Prerequisites include BOSRC, MSROC, PPO designation, media relations and management training.

Response Management System Course (RMS)
The current RMS curriculum is an introductory two-day course on the system and its user's guide. It is anticipated that future development will include multiple levels of training which will include organizational structure and

responsibilities, as well as in-depth requirements of each position within this emergency management structure.

Federal Monitoring Course (FMO) - Proposed
Subject to national development, this course will augment the On Scene Command Course to provide those persons designated as Canadian Coast Guard Federal Monitoring Officers the necessary skills and knowledge to perform FMO duties.

Operations Section

During a spill response operation, the operations section of the RMS may be populated by regional ER staff, CCG fleet officers and crew, CCG/DFO base personnel or contractors. The resident knowledge of this group will vary, and a comprehensive ER training program exists to train responders in spill response operations. Training for members of the CCG Regional Response Team (RRT) personnel is offered in the following three areas:

(a) Safety Training
(b) Operational Training
(c) Specialty Training

(a) Safety Training

Health and Safety training is required to ensure compliance with federal and provincial legislation with the ultimate goal of ensuring the health and safety of response personnel. Additional video and printed reference material is available through the Canadian Coast Guard ER Training Officer.

Site Safety Course
The Site Safety Course is designed for response personnel prior to commencing work on a response site. Topics include employer and employee responsibilities, classification and hazards of petroleum products, and the safety practices and considerations associated with both water-based and shore-based operations. Site safety training is mandatory for Regional Response Team members and all volunteers or short time workers who may be employed during a response.

Workplace Hazardous Materials Information System (WHMIS)
This 3-hour course is provided to Canadian Coast Guard employees to ensure compliance with appropriate worker safety legislation. It was developed to ensure workers have the necessary information to work safely with hazardous materials in their workplace.

First Aid/CPR
This 16 hour course provides the participants with the skills and knowledge to successfully obtain the St. John Ambulance Standard First Aid Certificate. The primary focus of this 14-hour course is to provide adequate knowledge

and level of skill to persons in positions of responsibility to provide for persons suffering from respiratory and circulatory arrest. Preventative measures are discussed.

Small Non-Pleasure Vessel Basic Safety Course - MED A3
The 8-hour MED A3 course is *required by regulation* for crewmembers of small non-pleasure vessels of not more than 150 GT operating not more than 20 miles offshore. Topics include marine hazards and emergencies, marine firefighting, lifesaving appliances and abandonment and survival and rescue skills.

Transportation of Dangerous Goods (TDG)
This 6-hour course provides personnel with the responsibility for the transportation of dangerous goods to be aware of and comply with safety measures and appropriate legislation concerning TDG.

(b) Operational Training
There are various levels of oil spill response courses designed for response team members, ships crews and other responders who may be expected to assist with marine oil spill response. Operational training related to the assessment and response to petroleum spills is delivered by ER while training for response to hazardous and noxious materials spills is obtained outside of the Branch.

First Responder Oil Spill Training (FROST)
This 1 day course is designed specifically for CCG personnel in Central & Arctic Region who are designated custodians of First Response Units (FRUs), and may be tasked with deployment of the pollution countermeasures equipment. It has also been adapted for use in communities north of 60° where Arctic Community packs function as first response units.
It teaches First Responders to:

- assess an oil spill according to its extent, possible source and likely behavior
- deploy boom for containment and protection purposes and in support of response activities
- work safely at the spill site

Basic Oil Spill Response Course (BOSRC)
This 20 hour course instructs First Responders how to:

- assess an oil spill according to its extent, possible source and likely behavior
- deploy boom for containment and protection purposes and in support of response activities
- operate oil recovery equipment
- undertake basic shoreline cleanup operations
- work safely at the spill site

Marine Spill Response Operations Course (MSROC)
This 40-hour course will enable trained and experienced personnel to coordinate and supervise the response operations of a marine oil spill. It is intended to train individuals to be On Scene Commander (OSC) for small (tier 1) spills, or operations section chief on larger spills. Topics include legislative framework, safety, equipment suites and strategies, media relations, RMS, shoreline assessment and cleanup techniques, and disposal. Prerequisites include BOSRC, a Radio Operator License and current or future deployment to a spill response team.

Environmental Response Duty Officer (ERDO) Training
This 15 hour course is a prerequisite for duty officers for the ER branch and the regional operations centre. It introduces the participant to CCG mandate, lead agency responsibilities and introductory spill assessment techniques. It also integrates delivery of training on the Marine Pollution Incident Reporting System (MPIRS), the database used to capture spill report and response information.

Pollution Response Officer (PRO) Training
This three day course is currently provided by the Environmental Response Branch of the Canadian Coast Guard and is required training for all Environmental Response personnel. Participants who successfully complete this course earn the designation of Pollution Response Officer under Part 8 of the Canada Shipping Act (2001). This course examines the powers of a PRO, specific procedures related to vessel directions and detentions and the legal framework and implications surrounding the execution of those powers. Course participants also learn sampling procedures and gain an understanding of the role of other government agencies involved in a marine pollution incident.

Pollution Prevention Officer (PPO) Training
This 40 hour course is currently provided by the Marine Safety Branch of Transport Canada. It is a prerequisite for any officer of the Canadian Coast Guard to be delegated Pollution Prevention Officer (PPO) powers under the *Arctic Waters Pollution Prevention Act*. Participants learn the existing pollution prevention and response regime, the powers of a PPO and the specific tasks of prevention, control, investigation and prosecution.

Small Vessel Operator Proficiency
This 21-hour course meets the training needs of the small vessel master. This course is required by regulation (for vessels less than 5GT on sheltered and near coastal voyages) and teaches participants to effectively manage safety of those on board, protect the vessel from damage and protect the marine environment.

Basic Barge Operator Training
This course was developed and is delivered by regional ER staff. Through both classroom and practical sessions, the course introduces participants to safe boating practices and procedures, rules of the road, collision regulations, load plans for pollution response vessels, safe deployment of oil spill response equipment and basic trailer towing and maneuvering.

Single Side Sweep System
The single side sweep is an equipment suite designed to allow one vessel to perform oil containment and recovery, and allow for temporary storage. This two day training session is provided to some ER staff and crews of Canadian Coast Guard vessels that can support this equipment. This training typically is conducted with crews who have previously completed BOSRC.

HAZMAT Awareness
This 6-hour course is intended for First Responders on the scene of a hazardous materials incident and shows how to assess the incident. Topics include; First Responder's role and responsibilities, scene safety, recognizing and identifying hazardous materials, incident management, and sources of assistance.

HAZMAT Technicians Level
This 40-hour course is designed for responders to releases or potential releases of hazardous substances. The focus is on recognizing and evaluating a hazardous materials incident, organizing the response team, protecting response personnel, identifying and using response resources, implementing basic control measures, decision-making, and protecting the public and environment. Emphasis is on hands-on use of equipment practically applying lecture information through exercises. Participants will wear fully encapsulating suits.
Prerequisite: Hazmat Awareness.

(c) Specialty Training
Specialty training includes training that only select members of the Regional Response Team (RRT) will have to apply.

Shoreline Clean up and Assessment (SCAT)
This 24-hour course covers how oil impacts the shoreline. Specific topics include shoreline types and effects of oil, wind, waves and ice on shorelines. Shoreline protection and cleanup methods are described in depth. Field exercises are conducted as part of the training.

Media Training
This 16-hour course is designed to provide participants with the skills and knowledge to communicate effectively and proficiently with various forms of media. Topics include; developing and disseminating incident information to

news media, incident personnel, other appropriate agencies and organizations.

Communications System Training
This 8 hours hands-on course provides participants with the knowledge and skills to provide communications in support of a spill response. Topics include; mobile telephone, fax, and intercom set up, preparing communication plans, and internal/external spill response communications.

Wildlife Rehabilitation
The capture and treatment of oiled wildlife is typically assigned to the trained experts at Canadian Wildlife Service (CWS). This CWS training is periodically made available to outside agencies, and some ER staff may participate to facilitate a better understanding of each others' role at the time of a spill.

Financial Management
This training is provided by the Public Service Commission (PSC) and teaches government spending and cost accounting principles. It is imperative that any response team member who may have to purchase assets or manage contracts be familiar with these practices and procedures.

Planning Section

During a spill response operation, the planning section of the RMS will likely be populated with ER staff whose substantive positions are as Planning Officers within the branch. Therefore, the planning skills and training required to effectively and efficiently perform these tasks should be resident within our branch staff.

Should additional personnel be required to fulfill these roles, they would require training in RMS, as well as Site Safety (as required by OSH regulation). The required planning skills and spill response knowledge may be acquired through various training or experience factors, and would be assessed prior to assignment on the response team. In addition to planning skills, preferred training might include SCAT, FROST and/or BOSRC, and MSROC.

Logistics Section

During a spill response operation, the logistics section of the RMS will likely be populated with ER staff whose substantive position involves the tracking of spill response equipment inventory and human resources within the region. Therefore, the skills and training required to efficiently and effectively perform the logistics function should be resident within our regional ER staff.

Should additional personnel be required to fulfill these roles, they would require training in RMS, as well as Site Safety (as required by OSH regulation). The required logistical skills may be acquired through various training or experience factors (knowledge of IRCMS and TMA, BOSRC training) and would be assessed prior to assignment on the response team.

Finance Section
During a spill response operation, the finance section of the RMS will likely be populated by regional finance staff whose substantive positions involve government expenditure and cost accounting knowledge and application. Therefore, the skills and knowledge required to effectively and efficiently perform the finance function should be resident within regional Canadian Coast Guard staff. These personnel will require RMS and Site Safety training prior to deployment on a spill response team.

Training Records
Records for personnel trained in spill response and/or emergency management are maintained by the Region.

4.5 Exercise Program

Introduction
Under the guidelines of the National Exercise Program (NEP), the Environmental Response Branch will implement a Regional Exercise Program. This program will be conducted over a three-year cycle. Coordination of the program will be the responsibility of the Regional Exercise Officer (RXO) of the Environmental Response Branch. Exercises will be designed and conducted in coordination with departmental staff, CCG base staff and CCG vessels on a regular basis. The purpose of the Regional Exercise Program is to validate environmental response training and regional emergency preparedness standards, policies and procedures.

Canadian Coast Guard will, through regional and area-specific exercising, ensure high priority initiatives such as exercising complex equipment (i.e. Lori Brush skimmers, sweep systems and command/communications facilities) are undertaken and will use industry and private sources of personnel where possible and/or appropriate.

Exercise Planning Matrix
The matrix below represents a typical three year exercising cycle followed by Canadian Coast Guard. The program cycle is designed to test all 17-response functions as outlined under NEP as well as including the different types of exercises. It includes internal, external (with other government departments as well as private sector organizations) and international exercises.

Table 4.1 *- Central & Arctic Region Exercise Matrix*

EXERCISE TYPE	YEAR1	YEAR2	YEAR3
Notification	**Quarterly**	**Quarterly**	**Quarterly**
Management	**2**	**2**	**2**
Operational drills	**3**	**3**	**3**
Combined Functional	**1**	**1**	**1**
Full Scale	**0**	**1**	**0**

Notification exercises will test the regional call-out system. Some of these exercises will be internal to the branch, some will be a full regional call-out to all CCG and DFO staff as well as to external resources (eg: freight contractors to check their availability to move Marine Emergency Response Trailers (MERTs) or First Response Units (FRUs).

Management exercises will focus on the development of the spill through the Response Management System (RMS).

Operational Drills will focus on equipment deployments in packages (i.e. a First Response Unit, NOFI V-Sweep).

Combined Functional exercises will be an equipment deployment (operational drill) with the goal of implementing a tactic designed in one of the Region's Area Plan Annexes.

A *Full Scale* exercise will incorporate a management-type exercise with the concurrent deployment of a spill countermeasure system (system = pollution containment, recovery, primary and secondary storage devices)

Exercising Partnership

Canadian Coast Guard will endeavor to participate, by request and on a situation by situation basis, in exercises lead by Oil Handling Facilities (OHFs), certified Response Organizations (ROs) and other government agencies throughout the Region.

Central and Arctic Region is a part of the Canadian Coast Guard response community and as such is also part of the International Response Community. Canadian Coast Guard's regional boundaries are in such close proximity with our United States neighboring response communities that joint exercising is a high priority. Specifically this region conducts joint exercises in the geographic areas of the Great Lakes and the Beaufort Sea with the United States Coast Guard's (USCG) (9^{th}) ninth (Great Lakes) and (17^{th}) seventeenth (Alaska) districts, respectively.

Exercise Evaluation and Shared Learnings

An important part of the National Exercise Program is the evaluation and use of subsequent findings. Four types of information can be learned from an exercise, all of which lead to improvement of overall response capability.

1) Contingency planning
2) Response techniques
3) Response training
4) Exercise program development

The primary sources of the information and learning will be the formal exercise evaluation report that is produced for every exercise by the evaluation team. This formal exercise report will follow the format laid out in Section 11 of the *Canadian Coast Guard National Exercise Program Planning and Evaluation Guide*.

4.6 Inventory Management, Maintenance and Infrastructure

Inventory Response Control Management System

To ensure that a nationally consistent and effective state of preparedness is maintained, an Inventory Response Control & Management System (IRCMS) has been implemented which utilizes The Management Authority database as its main tool. CCG HQ administers this system in concert with regional IRCMS Officers. In this region the program is administered by the Logistics and Statistics Officer in the Operations Section.

This system has been developed to:

- Maintain a real time record of the location and quantity of resources;
- Maintain a proper state of readiness through a pro-active approach using work orders and preventative maintenance;
- Assist in keeping response managers informed about Environmental Response's state of preparedness;
- Assist in the tracking of National Response Team personnel or equipment assigned to National or International incidents

Pre-positioned Equipment Caches and Depots

Central and Arctic Region covers an extremely large geographical and culturally diverse portion of Canada. There are, in essence, two zones of operation which are entrenched in the *Canada Shipping Act*. These are:

- the Arctic Zone, or all areas of Canadian jurisdiction north of 60^0 North Latitude; and
- the Central Zone, dominated in a marine transportation sense by the Great Lakes, but which include the southern portions of Hudson and James Bay, along with the major waterways and watersheds of Lake Winnipeg, Winnipegosis, Lake of the Woods, and Lake Athabasca.

The Environmental Response (ER) Branch has pre-positioned equipment to facilitate and maintain an effective response operation. Response strategies in each of the two zones (Central or Arctic) are based upon identification of local and regional response. This is means that the equipment generally required for such a spill size is contained within the Region. This capacity is supplemented by nationally available resources, which would be "cascaded" from/to other regions when and if required. Preparedness capacities in other regions are identified in their respective Regional Response Plans.

Arctic Zone

Arctic Community Packs (ACPs) are placed in northern communities for rapid (local) initial response. Canadian Coast Guard provides initial response training to members of the communities so that they may effectively deploy equipment in the ACPs in the event of a spill. Access (keys) for the ACPs have been given to an official in each community in most cases. The Senior Response Officer (ER-Hay River) maintains the current key holder listing.

The inventory for each Canadian Coast Guard Arctic Community Pack location is listed in Table 4-2. The program has received funding under the Health of the Oceans Initiative to proceed with placing Arctic Community Packs in additional sites. The equipment profiles at the existing Arctic Community Pack sites will be changed to reflect characteristics of the community. The inventory at all communities will be "site specific" and will coincide with response strategies designed by the ER planning group. The locations for the proposed additional Arctic Community Packs are: Baker Lake, Broughton Island (Qikiqtarjuaq), Chesterfield Inlet, Churchill, Hall Beach, Kimmirut, Iqaluit, Pangnirtung, Tuktoyaktuk and Yellowknife.

The main base of operations with Environmental Response dedicated personnel is located in Hay River, Northwest Territories. This base is home to a Rapid Air Transportable (RAT) cache of equipment known as the "RAT150". The RAT150T used in conjunction with the "Delta" (Δ) 1000T meets planning standards for a 1000 tonne (T) response. The selection of equipment for the RAT150 must meet pumping rates / capacities of 1000T thresholds and be complimentary[2] to the equipment held in the Δ1000T depots.

The response package, warehoused in Hay River, will be maintained in 100% readiness during the shipping season. The equipment will be broken down and be containerized such that it will fit through the smallest cargo door of any of the selected aircraft. Equipment will be TDG compliant, be palletized as appropriate, and labelled for ease of selection and loading.

[2] The logistics of moving large bulky items (ISO containers) in the arctic necessitates a LCM, deck barge, cargo vessel, icebreakers or any combination thereof. Consequently it is estimated that the 1000T design capacity would be available staged on-scene in 5 - 7 days. Following the doctrine *something sooner rather than everything later* having 150T of the 1000T equipment suite air-lifted within 48 hours is preferable to having nothing until the entire 1000T capacity arrives a week later.

Table 4-2 *- Canadian Coast Guard Arctic Community Pack Locations*

LOCATION	EQUIPMENT SUMMARY			
	Boom (24")	Skimmers	Boats	Storage
Arctic Bay (Ikpiarjuk)	3,650'	TDS-118	16' Aluminum	Open top Tank
Cambridge Bay (Ikaluktutiak)	1,350'	TDS-118	16' Aluminum	Open top Tank
Cape Dorset (Kinngait)	1500'	TDS-118	16' Aluminum	Open top Tank
Clyde River (Kangiqtugaapik)	4,500'	TDS-118	16' Aluminum	Open top Tank
Coppermine (Kugluktuk)	1,350'	TDS-118	16' Aluminum	Open top Tank
Coral Harbour (Salliq)	1,500'	TDS-118	16' Aluminum	Open top Tank
Gjoa Haven (Uqsuqtuuq)	1,350'	TDS-118	16' Aluminum	Open top Tank
Holman (Ulukhaktok)	1,500'	TDS-118	16' Aluminum	Open top Tank
Rankin Inlet (Kangiqsiniq)	2,200'	TDS-118	16' Aluminum	Open top Tank
Resolute (Qausuittuq)	1,350'	TDS-118	16' Aluminum	Open top Tank
Hay River FRU +	1,000'	-	37' Seatruck 42' Cutter	-

In combination with the RAT150T, equipment found in the ∆1000T depots will be at a 1000T capacity. Hence, the delta or "∆" is the difference between the RAT150T and a full 1000T. The ∆1000T depots will have containerized heavier equipment (not suitable for air transport to smaller communities) augmenting the RAT150T to a 1000T capacity, ready to be loaded on deck barge, Canadian Coast Guard icebreaker or freighter. While response personnel cascade in to the spill site pre-identified local, CCG base and available ER personnel will mobilize to the centres and load the equipment on suitable marine transport.

Three ∆1000T depots are strategically located in the northern communities of Tuktoyaktuk (NorthWest Territories), Iqaluit (Nunavut), and in Churchill (Manitoba). For the purposes of response in Central & Arctic Region, Churchill is included in the Arctic Zone of operations despite it being south of 60° North Latitude due to the similarities in response characteristics that it shares with locations north of 60° North Latitude.

Table 4-3 *- Canadian Coast Guard Arctic Design Inventory*[3]

PCM equipment	Description	Hay River RAT150T	Tuk Δ1000T	Iqaluit Δ1000T	Churchill Δ1000T
Skimmers	Light to medium product /disk type	3	1	1	1
	Heavy product /weir type	0	2	2	2
Boom	24" river type	0	10000'	10000'	10000'
	24" lay-flat type	5000'	0	0	0
Land storage	4T Open top tank	0	0	0	0
	8T Open top tank	7	3	3	3
	45T shore bladders	3	0	0	0
O/w storage	Total (in 5-25T Seaslugs)	50	250T	250T	250T
Pumps	2" low pres / volume style	4	1	1	1
	4" trash	5	1	1	1
	3" positive displacement	6	1	1	1
Vessels	"Car-topper" + 9.9hp	0	0	0	0
	Seatruck	0	2	2	2
	RAT RHI	2	0	0	0
Generators	5KW gas	7	2	2	2
Pressure washer	Larger hot water type	1	1	1	1
	Small cold water type	3	1	1	1
Incinerator	Sorbent	2	0	0	0
	Liquid waste	2	0	0	0

Central Zone

The Central zone is dominated by the Great Lakes and has well defined road transportation infrastructure.

Local / first response inventories have been established at all regional Canadian Coast Guard shore-side facilities that have fleet assets or a significant number of program vessels and that have operational personnel to deploy the equipment. Standardized inventory consists of a 20-24' trailer with a 1000' (nominal) of 24" boom and related accessories.

The 2500T Rapid Road Transportable cache is centred around the St. Mary's River and from time to time in major CCG facilities in Ontario. The response package warehoused in a series of 45' transport trailers will be maintained in 100% readiness during the shipping season. The primary purpose of the RRT 2500T system is significant containment of resources; shoreline, sheltered, and off-shore sweep and recovery ability; and staging and storage transfer area equipment.

[3] Inventories in Tuktoyaktuk and Iqaluit are at 95% completion. The Churchill Depot is at about 50% (pending the construction of a new and adequate facility) with the bulk of the inventory in storage at the Thundar Bay Coast Guard base. The RAT 150 needs an evaluation of the command and control component as well as storage for the second Saccke burner.

Table 4-4 *Canadian Coast Guard RRT 2500T Design Inventory*

PCM equipment	Description	BOOMERT #1-5 (each)	SKIMMERT #1 and #2[4]	Softside
Skimmers	Light to medium product/ disk type	-	3	
	Heavy product/ weir type	-	1	1
Boom	24" river type	4000'		
Sweep	36" Nofi V-sweep	-		1
Land storage	4T Open top tank	-	7	1
O/w storage	25T Towable bladders	-	4	4
Pumps	3" positive displacement	-	4	1
Generators	5KW gas	-	2	

Table 4-5 *Canadian Coast Guard locations for First Response Units (FRUs)*

Location	Relevant Area Plan(s)	Primary custodian	Secondary custodian
Amherstburg	Lake Erie/St. Clair-Detroit	SAR crew	ITS field services
Cobourg	Lake Ontario	SAR crew	
Gimli	Lake Winnipeg	SAR crew	
Goderich	Lake Huron	SAR crew	
Kenora	Lake of the Woods	ITS field services	
Kingston	Lake Ontario	SAR crew	
Meaford	Lake Huron	SAR crew	
Parry Sound	Lake Huron	ER personnel	ITS field services
Port Dover	Lake Erie	SAR crew	
Port Weller	Lake Ontario	SAR crew	
Prescott	St. Lawrence River	ER personnel	ITS field services
Selkirk	Lake Winnipeg	ITS field services	
Thunder Bay	Lake Superior	SAR crew	ITS field services
Tobermory	Lake Huron	SAR crew	
Hay River	Mackenzie River & Delta	ER personnel	ITS field services

[4] An additional SkimMERT is being added this year to accommodate additional hoses. The exact configuration of each SKIMMERT is not known yet so the inventories will remain listed together for this year.

Section 5 - RESPONSE OPERATIONS

5.1 Pattern of Response

Based upon the principles outlined in the *National Response Plan*, *(Sections 1.3, 1.5 & 4.4),* Central and Arctic Region assesses, notifies relevant parties, and initiates the tasking/deployment of necessary resources. This is based upon the determination of CCG's role as Lead or Resource Agency and the appropriate CCG Posture. The Duty Officer (DO) is tasked with this initial assessment, which is then verified by the Superintendent, Environmental Response. The appropriate response is activated by the Superintendent who in turn assigns an On-scene Commander (OSC) or Federal Monitoring Officer (FMO) and notifies Canadian Coast Guard (CCG) Management. Upon termination of the incident cost recovery actions are undertaken. To illustrate the generic process see Figure 5-1-Typical Sequence of Events and Table 5-1-Typical Functions Descriptions has been provided.

CCG Expectations of Ships for Response

In most instances when a spill occurs the initial report will trigger the mobilization of local response organizations. It is not normally practical for ship personnel to be directly involved in the clean up activities.

Small Spills

Ships are expected to take whatever actions listed in their Shipboard Oil Pollution Emergency Plan (SOPEP) that are reasonable and necessary to prevent the oil from escaping over the side and having done so, to take action to clean-up the oil contained on deck. Spilled oil should not be washed overboard, nor should degreasers or dispersants be used on spilled oil in the water. Once the oil is in the water, the ship's ability to respond in a practical manner is greatly reduced. It is Canadian Coast Guard's expectation that a response organization or other competent contractor be called upon to provide operational response capability at the discretion of the Polluter.

Where there is no availability of local response contractors or where there is a delay in response activation, the Master of the vessel should consider the use of available materials to contain and clean up the spilled oil by, for example, using ship-stocked absorbent material or utilizing mooring ropes or air filled hoses as makeshift booms.

Large Spills

The ship is restricted as to what action it can take to respond to a major spill. In the case of a casualty the safety of the ship and crew take priority. Therefore the ship's actions will be limited to reporting the incident details

to the appropriate authorities and to ensure that a response is initiated. In large spills it is Canadian Coast Guard's expectation that the Polluter appoint an On-Scene Commander (OSC) which may be a representative of the company that owns the ship or the ship's insurer.

Canadian Coast Guard needs to be kept informed as to the escalating response costs accrued by the Polluter during a response in order to prepare for the possibility that the Polluter will cease their response activities once their Limit of Liability is reached.

CCG expectations of Oil Handling Facilities (OHF) for Response

In most instances when a spill occurs, the initial report will trigger the mobilization of the facility response team. It is normal, in most cases, for the oil handling facility personnel to be the initial responders when a spill occurs.

Small Spills

For the purpose of this plan, a small spill will be defined based on the maximum oil transfer rate of the oil handling facility (i.e. what Level it is assigned under the *Canada Shipping Act, 2001),* which directly links to the minimum spill size to which it must be prepared to respond to within one hour. Oil handling facilities are required to have the resources on site to contain a spill of a minimum size within one hour and have the resources required to recover, or where the oil cannot be recovered the resources to control a spill of a minimum spill size within six hours. Response organizations may be called upon to provide additional operational response capability at the discretion of the Polluter.

Large Spills

For the purposes of this plan, any spill above the facility's minimum spill size will be characterized as a large spill. Oil handling facility personnel are still expected to deploy their on-site equipment. Response organizations will likely be called upon to provide additional operational response capability at the discretion of the Polluter.

Figure 5-*1 - Pattern of Response – Typical Sequence of Events*

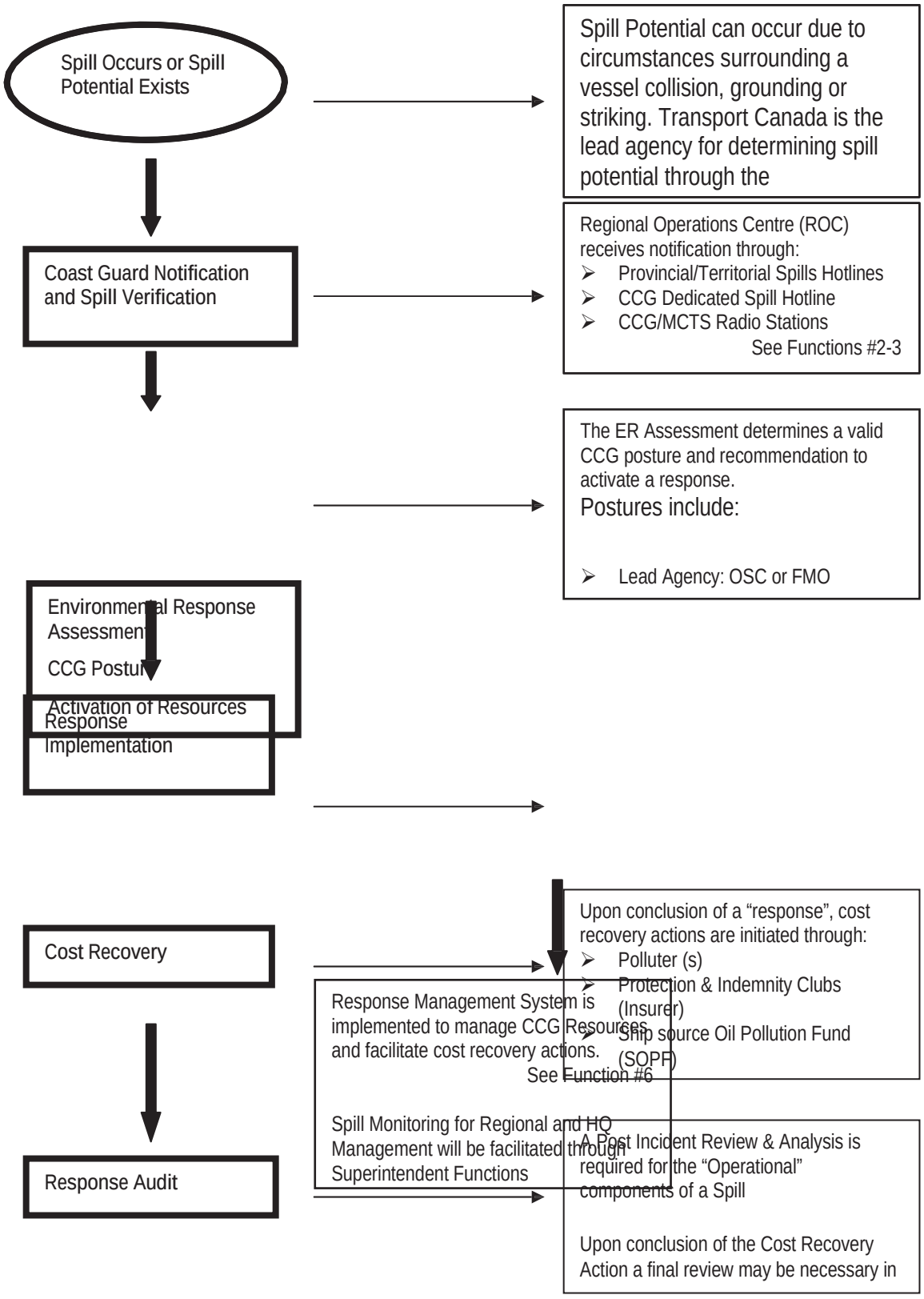


Table 5-1 *- Pattern of Response – Function Descriptions*

Function		Description
1	**Responsible Party/Third Party Functions** *(Spill occurs or sufficient potential risk exists)*	• Spill is sighted/reported. Spill reports originate from source (to regulatory body) or by third party (to various emergency or dedicated pollution hotlines) • Transport Canada is responsible for determining potential risk
2	**Spills Hotline Functions** *(Canadian Coast Guard Notification)*	• Assessment for dissemination • Dissemination (fan out according to applicable procedures) to relevant parties, calls from other spill hotlines are received by CCG-ROC.
3	**CCG-ROC Duty Officer Functions** *(Canadian Coast Guard Spill Verification)*	• Spill Assessment-pollution verification ➢ Mandate Confirmation ➢ Pollution Verification ➢ Source Credibility • Notification to ERDO • Dissemination • Initiation of MPIRS
4	**ER Duty Officer Functions** *(Environmental Response Assessment – CCG Posture)*	• Spill Assessment-response analysis • Source Control/Mitigation • Safety Issues • Tactical & Logistical Issues • Recommendation to Superintendent of likely Response Posture • Documentation – MPIRS
5	**Superintendent Functions** *(Environmental Response Assessment – Activation of CCG Resources)*	• Response Posture Evaluation ➢ Potential Risk to CCG Personnel and Equipment ➢ Propriety of request ➢ International Implications • Identification of OSC/FMO • Obtain an Order-In-Council (Arctic) • Obtain a Finance Code & Regional File Number • Notification of Senior Management and ongoing monitoring • MPIRS documentation • Obtain AC CCG sign off on MPIRS situation report
6	**OSC/FMO Functions** *(Response Implementation*	• Management or monitoring of response using the Response Management System (RMS). Escalation or de-escalation in accordance with needs of the incident. • Consolidation of all documentation upon conclusion of the response for Cost Recovery purposes. • Coordinate final debrief to facilitate future improvements to the systems and processes in place.
7	**Chief Financial Officer Function** *(Cost Recovery)*	• Utilizing CCG Ship-source and Marine Pollution Response Costing Principles and Documentation Standards (DFO 6332) compile pollution response costs recovery claim.

8.	**Internal** **Review Team Functions** *(Audit)*	• Utilizing the National Exercise Program Planning and Evaluation Guide, a Team is selected to complete the Post-Incident Review of an incident. • Improvements & corrective actions are to be documented

5.2 Spill Potential or Pollution Risk Assessment

Given an actual spill (i.e. pollutant in the water), the activities specified in this plan are rather obvious. However, in the event of vessel grounding, striking or collision that does not immediately result in a release, the responsibility for determining the risk of pollution rests with a Pollution Prevention Officer (PPO) within the Marine Safety (MS) branch of Transport Canada (TC). Should TC-MS be unable to make that determination, the Canadian Coast Guard (CCG), Environmental Response Duty Officer (ERDO) will complete that requirement. In some cases this may involve engaging a marine architect as no accredited expertise for vessel stability assessment resides within the ER section.

For all other areas where Canadian Coast Guard is the Lead Agency, this activity shall be considered the responsibility of the Canadian Coast Guard, Environmental Response Duty Officer.

5.3 Notification

To facilitate the notification of Canadian Coast Guard, and in addition to the existing Marine Communications system, a series of call-out or “Spill Hotline” agreements with the Province of Ontario, Nunavut and Northwest Territories and other Federal Departments within the Region have been implemented.

In addition, Central and Arctic Region, provides a 24 hr public access spills hotline:

24 hour toll free - Spills Hotline:
1-800-265-0237

Notification may occur through various mechanisms, depending upon the manner in which the spill (incident) occurs.

5.4 Verification

In all cases, spill information is initially processed and verified through the Regional Operations Centre (ROC) located in Sarnia, Ontario (See Section 3.3 – Organization). The ROC Officer on duty:

1. Determines whether the pollution is within Canadian Coast Guard’s mandate as Lead Agency or as a potential Resource Agency
2. Establishes the credibility of the source

3. Identifies the following:
    - Incident name (nature of incident)
    - Time of call (local / UTC)
    - Time of spill (local/UTC) *(if available)*
    - Reported by / call back particulars
    - Source determination
    - Incident background and description of clean-up activities (if any)
    - On-scene environmental/atmospheric conditions
    - Pollutant type and quantity
    - Verifying party contact information (as applicable)
4. Initiates an MPIRS entry for the following cases:
    - Originally pursuing verification as Canadian Coast Guard mandate but additional information about source changes lead to another agency
    - Canadian Coast Guard mandate and verified no pollution
    - Canadian Coast Guard mandate and verified pollution
    - Likely to impact on / impacting on foreign waters
    - Significant impact on region, though not falling under Canadian Coast Guard mandate.
    - Request for Canadian Coast Guard as a resource agency.
5. Enters information into MPIRS (indicated in #3 above) as well as name of paged ERDO.

This information is then relayed to the Environmental Response Duty Officer to determine Canadian Coast Guard posture. It should be noted that all spill incidents, irrespective of CCG's mandate, may require Canadian Coast Guard resources if requested (see Resource Agency Role in Section 1.5 of the *National Response Plan).*

By agreement, spill verification will be completed by the Regional Operations Centre (ROC) Duty Officer. The verification will be complete when the ER Duty Officer is advised where Canadian Coast Guard is Lead Agency. (see Figure 5.2 Pollution Verification Process and Figure 5.3 Response Analysis Process)

5.5 Spill Assessment – Environmental Response Duty Officer

To facilitate the requirement for efficient and rapid notification and assessment of incidents, Central and Arctic Region, in accordance with the *National Response Plan,* Section 4.4, has instituted a 24-hr year round monitoring regime integrated with the Regional Operations Centre (ROC). The following sections identify the context in which this activity is carried out.

Coordination

The coordination of the ER Duty Officer is the responsibility of the ER Regional Emergency Operations Officer (REOO). These duties include assigning shifts in an equitable manner, keeping records of the duty officer schedules, maintaining equipment required to perform ER Duty Officer functions, reviewing individual ER Duty Officer performance, reviewing ER Duty Officer procedures, and liaising with the ROC and National HQ.

Performance

The ER Duty Officer function shall be performed by the following positions provided sufficient experience, appropriate training, and at the discretion of the Superintendent ER:

- ✓ Senior Officers
- ✓ Those in capacity to act for Senior Officer.

Review

The ER Duty Officer procedures shall be reviewed in reaction to:

- Changes at the Regional Operations Centre (ROC) affecting the ER Duty Officer function
- Changes in Canadian Coast Guard (CCG) policy on the response to ship source pollution
- In consideration of accepted recommendations stemming from exercises and operational responses.

The individual officer performance shall be reviewed in context of their execution of a spill assessment.

Responsibilities

At the beginning of the ER Duty Officer's shift the following are required:

- Functioning communication equipment (pager, cell phone/Blackberry);
- The necessary analytical tools (e.g. spill assessment forms, Greenwood's Guide to Great Lakes Shipping, Area Plans, Oil Spill Response Field Guide, OSH reference tools, and the CANUTEC Emergency Response Guide book.)

During the ER Duty Officers shift the following are required to be complete:

- MPIRS cases for any spill reports that required ER Duty Officer analysis by noon of the next business day;
- Extra Duty Reports;
- Notification of the next ER Duty Officer and the ER Regional Emergency Operations Officer of any on-going cases.

Availability

The availability of the ER Duty Officer is 24 hours/7 days a week. Pages must be responded to within 10 minutes of notification. Should the ER Duty Officer (DO) be unable to fulfill their duties at any time during the shift, they are required to

notify the ER Regional Emergency Operations Officer (REOO) immediately who will notify the ROC of any changes immediately. The following activities conflict with the performance of the ER Duty Officer function:

- travel out of country / region / pager range;
- inability to respond immediately due to performance of other job functions (instructing a course, running an exercise, delivering a presentation, involved in a maintenance run that would be too difficult to reschedule, chairing a meeting, or participating in any activity that requires attendance or would be inappropriate to leave);
- inability to respond immediately due to personal reasons (vacation, sickness, etc.).

Should an individual become unavailable for a significant portion of the shift for reasons noted above, that shift may be assigned to another officer at the discretion of the ER Regional Emergency Operations Officer.

Function

The primary function of the ER Duty Officer is to complete an initial incident assessment and analysis, making a recommendation to the Superintendent of ER as to the appropriate course of action. [**]

The initial assessment will be complete for the following cases:

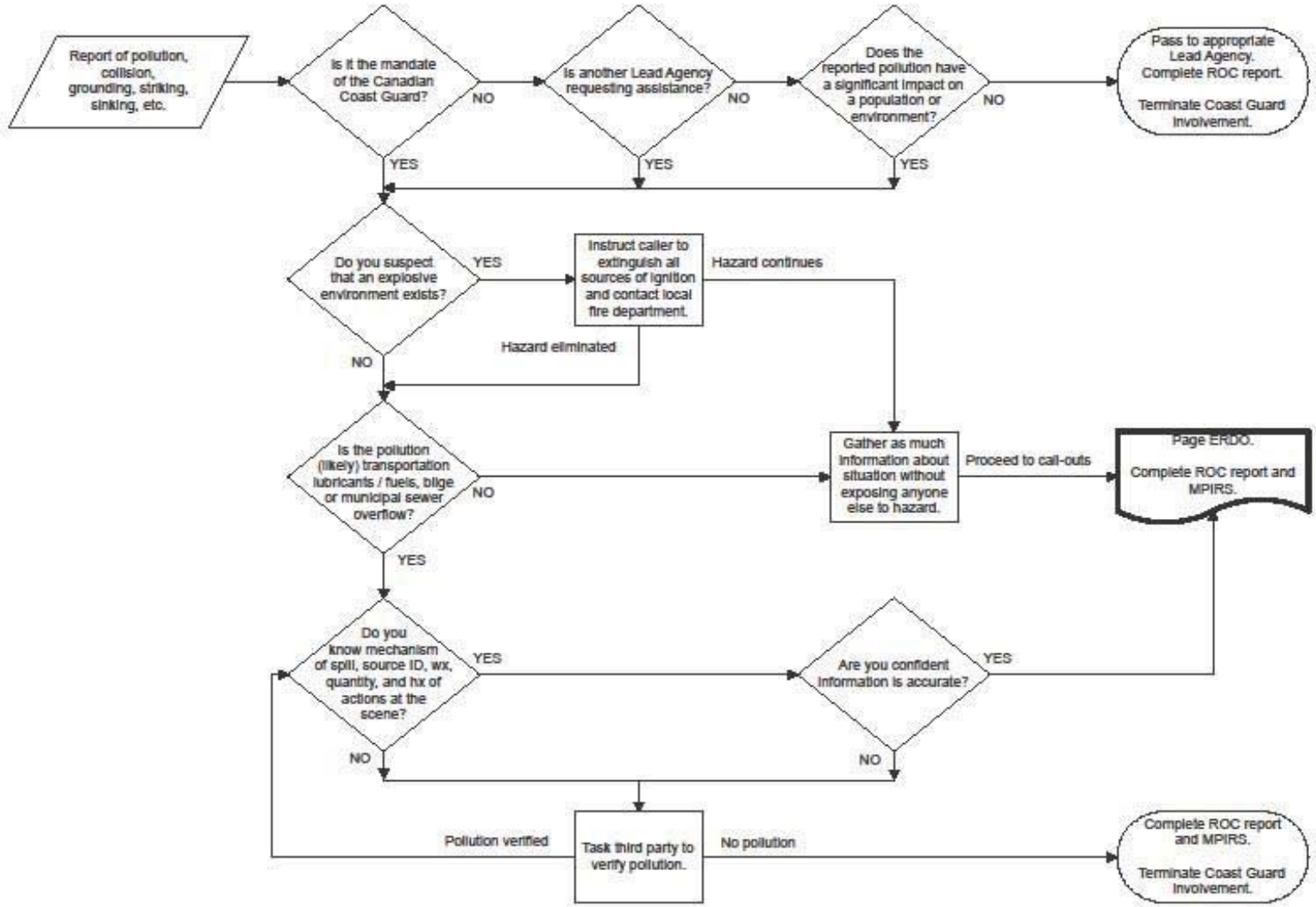
- Canadian Coast Guard mandate and verified pollution
- Likely to impact on / impacting on foreign waters
- Significant impact on region, though not falling under Canadian Coast Guard mandate.
- Request for Canadian Coast Guard as a resource agency.

The analysis function is complete when the Superintendent ER is informed and advised of the recommended course of action that will consider the following (see flow chart):

- polluter's actions and intentions (if applicable);
- safety concerns, tactical, logistical, and environmental feasibility of any response.

[**] The ER Duty Officer does not need to notify the Superintendent of any incidents that require "no activation" of CCG resources (assets/personnel) in monitoring/clean-up activity.

Spill assessment: *pollution verification process*



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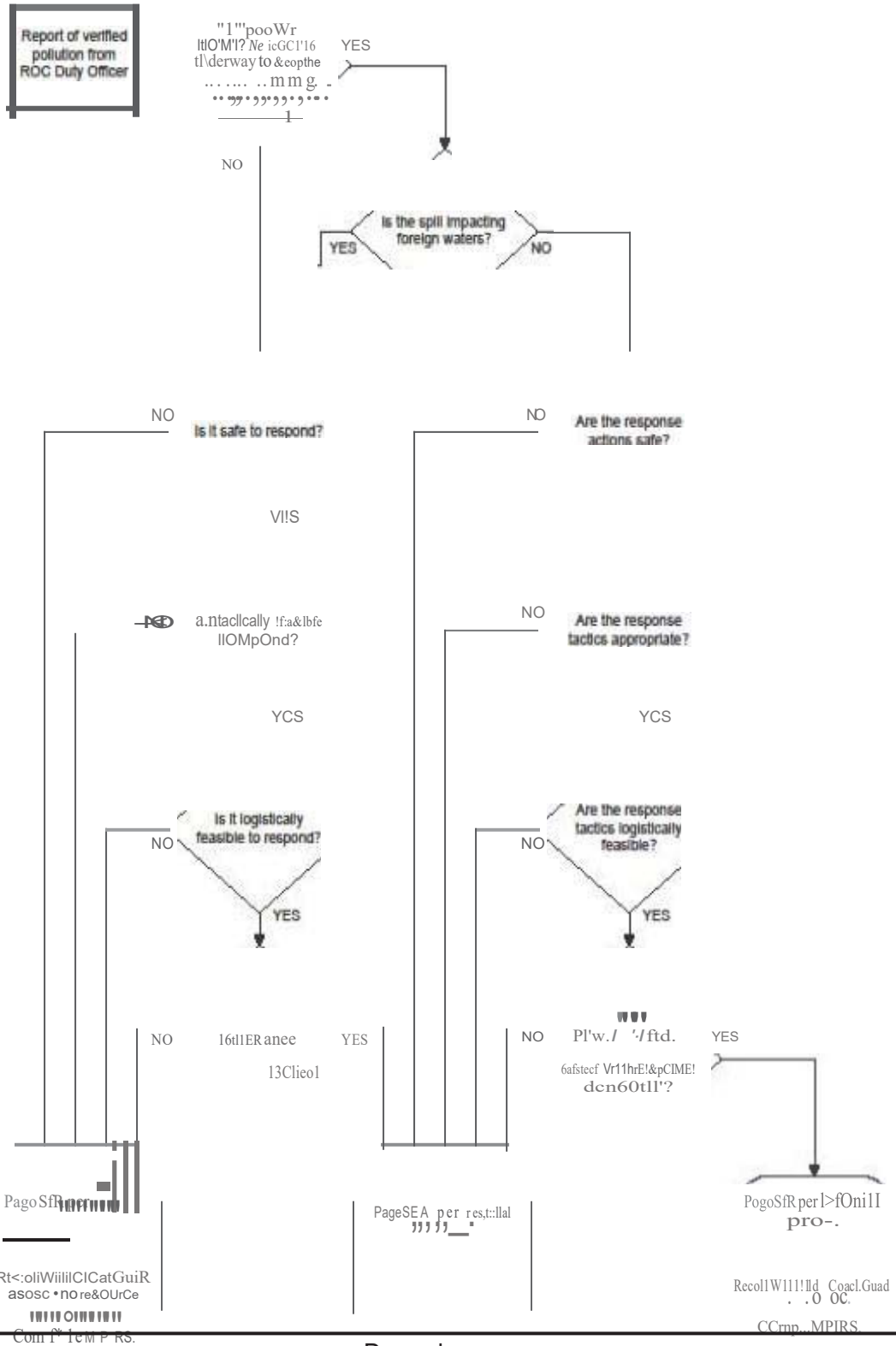

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complete MPIRS.

5.6 Activation of Canadian Coast Guard Response Resources

In the event of small (0-150 T) to medium size (150-1000 T) spill incidents, the Superintendent, Environmental Response, acting upon the assessment provided by the Duty Officer, initiates/activates the appropriate response. This entails, but is not limited to, the following activities:

- Identification of overall health and safety risks to response personnel.
- Establishing the propriety of the recommended response posture. This includes the verification of international issues in border areas.
- Verification of Canadian Coast Guard capability to respond, impact on normal regional operations and, if necessary, the potential requirement for the notification and activation of the National Response Team.
- Assignment of the designated On-Scene Commander (OSC) or Federal Monitoring Officer (FMO). SROs are typically assigned as FMO/OSC for incidents occurring within their geographic area.
- Obtaining the necessary Order-in-Council, for spills in Arctic Waters
- Obtaining the financial project code, and forwarding it to the OSC/FMO.
- Signing a contract with the Response Organization (RO) in accordance with PWGSC contracting rules.
- Creation and dissemination of initial situation report to Regional and National management in accordance with the *Safety and Environmental Response Systems (SERS) – Incident Notification Guidelines*.
- Completion of MPIRS to document above activities.

For significantly larger spill incidents (1000T and above) the Superintendent, Environmental Response shall immediately assume the OSC/FMO role, notify Regional and National management of the situation and initiate the Response Management System (RMS) (and activation of the National Response Team, if necessary) in addition to the above activities. Upon stabilization of the immediate emergency, the Assistant Commissioner, Canadian Coast Guard, Central and Arctic Region and/or Director General, Canadian Coast Guard shall assess the requirement for assigning a new OSC/FMO.

5.7 Response Implementation

As stated previously (Section 4 - Preparedness), the Canadian Coast Guard will employ the Response Management System (RMS) as its primary management and operational tool. At the heart of this system is the development of clear obtainable objectives and the implementation of the supporting tactical deployment. This is achieved through the creation of incident action plans spanning specified operational time periods. For small spills these plans can be rather informal. As spill size and impacts increase, so to will the complexity of

operational assignments and hence a need for greater formalization of the Incident Action Plan.

All operations shall be carried out in accordance with the Guiding Principles set out in *Section 1.3* of the *National Response Plan* and the *Oil Spill Response Field Guide* (ISBN 0-660-16112-5).

Central and Arctic Region covers an extremely large geographical and culturally diverse portion of Canada. There are, in essence, two zones of operation which are entrenched in the *Canada Shipping Act*.
These are the:

- Arctic zone, or all areas of Canadian jurisdiction north of 60^0 N Latitude;
- Central zone, dominated in a marine transportation sense by the Great Lakes, but which include the southern portions of Hudson, James and Ungava Bay, along with the major waterways and watersheds of Lake Winnipeg, Winnipegosis, Lake of the Woods, and Lake Athabasca.

Arctic zone – first response
The highest risk of pollution in the arctic is during a ship fuel transfer to facilities in Canada's northern communities. Should pollution occur, the vessel and oil handling facility have responsibilities to implement their Oil Pollution Emergency Plans (OPEP) that deal with source control. The next step would be for the community to respond using its response plan, protecting the identified priority area(s) and employing the response equipment in an Arctic Community Pack, if so equipped.

Arctic zone – escalation
If the pollution is beyond the ship, facility, and community response then the Rapid Air Transportable (RAT)150T will be the first line Canadian Coast Guard ER response (Arctic icebreakers or Special River Nav-aid Tenders may have been on-scene first). Upon activation of the RAT150T, standing offers with aviation contractors will be called up. Closest ER personnel will be dispatched to the community to assess, plan, assemble (and train) responders, while preparing to stage the in-coming equipment. The Hay River base personnel will transport the pallets to the airport where they will be loaded into the awaiting airframe. Upon arrival the pallets will be unloaded and a trailer tongue and wheels affixed to the pallet to facilitate movement (by ATV if necessary) to a forward staging area and ultimately to a beach site. The timeframe for full forward staged capacity with personnel at any community with suitable runways is under 48 hours.

The hospitality industry of Arctic communities can be rapidly overwhelmed with the influx of as little as 10 people. Experience has shown that these communities could only support 10-15 additional personnel and only offer 10-15 community responders. Consequently, the RAT was designed considering the amount and type of equipment that is most easily handled by a combination of trained

Canadian Coast Guard personnel and community responders. The RAT150T response is predicated on an in-community response with the following positions identified in the table below:

Table 5-2 *Anticipated personnel usage for the RAT150T in an Arctic community*

Position	Canadian Coast Guard responder	Community responder
OSC	X	
OSC support		X
Chief Ops & Planning	X	
Logs – services	X	X
Logs – support	X	X
Ops skimming (A)	X	X
Ops skimming (B)	X	X
Ops shoreline (A)	X	X X X X
Ops shoreline (B)	X	X X X X
Ops booming vessel (A)	X	X
Ops booming vessel (B)	X	X
Transfer / disposal	X	X
Totals	**11**	**16**

Upon escalating beyond a RAT150T response, the Δ1000T will be stood up. Standing offers / arrangements with local contractors will be activated to move the containers / seatrucks to a location where they can be transferred to a ship / barge. If required, closest Canadian Coast Guard base personnel will be dispatched to the depot to assist. The closest suitable marine transportation asset will also be contracted to move the equipment to the spill site. The timeframe for full forward staged capacity with personnel is estimated at one week.

As the 150T response is predicated on an in-community response a larger spill would have to be supported by a Canadian Coast Guard icebreaker, rented camp barge, or flown in from surrounding communities.

Table 5-3 *Anticipated personnel usage for the 1000T in an Arctic community.*

Position	Canadian Coast Guard ER responder	CCG Fleet or professional contractor	Community responder
OSC	X		
OSC support		X	X
Chief of Planning	X		
Plan – response	X		
Plan – demobilization	X		
Chief of Logs	X		
Logs – services		X	X
Logs – support	X X	X X X	
Chief of Ops	X		
Air Ops		X	
Ops on-water	X X	X X X X	
Ops shoreline	X X		X X X X X X X X X
Ops booming	X X	X X X X	
Transfer / disposal	X	X	X
Totals	**14**	**13**	**13**

Central Zone – first response

The highest risk of pollution occurring in the region is found in the Great Lakes. Statistically the areas in the Great Lakes of highest risk are the connecting channels due to volumes, numbers of transits, and convergence factors (existing VTS / navigational aid systems recognize this). Areas with traditionally high pleasure craft and small commercial craft traffic experience frequent (though low in volume) pollution incidents.

If the pollution is in the local vicinity of a Canadian Coast Guard Search and Rescue (SAR) station or facility with operational staff, a First Response Unit (FRU) may be deployed as an initial attempt at containment. If more equipment sweeps systems or recovery units are required then the Rapid Road Transportable (RRT) 2500T will be activated.

Transfer of Lead Agency

Transfer of Lead from CCG

Should an incident initially appear to fall within the jurisdiction of the Canadian Coast Guard yet later is determined to be another government agency's

responsibility, the CCG-appointed OSC or FMO will verbally acknowledge the transfer of Lead Agency responsibility followed by written confirmation on the terms of the transfer (this may require time for termination of a response contract with CCG and the establishment of a response contract with the appropriate Lead Agency.) When the Lead is transferred from CCG to another Lead Agency, CCG will submit an invoice of its response costs to the Lead Agency for response activities undertaken up to the time of transfer recognition.
Should the Lead Agency wish to retain CCG as a Resource Agency, the criteria in Section 7 of the *National Response Plan* of the *CCG National Marine Spills Response Plan* will apply.

Transfer of Lead to CCG
When the Lead is transferred to Canadian Coast Guard from another agency, the Canadian Coast Guard will incorporate the appropriate costs borne by the other agency in the initial stages of the spill into its claim to the Polluter or to the Ship Source Oil Pollution Fund, (SOPF) as the case may be.

Safety Procedures and Considerations

All petroleum cargoes are considered hazardous substances. Canadian Coast Guard command, clean-up, monitoring and verification personnel have protective equipment and training available to them up to Level “D”. All Environmental Response branch staff have been issued with a variety of personal protective equipment (PPE) and are expected to deploy to a spill site (includes exercises and training) with all appropriate gear. Safety glasses and rain suits with rubber boots and gloves are appropriate for Canadian Coast Guard's traditional verification of and response to oil pollution.

Bulk chemical carriers, rail cars, road trailers, sour (H2S) petroleum products or BTX (benzene, toluene, xylene) carried on oil tankers are all sources of substances for which Canadian Coast Guard personnel are not readily equipped for. In most cases where the pollutant reported is suspected to be from one of these sources Canadian Coast Guard assets should not be tasked to verify. If it falls within Canadian Coast Guard mandate the ER program personnel will get directly involved in the verification, likely looking to other government departments or contractors to continue with the assessment and response.

When the pollution is reported to the ROC by a member of the public, or by a credible professional as a mystery spill, closer examination of the circumstances or probable cause of the pollution will occur as part of spill verification. During the conversation with the individual reporting the incident the ROC Duty Officer will want to find out what it is that they observed. These are:

- Colour [typical petroleum silvery to rainbow to dark purple / brown or is it frothy, green organic matter, rusty, etc.]
- Odour [does it smell like gas, diesel, rotten eggs, no odour]
- Proximity to any likely source [vessel, industrial outfall, municipal outfall, midlake, mid channel, washed up industrial storage drum]

- Volumes [football field sized, shopping mall parking lot big, or a thin ribbon]
- Other factors [heavy rainfall in last 12 hours; seasonal conditions / times / areas known for algae blooms; fish or animal kills].

By picking up on any "flags" during an assessment it can be reasonably determined whether the pollution should not/should be classified as a hazardous substance (for which CCG personnel are unable to respond to). The ER duty officer will consult with experts in Environment Canada (EC), Spills Action Centre (SAC), and CANUTEC, as appropriate to determine the safety for personnel.

Alternative countermeasures

Alternative countermeasures are those non-mechanical techniques utilized in oil spill response operations such as in-situ burning, dispersant application, and shoreline cleaner application.

Central Zone

The likelihood of approval of in-situ burning operations on the Great Lakes or in connecting channels or inland lakes is minimal. The use of dispersants in the Great Lakes, connecting channels or in inland waterways will not be considered. Shoreline cleaner agents approved by Environment Canada may be considered.

Arctic Zone

In view of the difficulties associated with mounting an effective response in the Arctic, the CCG has recommended that further research be done in the areas of in-situ burning, the use of dispersants (reference Quebec paper) and other oil in ice recovery methods. This research should be operational R&D and assume that the product spilled is Arctic diesel and that the spill occurs during the Arctic shipping season.

5.8 Summary Report and Post Incident Review

It is regional policy to provide a Summary Report and/or conduct a formal Post Incident Review for incidents deemed noteworthy or valuable by the OSC/FMO or Assistant Commissioner, Canadian Coast Guard.

Summary Report

The summary report shall contain at minimum the following, but can include any information deemed relevant by the OSC/FMO.

Summary Incident Report Format

(a) Overview of Crisis Event

- spill source (not cause), initial environmental conditions and assessment of situation

(b) Spill chronology
- spill response activities and climate/wind /sea condition data
- key response objectives (success and failures in implementation), major shifts in tactics, other agencies involvement

(c) Costs and cost recovery issues
- total estimated cost summary
- identification of Cost Recovery requirements and options

(d) References
- Situation Reports

Post Incident Review

The main objective of a Post Incident Review is the evaluation of the incident to ultimately improve Canadian Coast Guard's effectiveness at spill response. To that end, this requirement is essentially similar to the principles of exercise evaluation. Therefore, when required, the review shall be conducted in accordance with the principles contained in the *National Exercise Program – Evaluation guidelines, Chapter 11*.

This entails six distinct tasks:

1) Brief the Evaluation Team
2) Brief the Response Team
3) Evaluate the Incident
4) Prepare a Preliminary Summary of Key Observations
5) Hold an Incident Debriefing Session
6) Prepare an Official Post Incident Evaluation Report

Post Incident Evaluation Report Format

(a) Executive Summary -Summarizes overall findings and observations

(b) Overview of Incident Objectives -Briefly describes the key objectives, environmental conditions and initial situation assessment

(c) Evaluation Techniques and Criteria - Describes the technique(s) (i.e. self, peer or independent evaluation) and the major evaluation criteria used

(d) Assessment of Key Incident Objectives - This provides a critical appraisal of the incident objectives or major shifts in tactics. Each key objective assessment will include the following:

Findings – A summary statement describing key positive and negative findings.

Specific Observations - Observed decisions and tasks noted during the incident by responders, management and interested parties.

Conclusions - Assessment of the impact of the finding on overall achievement of the incident objective(s)

Recommendations – A description of potential corrective or follow-up action required to implement the findings to improve overall marine spill response preparedness.

(e) Appendices or Attachments - May or may not be required

Section 6 – CLAIMS & COST RECOVERY

6.1 Purpose

The purpose of this section of the *Regional Response Plan* is to outline the requirements and regional processes to assist in the creation of a claim to the relevant fund or directly to a polluter.

The ability of Canadian Coast Guard to recover or pursue recovery of response expenses or costs associated with monitoring activities is set out in the *Marine Liability Act, Part 6, "Liability and Compensation for Pollution"*. This ability to recover costs is seen as the embodiment of the polluter-pay-principle set out in the *National Response Plan, Guiding Principles, Section 1.3*.
Note: That at this time there is no mechanism to recover monitoring costs from an oil handling facility.

In addition to the above and recognizing the potential financial risks and impacts to Canada, Canadian legislation also provides for the creation and maintenance of a Ship-Source Oil Pollution Fund, (SOPF). This fund, in addition to the International Oil Pollution Compensation Fund (IOPCF) and the Protection & Indemnity (P&I) Clubs, provides for the assessment of claims/loss against member ships and/or shipping companies. Neither of these funds hinder nor otherwise limit Canadian Coast Guard's ability to lay claims directly against a Polluter. However, the Polluter is only required to reimburse a claim up to its Limit of Liability. This limit is calculated using the guidelines established in the *Convention on Limitation of Liability for Maritime Claims (LLMC), 1976*.

6.2 Policy Guidelines

The following points serve as regional guidelines for pursuing cost recovery activities:

- The decision to seek cost recovery should be made based on common sense and in consultation with other operational and finance team members.
- Cost recovery should be avoided in situations where the administrative costs of recovery action exceed the dollars expected to be recovered.
- Cost recovery embodies the "Polluter Pays" principle.
- Costs incurred while acting as a resource agency must be recovered from the lead agency.
- Costs incurred while acting as OSC/FMO are recoverable from either the polluter, its P&I Club, the Ship-Source Oil Pollution Fund or from the International Oil Pollution Compensation Fund.

6.3 Responsibilities

On-Scene Commander/Federal Monitoring Officer (OSC/FMO)
The OSC/FMO is responsible for ensuring that complete and accurate documentation is provided for a timely and effective cost recovery process. The OSC/FMO is responsible for preparing all documentation necessary to initiate cost recovery.

Regional Finance Staff
Response, monitoring and administrative costs must be calculated in accordance with national financial accounting and recording practices. Senior administrative officers within Maritime Services may be called upon to provide expert advice as required. It is recommended that a regional finance representative be on-scene as soon as possible to help establish procedures, to safeguard documentation, and to ensure the integrity of the costing process.

Environmental Response Headquarters
The Environmental Response Senior Advisor for Cost Recovery and Claims will submit those claims that are intended for the Ship-Source Oil Pollution Fund and to International Fund Conventions in accordance with the guidelines specified by each. The Advisor will also issue equipment charge-out rates periodically for use by all regions.

6.4 Process
The Response Management System (RMS) documentation (field notes, Incident Action Plans, Minutes and meeting records, time sheets and any and all expense records, invoices/requisitions etc.) shall form the basis of data for the Cost Recovery action.

The Region will initiate cost recovery actions against the Polluter. Should the Polluter be unable or unwilling to pay the costs, the Region will forward the claim to HQ Senior Advisor for Cost Recovery and Claims for submission to the Ship-Source Oil Pollution Fund. Should the costs of the response exceed the Limit of Liability of the Polluter, reimbursement of costs will be through the SOPF and then through the IOPCF. Claims associated with mystery spills will be submitted directly to HQ for a claim against the SOPF.

6.5 Documentation
Proper documentation alleviates the need to reconstruct the incident after the fact, reduces the volume of questions, and adds credence to the claim. The key source of information that enables various parties to determine the degree of reasonableness of the actions taken and the costs claimed is the part of the cost recovery summary known as a “narrative”. That justification is considered to be a critical component to successful and timely claims.

The regional guideline for producing cost summaries and documentation handling is as follows:

Incidents of minimum complexity and limited expenditures (under $15K)

- Expenditures may be summarized within the body of the Final Report, including any description of "calculated" values (i.e. administration costs)
- Original invoices shall be kept on the dedicated spill file.

Incidents of medium complexity and moderate expenditures (up to $50K)

- Expenditures will be summarized in a single table by Cost Element within the body of the Final Report.
- A supporting cost summary document or appendix shall be created to provide a detailed cost summary by date. Copies of the expenditure documentation will be included.
- Original invoices shall be kept on the dedicated spill file organized by date.

Incidents of high complexity and significant expenditures ($50K plus)

- Expenditures will be summarized in a single table by Cost Element within the body of the Final Report. (similar to medium complexity incidents)
- A supporting cost summary document will be created summarizing the daily expenditures by individual cost element, followed by a cumulative summary of each cost element (spreadsheet of all daily summaries). The sum total of all cost elements will then be summarized for use in the final report.
- Due to the volume of transactions, copies of the expenditure documents will not be provided in the supporting cost summary document.
- Original invoices will be kept in their original state, filed by date and archived when feasible to a dedicated file.

Table 6.1 Sample Cost Element Table

Cost Element	Description
Personnel	Includes hourly regular and overtime costs associated with CCG Staff (includes EBP)
Equipment	Includes cost of all CCG assets, based upon established charge out rates
Purchases/Expendables	Includes expendables such as office supplies and PPE
Travel	Includes meals and accommodation costs incurred by CCG staff accordance with TB travel directive.
Contractors	Includes the costs of all private sector contractor/goods and services.
Administration	Includes the cost of CCG administration.
Total Estimated Cost	

6.6 References

- CCG Ship Source and Marine Pollution Response Costing Principles and Documentation Standards DFO2004-6332
- Cost Recovery of Ship Source and Marine Pollution Response Directive # D-4010-2001-01
- Cost Recovery Related Policies, Memorandum dated October 26, 1998, File AWE 1001-5-2-1 (AWEA)

6.7 Third Party Claims

While monitoring or responding to an incident, Canadian Coast Guard will refer all inquiries regarding third party claims to the Polluter. In the case of a mystery spill, the Canadian Coast Guard will encourage claimants to submit a claim directly to the Ship Source Oil Pollution Fund.

Section 7 - PLAN MAINTENANCE AND CUSTODIANS

7.1 *Maintenance Process*

Responsibility
The *Regional Response Plan* of the *Canadian Coast Guard Marine Spills Response Plan* for Central & Arctic Region is the responsibility of:

Assistant Commissioner, Canadian Coast Guard
Central & Arctic Region
520 Exmouth Street
Sarnia, Ontario
N7T 8B1
fax (519) 383-1991

Revision Requests
All requests or suggestions for revision to this plan should be forwarded, in writing, to the above noted address and should include the following information:

- Originator (including return address and telephone number)
- Date
- Subject (i.e. request for revision)
- Suggested change (including section and page number references)
- Reason for revision

All formally received requests will be acknowledged in writing and assessed for inclusion into the plan. Upon approval the revision will be distributed accordingly.

Revision Record
Upon receiving a revision transmittal, recipients are requested to ensure that its number is next in sequence to the previous issue, process the amendments according to the transmittal instructions and complete the revision record in this section.

Should there be any discrepancies or questions, the recipient should contact the Canadian Coast Guard, Assistant Commissioner, Central & Arctic Region at the above address.

The onus is on the plan holder to maintain a current plan.

7.2 *Canadian Coast Guard Custodians*

This document is structured to reflect the fundamental phases of Environmental Response (ER) activities and hence reflects the co-operative nature of each

aspect of the Central and Arctic Region Environmental Response organization. In conjunction with this, each component has been assigned to a specific section within the branch (e.g. training is the responsibility of the Training Officer). The Assistant Commissioner – Canadian Coast Guard, Central and Arctic Region retains the overall responsibility for the document's implementation. The Emergency Plan Development Officer (EPDO) facilitates the physical management and co-ordination of this document.

These custodial relationships herein are designed to facilitate the annual review and maintenance of the *Regional Response Plan*.

Letter of Promulgation	Emergency Plan Development Officer
Record of Revision	Plan Holders
Section 1 – Introduction	Emergency Plan Development Officer
Section 2 - Agreements & Memoranda of Understanding	Emergency Plan Development Officer
Section 3 – Organization	Emergency Plan Development Officer
Section 4 – Preparedness 4.2 RMS	Regional Training Officer
4.3 Planning	Emergency Plan Development Officer
4.4 Training	Regional Training Officer
4.5 Exercising	Regional Exercise Officer
4.6 Inventory Maintenance & Management	Regional Emergency Operations Officer
Section 5 – Response Operations	Regional Emergency Operations Officer
Section 6 – Claims & Cost Recovery	TBD
Section 7 - Plan Maintenance & Custodians	Emergency Plan Development Officer
Section 8 – Contacts	Emergency Plan Development Officer
Section 9 – References & Annexes	Responsibility for each annex is assigned in each Annex.

All unassigned sections shall be considered the responsibility of the Emergency Plan Development Officer unless otherwise indicated.

7.3 Plan Distribution

The *Regional Response Plan* shall be distributed to all holders of the *Canadian Coast Guard Marine Spills Response Plan*, in accordance with the Area of Responsibility set in Section 1 - Introduction. This includes the relevant Federal and Provincial Lead Agencies as described in the National Response Plan Section 1, sub-section 1.5; all Canadian Coast Guard Management; Facilities and Vessels; all Oil Handling Facilities and relevant certified Response Organizations by request and in accordance with Transport Canada-Marine

Safety, Compliance and Enforcement division. All subsequent revisions will be automatically distributed to these plan holders.

Any member of the general public wishing to obtain a copy may do so through the Fisheries and Oceans, Canadian Coast Guard, National Headquarters. These plan holders will not be advised of revisions.

Section 8 – CONTACTS

8.1 Pollution Reports for Canadian Coast Guard, Central & Arctic Region

To report a pollution emergency anywhere within Central & Arctic Region telephone the Canadian Coast Guard, Regional Operations Centre (ROC) toll free at:

1-800-265-0237

or report via

Marine Radio on VHF, Channel 16.

8.2 Other Lead Agencies that Maintain Spill Report Lines

- Ontario Ministry of the Environment - Spills Action Centre: 1-800-268-6060
- Territorial Spills Line – Arctic Alarm: 1-867-920-8130
- Manitoba Conservation: 1-204-944-4888
- Saskatchewan Environment - Saskatchewan Spill Centre: 1-800-667-7525
- Alberta Environment: 1-800-222-6514

8.3 Canadian Coast Guard, Environmental Response Branch (CCG/ER) Phone List – Regular Office Hours

Regional Office, Canadian Coast Guard 520 Exmouth Street Sarnia, ON N7T 8B1	
Title	**Telephone**
Superintendent, Environmental Response	519-383-1954
Emergency Plan Development Officer	519-464-5126
Assistant Contingency Planning Officer	519-383-1953
Regional Exercise Officer	519-383-1978
Regional Emergency Operations Officer	519-383-1956
Environmental Training Officer	519-383-1957
Administrative Assistant	519-383-1951

Canadian Coast Guard Base **42037 McKenzie Highway** **Hay River, NT X0E 0R9**	
Title	**Telephone**
Senior Response Officer	867-874-5557
Response Specialist	867-874-5558
Response Specialist	867-874-5559

Canadian Coast Guard Base **PO Box 1000, 401 King Street** **Prescott, ON K0E 1T0**	
Title	**Telephone**
Senior Response Officer	613-925-2865 x 157
Response Specialist (2)	613-925-2865 x 262
Logistics and Statistics Officer	613-925-2865 x 126

Canadian Coast Guard Base **28 Waubeek Street** **Parry Sound, ON P2A 1B9**	
Title	**Telephone**
Senior Response Officer	705-746-2196 x 228
Response Specialist	705-746-2196 x 270
Response Specialist	705-746-2196 x 201

Section 9 – REFERENCES & ANNEXES

9.1 References

The following list includes those documents which supplement the Regional Response Plan.

Supplement	Custodian
Environmental Response Manual – Standard Operating Procedures and Directives	Canadian Coast Guard, Environmental Response, Headquarters
Response Management System User's Guide, version 3.0 (May 2006)	Canadian Coast Guard, Environmental Response, Headquarters
Environmental Response Superintendent's Manual	Superintendent, Environmental Response, Regional Office
Environmental Response Regional Health & Safety Plan	Environmental Response, Regional Emergency Operations Officer
National Exercise Program (NEP) Manual	Canadian Coast Guard, Environmental Response Headquarters
Inventory Control and Response Management System – TMA database	Regional Logistics and Statistics Officer, Environmental Response
DFO Crisis Communications Plan	DFO Corporate Services, Communications Branch

9.2 Annexes

The following Area Plans make up the Annexes to the Regional Chapter:

1) St. Lawrence River and Lake Francis
2) Lake Ontario
3) Lake Erie
4) St. Clair and Detroit River
5) Lake Huron, Georgian Bay and North Channel
6) St. Mary's River
7) Lake Superior
8) Lake of the Woods
9) Inland waters (South of 60°N Latitude)
10) Hudson and James Bay
11) Baffin Region
12) Keewatin Region
13) Kitikmeot Region
14) Great Slave Lake Region
15) Mackenzie River and Delta
16) Beaufort Sea and Amundsen Gulf

APPENDIX G – Agnico Internal Spill Report Form

Spill >100 L need to be declared to Env. Dept. Immediately

Meliadine Gold Project
Internal Spill Report Form

Everyone is responsible of cleaning their spills

	Date of spill
	Date of spill report
AGNICO EAGLE	Date at the end of cleanup/incident
	* special note :

Reported by / Unreported		Select one Cause for the incident
Contractor Involved	☐	In the selection under :
Employee Involved	☐ Chec	Equipment Breakdown
Supervisor Involved	☐ Chec	Equipment malfunction
Equipment Involved	☐ Chec	Human error
Nature of Contaminant	☐ Chec	Improper storage
Quantity of Contaminant	☐ Chec	Act of god
Exact Location : Easting / Northing	☐ Chec	Non respect of procedure
Environmental Personnel Contacted	Chec	Other

Description of the incident

Immediate Corrective Action

Action to be taken to reduce/eradicate risk of similar incident in the future

Volume (in m3 - cubic meter) of soil transferred to the landfarm

Report Completed by

For Environmental Department Purpose Only

Incident Investigation Recommended

Government agency notified

Date of notification to government agency

Comment :

Environment Personnel Signature

APPENDIX H – NT-NU Spill Report

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR	REPORT NUMBER
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME	☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	____-____

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS
F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION

H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

APPENDIX I – Latest MOCK Scenario

AGNICO EAGLE

On August 4, 2018 the AEM Environment Department conducted a mock spill event at the Itivia refueling station/tank farm with AEM emergency response (ERT) members, Orbit Garant Environmental/health and safety AEM warehouse staff, AEM Site Service/HTO vice president and AEM community relations personnel., Spill Training contractor, Nunatta Environmental was on site to assist and provide advice/training, The Rankin Inlet Fire Chief also attended the event as an observer.

An AEM ENV Tech documented the spill response actions and acted as the "Control Room" responder, Rankin Inlet dispatch and the ENV Tech/ENV Coordinator on site.

The mock scenario involved a broken fuel line fitting at the onshore receiving manifold during refueling (from offshore ship) of the fuel storage tanks at Itivia.

14:12 – Spill occurs (4000 L of leaking fuel towards the shoreline) Dave Loder spotted fuel leaking from the broken fitting/line

14:13 – ERT responder calls the vessel to stop transfer of fuel ASAP and relays the message of a leaking fitting to the Captain.

14:18 - Confirmation from the Captain that the transfer has stopped. During that time, AEM Site Service blocked the access to the area and called "CODE 1" to Rankin Inlet dispatch and requested to have environmental personnel contact ERT responder on the radio.

14:19- ERT responder asks ENV Coordinator to contact the coast guard
14:20 – ERT responder requested heavy equipment from construction/site services to dig a trench (no operators in area)

14:25 – Fire Marshall from Rankin Inlet arrived (did not participate but was ready with staff if assistance needed assistance)

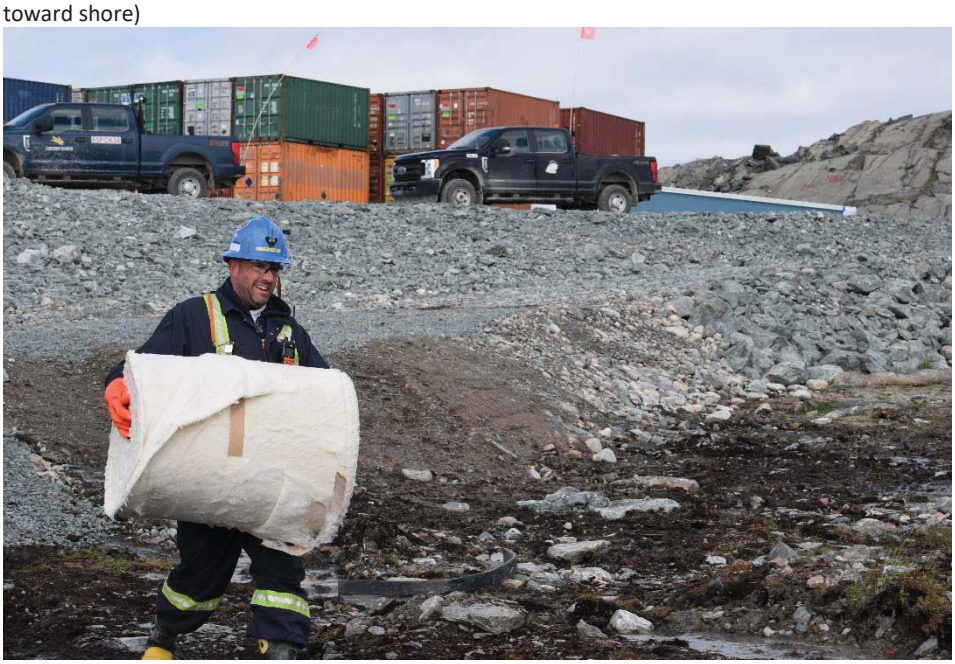
14:25- AEM Warehouse staff from Itivia and started deploying booms along coast from emergency sea-can/ ERT responder supported.

14:38- Additional AEM Environment Dep't staff were travelling on the road to Meliadine site when the "CODE 1" was called (came to Itivia to provide support) and helped deploy absorbent booms and rags as ERT responder instructed.

15:50 – full ERT team arrived for assistance- First ERT responder (Commander) instructed immediate deployment of marine curtain (water was too rough 80 km/hr winds- did not want to put anyone's safety at risk; deployed on shore)

16:00 – More absorbent booms are placed in front of the marine barrier to collect spill and prevent it from going under marine barrier- no operators present for heavy equipment; ERT and environment staff attempted to make a trench – did not succeed due to bed rock

16:04 – Absorbent padding was placed on top of spill where visible product was observed behind marine barrier (wind blowing toward shore)



17:25 – ERT, ENV and Agnico staff declare the spill has been contained and absorbed; called off the ”CODE 1” and spill report prepared with follow up investigation of event.

Summary:

Nunatta - guided and assisted AEM staff (total 14 on site) to implement the correct procedures and equipment handling to successfully participate in the mock spill training event (fuel leak/water); the ERT commander did a great job of delegating responsibilities with everyone; all communication was satisfactory during the event. Heavy equipment (excavator) would be required as the area is underlain be bedrock – shovels and picks were not effective to dig a collection trench. It took 23 minutes for the spill to go from the pipe connection to the marine barrier- it would in a realistic scenario take ERT a minimum of 1 hour (It took 1.5hr) to get from Meliadine to Rankin Inlet (includes time to prepare) and Environment Dep’t staff members could mobilize within 50 minutes. In order to provide additional line of defense to capture fugitive oil/fuel spills the overburden on the inter-tidal zone should be removed so that loose absorbent can be spread. Nunatta advised that we contact Department of Fisheries and Oceans and ask if we can remove some rock along the beach in case of an emergency (this is fish habitat). A collection trench or sump would reduce the speed of any spill.

AEM and Nunatta Comments/Recommendations

- Buoys that can be attached to the maritime barrier or the fuel line were not blown up- these should be blown up prior to refueling season
- Sea-cans that contain Emergency environmental spill response should be placed together (one is placed on top of hill- these sea-cans should be placed as close to the shore manifold as possible)
- Shore line where fuel line connects should be cleaned of all obstructions to prevent injury to staff and damaging the containment booms
- Life jackets or mustang suits must be worn while working near the water and/or on boats
- It’s required that AEM warehouse staff working at Itivia area review the OPEP and Emergency Response Plan with ENV Tech prior to barge/fuel transfer season (both rotations)
- AEM observed that the OPEP and Spill Contingency plan was located in the Itivia warehouse office
- Follow up with DFO; if strip of overburden can be removed from inter-tidal zone to facilitate spill response and pro spill prevention measures
- Order more shackles
- OPEP should include the local municipality emergency numbers (I included this document in the PDF)
- AEM and ERT members will conduct annual training with Environment Dep’t staff.
- Lighter anchors (20 pound range) for the boat (ordered); currently have 60 pound anchors

Annual Mock Spill Attendee List

AGNICO EAGLE
MEL IADINE

CREDO
An injury can be avoided: drop the excuses. When we believe in safety, we first follow the instructions. Everyone is responsible for behavior that ensures its safety.

4 m^3 - water truck

ANNUAL MOCK SPILL EVENT

Fill out this form, attach the minutes and handouts

Department: ENV
Supervisor: _____

DATE: 2018-08-04

MEETING (DÉTAILS) :
Topic: Mock Spill event - Itivia refueling area
Safety Concerns: High winds

NAMES (PRINT)	SIGNATURE	NAMES (PRINT)	SIGNATURE
Randy Schwandt			
Jean-Francois Demers			
Hugues Dubé			
David Loder			
Claudia Remillay			
Roberto Eno			
Candace Ramcharan			
Richard Jackson			
ISRAEL ALIYAH			
Matt Caitlin			
Sean Arnda			
MARK WYATT			
[illegible]			

Emergency Contact Numbers

Last update: Jan 15, 2017 Version D

Radio: Channel 1; call "CODE 1, CODE 1, CODE 1"

AGNICO EAGLE
MELIADINE

Agnico-Eagle Mines (AEM) Meliadine Project
25 km north-north-west of Rankin Inlet

63.027400 (N), - 92.171700 (W) (Helipad)

Meliadine Site Telephone Number: **819-759-3555**
Rankin Office: (Ext:3199) 867-645-2920

Onsite Health Care Professional: 3911

Medical Emergency		
Rankin Inlet Health Center Head Nurse: Gracy Dcunha	Monday - Friday 8h30 to 17h00 AFTER HOURS EMERGENCY	**(867) 645-8300** **(867) 645-6700**
Rankin Inlet Ambulance Service (Fire Dept.)	**Emergency**	**(867) 645-2525**
Rankin Inlet Search and Rescue		(867) 645-3300
Poison Control Centre (Qikiqtani General Hospital, Iqaluit)	Emergencies General inquiries	(867) 979-7350 (867) 979-7300
Law Enforcement, Rescue, Wildlife		
RCMP in Rankin Inlet (Death on camp or for Search & Rescue) (0123 = General Information, 1111 for emergency, 24H)		(867) 645-1111 (867) 645-0123
Workers' Safety and Compensation Commission (WSCC) Mine Inspector: Lex Lovatt		(800) 661-0792 **Hot Line** (867) 920-3849
Coroner		(867) 975-7292 (867) 975-1063 cell
Conservation & Wildlife officer in Rankin Inlet Officer Johanne Coutut Autut		(867) 645-8084 (867) 645-8085
Hazmat & Spills		
CANUTEC		(613) 996-6666
Spills Hotline	Phone	(867) 920-8130
Agnico-Eagle Mines (AEM)		
Program Manager: Martin Plante martin.plante@agnico-eagle.com	Office	(819) 759-3555 ext:8058 (819) 856-1873 Cell
Others		
Health & Safety Superintendent: Dominic Richard dominic.richard@agnicoeagle.com Environment Superintendent: Nancy Harvey nancy.harvey@agnicoeagle.com Human Resources Superintendent : Sandra Marseille sandra.marseille@agnicoeagle.com		(819) 856-4104 Cell (819) 856-4385 Cell (819) 860-3723 Cell
FM Radio Frequencies		
Channel 1 – CAMP (Emergency call Channel)		Rx & Tx: 167.43000
Channel 2 – CONSTRUCTION		Rx & Tx: 163.32000
Channel 3 – EXPLORATION		Rx: 163.57500 Tx: 168.70500
Channel 8 – ROAD Meliadine		Rx: 162.54000 Tx: 165.57000
Channel 9 – ROAD Rankin		Rx: 162.66000 Tx: 167.64000
Channel 10 – UG OPERATION		
Channel 11 – UG Spare		

APPENDIX J – Product Transfer Area Assessment

Meliadine Gold Project

Product Transfer Area Assessment – Rankin Inlet Itivia Oil Handling Facility

January 6th 2019

Prepared for:

Environment and Climate Change Canada

Prepared by:

Agnico Eagle Mines Limited – Meliadine Division

Document Control

Version	Date	Tank/EC number	Section	Revision	Author
1	January 2019	EC# 00044507		Implementation of the Product Transfer Area Assessment – Rankin Inlet Itivia Oil Handling Facility for the ERP	Dan Gorton Env. Coordinator
2					

1. Introduction

The purpose of this document is to satisfy the requirement of section 15 of the Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations made pursuant to Canadian Environmental Protection Act, 1999 which states

15 (1) The owner or operator of a storage tank system must ensure that petroleum product and allied petroleum product transfer areas are designed to contain any releases in liquid form in the environment that occur during the transfer process. In accordance to the STSPPR a ''transfer area" means the area around the connection point between a delivery truck, railcar, aircraft or vessel and a storage tank system in which the tanks have an aggregate capacity of more than 2 500 L. Furthermore, Subparagraph 2.1(2) of the STSPPR states a person must not release or permit or cause any release of a petroleum product or allied petroleum product, in liquid form in the environment, during the transfer of the product to or from a storage tank system if, in the case of a system that has a transfer area, the release during transfer reaches outside the transfer area.

2. Summary

Location: 62°48'16.66" N, 92°05'5.32" W. Itivia Road, Rankin Inlet.
Tank System ID: EC# 00044507

Figure 1 and 2: Agnico Eagle Ltd.'s Itivia Site Fuel Storage Area

Figure 3 and 4: Agnico Eagle Ltd.'s Itivia Site Fuel Storage Containment

The diesel (13.5ML and 20ML) storage tank system owned by Agnico Eagle Mines (AEM), located at Rankin Inlet was evaluated in accordance with Environment and Climate Change Canada's (ECCC) approach to transfer area protection. A number of potential incidents, risk and related receiving environments were identified for this product transfer area. The risk evaluation identified two risks requiring action. The risks were mitigated by designing secondary containment for the two product transfer areas.

At the marine line connection point, a 400L concrete spill basin was installed to catch small quantities of product in the event of a pinhole leak at the connection point, or during disengagement of the coupling. At the vehicle refueling station, a secondary containment area was designed to accommodate a fuel tanker during refueling. This containment area is designed to capture small spills that may result during disengagement of the dry quick connect coupling.

In addition, there were several procedures related mitigation measures developed for this site to address the identified risks (see Section 5 - SOP).

3. Background

The oil handling facility contains two steel tanks of 13.5ML (tank 1) and 20ML (tank 2) capacity. The tank system is owned and operated by Agnico Eagle Mines Limited. Tank 1 was installed in 2017 and Tank 2 was installed in 2018. Both tanks are operational 12 months of the year. The tanks are refilled annually (July to October). There have been no previous failures where product reached the environment with this storage tank system.

Refueling station to truck transfer area

There is one loading arm with dry quick connect coupling for tank truck filling operation, connected to an insulated pumping station (watertight 20' container). A single continuous 3m x 100mm hose transfers fuel from the loading arm to the fuel truck. The flow rate is a maximum of 800 L/min, or less, depending on the truck.

Transfer of fuel into trucks is performed in conformance with procedures outlined in:

- The National Fire Code of Canada (NFCC);
- The American Petroleum Institute (API) Standard: 2610-94: *"Design, Construction,*
- *Operation, Maintenance and Inspection of Terminal and Tank Facilities"*
- The Canadian Petroleum Products Institute (CPPI, 1992*): "Professional Driver's*
- *Manual".*
- Canadian Council of Ministers of Environment (CCME) – Code of Practice (COP) 2003.
- Agnico Eagle fuel transfer procedure.

Ship to shore transfer area

The ship to shore PTA consists of a marine line connection with flange connection and check value. A 400L concrete spill basin is present beneath the connection point. Product is transferred via a 120m x

100mm hose at a rate of 250m^3/h. The ship's pumping system is fitted with an emergency shut off system which is activated when pumping pressure is lost.

Transfer of from ship to shore is performed in conformance with procedures outlined in:

- The National Fire Code of Canada (NFCC);
- The American Petroleum Institute (API) Standard: 2610-94: *"Design, Construction,*
- *Operation, Maintenance and Inspection of Terminal and Tank Facilities"*
- The Canadian Petroleum Products Institute (CPPI, 1992*): "Professional Driver's*
- *Manual".*
- Canadian Council of Ministers of Environment (CCME) – Code of Practice (COP) 2003.

The risks identified under the following table (Section 3) as needing action have been addressed.

4. Analysis of Product Transfer Area Risks

The table below lists potential incidents, outcomes, description of PTA and receiving environments that have been identified for the storage tank system on site. The table also provides an evaluation of identified risks and an assessment on whether further action is required, and a list of mitigation measures.

Table 1: Product Transfer Risk Assessment - refueling station to fuel truck

Potential Incident	Outcome	PTA and Receiving Environment	Spill Consequence	Probability	Potential Impact	Evaluation	Mitigation Measures
Overfill during loading of fuel truck	Approximately 132.27L product is captured in secondary containment	Secondary containment Adjacent soil/gravel area within ~10m Melvin Bay	Low: the product is confined secondary containment. Moderate: the product reaches bare ground. High: the product reaches a water body.	Moderate	Low	No Action Required	Secondary containment with 40000L capacity at tanker connection point Scully fitted with optic overfill prevention system Permanent indoor structure with visual display for operator in cold weather
Overfill device fails	Product flows into 40000L secondary containment			Moderate	Low	No Action Required	Shut off button and tanker overfill pipe
Coupling/equipment fails at pump station-hose connection.	Broken piping/hose releases ~1000L of fuel to adjacent gravel area.			Moderate	Moderate	No Action Required	Shut off button, drainage to low point on roadside. Emergency Response Plan and Spill Contingency Plan Trained spill response staff and equipment for large spills on site.
Absence of inspection (pre-op, checklist)	Faulty component or leak is not detected resulting in slow release of ~1L of product			Moderate	Moderate	No Action Required	Pre-op inspection (daily by M&T and AEM) Standard Operating Procedure (SOP)
Public access	Member of the public attempts to take or release fuel			Low	Low	No Action Required	Signage and surveillance cameras Fuel system security coded Community awareness conducted by AEM
Vehicle contact with building/equipment	Broken piping releases ~1000L of fuel to adjacent gravel area.			Low	Moderate	No Action Required	Secondary containment structure protects fuel station from collision by forming a barrier. Fuel lines connected to tank farm can only release contents of the line.

Table 2: Product Transfer Risk Assessment – refueling station to fuel truck cont.

Potential Incident	Outcome	PTA and Receiving Environment	Spill Consequence	Probability	Potential Impact	Evaluation	Mitigation Measures
Inappropriate equipment for arctic conditions (arm/valve)	Valves and components fail in arctic conditions releasing ~100L of product			Moderate	Moderate	No Action Required	Valves and hoses suitable for arctic conditions installed. Pre-op inspection (daily by M&T and AEM)
Operator spills small amount of fuel while uncoupling hose	~100ml of fuel is captured in secondary containment			High	Low	No Action Required	Portable drip tray used within secondary containment

Table 3: Product Transfer Risk Assessment – Ship to shore

Potential Incident	Outcome	PTA and Receiving Environment	Spill Consequence	Probability	Potential Impact	Evaluation	Mitigation Measures
Leakage if fuel remains in line after off loading and leakage at all couplings in the line (by the boat and outside the connections)	Maximum of ~1500L of fuel is released to Melvin Bay	Secondary containment Adjacent soil/gravel area within ~10m Melvin Bay	Low: the product is confined secondary containment. Moderate: the product reaches bare ground. High: the product reaches a water body.	Moderate	High	No Action Required	Trained Intertek Personal oversee product transfer Line is cleared of fuel following transfer
Coupling/equipment fails at onshore coupling	Maximum of ~1500L of fuel is released to Melvin Bay			Moderate	High	No Action Required	Ships pumping system shuts off if hose pressure is lost. Trained Intertek Personal oversee product transfer Transfer point is up gradient of pumping point so line does not completely drain if uncoupled. Emergency Response Plan and Spill Contingency Plan Marine spill response equipment adjacent to transfer point.
Coupling/equipment fails at offshore coupling	Maximum of ~1500L of fuel is released to Melvin Bay			Moderate	High	No Action Required	Spill contained onboard at pumping area.
Public interference	Transfer hose is damaged by passing boat or transfer impacted by public protest			Low	High	No Action Required	Community awareness conducted by AEM Boat traffic monitored by Desgagnes and Intertek
Operator spills small amount of fuel while uncoupling hose	~100ml of fuel is captured in secondary containment			High	Low	No Action Required	Portable drip tray used within secondary containment

Table 4: Product Transfer Risk Assessment - Ship to shore cont.

Potential Incident	Outcome	PTA and Receiving Environment	Spill Consequence	Probability	Potential Impact	Evaluation	Mitigation Measures
Vehicle contact with piping between transfer point and tank	Broken piping releases ~5000L of fuel to adjacent gravel area, potentially reaching Melvin Bay.			Low	High	No Action Required	Rock barrier protects pipeline from vehicles. Double walled piping installed beneath roadway. Fuel lines connected to tank farm can only release contents of the line.

Please see Appendix A for the calculations relating to the product transfer areas. In summary, potential product spillage, volume has been calculated as follows:

Fueling station: a confirmed maximum delivery rate of 800 L/min and an emergency shut off time of 8 seconds would result in a product spillage volume of approximately 108.72L. Based on 10cm hose at 3m in length, a potential spill at the tank / hose connection would result in an additional volume of 23.55 L, for a total 132.27 L of fuel spilled.

Ship to shore: a confirmed maximum delivery rate of 4166.67 L/min and an emergency shut off time of 8 seconds would result in a product spillage volume of approximately 556 L. Based on 10 cm hose at 122 m in length, a potential spill at the tank / hose connection would result in an additional volume of 957 L, for a total 1512 L of fuel spilled.

5. Mitigation of Risks

Refueling station to truck transfer area
At the vehicle refueling station, a 40,000L secondary containment area was installed to accommodate a fuel tanker in the event of an accidental overfill or connection failure during fuel transfer. This area is a lined and bermed depression where the transfer station and the fuel truck are located during the fuel transfer process.

In the event of a spill three potential receiving environments have been identified for the refueling system: the gravel area surrounding the refueling station and extending a distance of approximately 10 meters, the adjacent soil/ground surface, and the adjacent body of water, Melvin Bay.

Any product amount of 1000L or less that spills onto the gravel area can be recovered using the spill kit and heavy equipment on site. For spills of over 1000L, the product will likely reach the adjacent soil/ground surface and/or the Melvin Bay directly via overland surface flow (depending on the season). The low point containing a double wall culvert would contain the product before reaching soil or Melvin Bay. During winter, the likely hood of product flowing to the shoreline increases; however, snow berms can be quickly installed. Mitigation measures include;

- 60 L secondary containment for hose storage
- 40000L secondary containment for refueling of fuel trucks
- Standard Operating Procedure
- Trained operators
- Spill kit at refueling area containing absorbent pads
- Personnel monitor transfer from viewing window in pump station
- Five wire optic transfer system to prevent overfill
- Containment designed to hold 110% of fuel truck load limit

Ship to shore transfer area
At the marine line connection point, a 400L concrete spill basin was installed to catch small quantities of product in the event of a pinhole leak at the connection point, or during disengagement of the coupling.

In the event of a spill three potential receiving environments have been identified for the fuel transfer system: the gravel area partially surrounding the secondary containment and extending a distance of approximately 5 meters, the adjacent soil/ground surface, and the adjacent body of water, Melvin Bay.

Any product amount of 100L or less that spills onto the gravel area can be recovered using the spill kit and shovels. For spills of over 100 L, the product will likely reach the adjacent soil/ground surface and/or Melvin Bay directly via overland surface flow (depending on the season). During winter, the likely hood of product flowing to the shoreline increases; however, snow berms can be quickly installed. Mitigation measures include;

- 400L secondary containment at onshore connection point
- Pump and 1000L portable containments on standby during transfer if concrete containment overfills
- Trained Intertek Personnel oversee product transfer
- Standard Operating Procedure

- Emergency Response Plan and Spill Contingency Plans on site
- Oil Pollution Prevention Plan on site
- Marine spill response equipment on site

6. Standard Operating Procedure (SOP)

Refueling station to truck transfer area

The AEM procedure for refueling fuel trucks in summarized as follows;

1. Perform an inspection of the vehicle.
2. Park the vehicle in the vicinity of the refueling tank and shut off your ignition.
3. Install wheel chocks on either side of the tanker tire.
4. Inspect the entire working area including the steps up to the HMI and the area in front of the loading arm and scully system; call your supervisor if there are problems.
5. Install the portable spill containment underneath the connection point.
6. Check the maximum capacity for the tanker being used. Ensure to only fill the tanker at 90% of the capacity to have room for fuel expansion at different temperatures, and a safe level for haulage. Verify the current tank level from the electronic gauge on the side of the tanker, fill the tank to 37800 L maximum (18.9 in each compartment).
7. At the valve control panel, lift all the levers up, and make sure the valves are open.
8. Remove the cap of the scully plug and push and twist it onto the receiving end on the truck. Make sure the green light is on before continuing.
9. Connect the loading arm to the tanker.
10. Below is a picture of the final arrangement. Make sure the valve are open on each side.
11. Open the valve on the building.
12. Enter the control room and begin to program the fuel loading on the HMI.
13. Enter the applicable Microload identification and load sequence.
14. Enter the volume measure with the pop-up keypad.
15. Select the tank from which to pump fuel.
16. Select the start button to activate the pump.
17. Once the fueling begins, the operator must monitor the situation diligently; this includes checking for leaks or monitoring any other unusual situations. The operator must be at the connection point at all times during fueling.
18. When finished pumping, close the valve on the building.
19. Disconnect the loading arm first, and then the truck level control.
20. Put the arm back and the truck level control in place. Close the valve.
21. Put the protection bag over the scully and the hose. Verify if the caps are put back on the truck.
22. Put back the portable spill containment, and unhook the overflow hose, install the cap and close the valve.
23. At the valve control panel, pull down all the lever to close valve, and make sure they are closed.
24. Complete the mechanical verification in the pump station, just beside the HMI trailer. Make sure they have no leaks on the equipment.
25. Before you leave, make sure the three doors are locked at the fuel station.
26. Remove the wheel chocks and fully inspect the vehicle before beginning to bring the fuel to the Meliadine Fuel Tank Farm.

27. If you encounter any emergency or a spill occurs, call your supervisor immediately and the supervisor of Agnico Eagle Mine Meliadine.

Ship to shore transfer area

The AEM procedure for refueling tanks in summarized as follows, however the fuel transfer is overseen by Intertek (contracted first responder);

1. The Oil Pollution Emergency Plan (OPEP) must be reviewed on an annual basis and updated prior to the first annual discharge. This will include but not limited to:
   a) Reviewing the phone numbers for emergencies
   b) Updating maps
   c) Review and if necessary update equipment lists
   d) Review roles and responsibilities
   e) Update Declaration
2. Contact Canadian Coast Guard and Transport Canada Pollution Prevention and make them aware of plans for transferring of fuel into our Oil Handling Facility (OHF) for that season.
3. Complete *Inventory report for Spill Response Sea Can at AEM's Oil Handling Facility in Rankin Inlet.*
4. Ensure Shipping Company has provided Hose Testing Annual certification.
5. All personnel who will be a part of the fuel transfer (including Rankin Inlet Supervisor and third part contractor Intertek) must review the OPEP and be familiar with preventive measures to take and with the steps to take in the case of a spill event while fueling.
6. Install and monitor secondary containment underneath each connection of conduit on land.
7. Ensure there is two-way functional communications between the OHF and the off-loading vessel.
8. Ensure there is lighting in place at the transfer flange to provide illumination during any transfers taking place during the low to no light hours.
9. Prior to any discharge Agnico Eagle must receive a copy of the ship/shore checklist completed by the shipping company. Agnico Eagle should also verify this has been completed (as much as realistically possibly without boarding the ship).
10. Contact must be made with both the H&S, Environment, Warehouse and Community Relations Departments prior to the discharge of fuels.
11. The *Pre-discharge Checklist for AEM's Oil Handling Facility in Rankin Inlet* must be completed, signed and provided to the Environment Department prior to discharge.
12. Photos of the complete fuel transfer process should be taken, proving that all above procedures have been reached.
13. During the ship-to-shore transfer, Agnico Eagle will have competent personnel on location at all times to monitor the fuel transfer and maintain contact with the tanker's crew.
14. Monitor the fuel transfer at the beginning of each transfer and after that on an hourly basis checking the manifold, conduit, tank, and any connection points on land for spills and/or leaks. Communication between shore and ship should take place on an hourly basis.
15. Have a fuel spill scenario annually to cover both crews .

7. Conclusion

The Itivia Fuel Tank Farm, owned by Agnico Eagle Mines and located in Rankin Inlet, NU, has recently undergone modifications to mitigate risks associated with transfers of fuel at the ship to shore transfer area, as well as the truck transfer station. A 400L concrete spill basin was installed at the ship to shore PTA, beneath the on-shore connection point from the ship. This ship to shore PTA was designed to contain spills that may occur in the event of a pinhole leak at the connection point, or during unexpected disengagement of the coupling. Additionally, a 40,000L secondary containment was constructed for the truck transfer area. Fuel transfer vehicles now park within a lined and bermed depression, designed to contain spills that may occur from an accidental overfill, coupling device failures, and other spill scenarios while transferring fuels.

In addition to the secondary containment areas noted above, emergency spill response equipment is located near the ship to shore transfer valve on shore. In the event of a spill reaching Melvin Bay, Marine containment booms, anchors, trench shovels, absorbant pads, pumps and a dedicated boat and ATV are accessible year-round, and regular spill response training is conducted with members of the Meliadine Emergency Response Team and Environment Department. Meliadine Environment Technicians also conduct regular inspections of the Itivia site in order to ensure proper spill prevention and containment equipment is available, and that proper fuel transfer protocols are followed. All of the measures noted above are in place in order to contain, mitigate and prevent spills during the process of transferring fuel.

Appendix A - Potential Spill Quantities

Fuel Station to Fuel Truck

Flow rate = 800L/min maximum rate
Scully arm and hose length: 300cm, 10cm diameter

1. Calculate Volume of Spill (from time it takes operator to shut off pumping)
   800L/min = 800/60s = 13.34
   8s = time it takes for operator to turn off the pump should the tank start to overflow

   Volume = 13.34L/s * 8s
   = 108.72
2. Calculate the Volume of the pipe:

   Radius = (diameter of the pipe / 2)

   Radius = (10/2)
   = 5

   Volume of a cylinder: V = πr2h

   Volume = 3.14 * 5^2 * 300
   = 23550

3. 1 Litre = 1000m^3
   Volume in Litres = (volume in cm^3) * (1L/1000cm^3)
   Volume = (23550 / 1000 L)
   = 23.55 L

   Total Potential Spill = 108.72 + 23.55
   = 132.27 L

Therefore, the amount of a potential spill at the site would be 23.55L of fuel in the hose, plus 108.72L (using 8s before shut off) for a total of 132.27L.

Ship to shore:

Flow rate = 4166.67L/min maximum rate
Transfer hose length: 12192cm, 10cm diameter

1. Calculate Volume of Spill (from time it takes operator to shut off pumping)
   4166.67L/min = 4166.67/60s = 69.45
   8s = time it takes for operator to turn off the pump should the tank start to overflow

   Volume = 69.45L/s * 8s
   = 555.6L

2. Calculate the Volume of the pipe:

   Radius = (diameter of the pipe / 2)

   Radius = (10/2)
   = 5

   Volume of a cylinder: V = πr2h

   Volume = 3.14 * 5^2 * 12192
   = 957072

3. 1 Litre = 1000m^3
   Volume in Litres = (volume in cm^3) * (1L/1000cm^3)
   Volume = (957072 / 1000 L)
   = 957.07 L

   Total Potential Spill = 555.6 + 957.07
   = 1512.67 L

Therefore, the amount of a potential spill at the site would be 957.07 L of fuel in the hose, plus 555.6 L (using 8s before shut off) for a total of 1512.67 L.

APPENDIX K – STR's Cross Reference Table

Table 1. Cross-reference of STS Regs, s. 30 to 32, to this emergency plan for P-50 Diesel Storage Tank System STS EC-00044507

STS Regs reference	Information required	Location of information in this emergency plan
s. 30(1)	The owner or operator of a storage tank system must prepare an emergency plan taking into consideration the following factors:	
s. 30(1)(a)	- the properties and characteristics of each petroleum product (i.e. Jet A1) or allied petroleum product stored in each tank of the system and	- MSDS for P-50 Diesel in Appendix D of the OPEP - Spill Contingency Plan and Hazardous Materials Management Plan, submitted with the annual report
s. 30(1)(a) continued	- the maximum expected quantity of the petroleum product or allied petroleum product to be stored in the system at any time during any calendar year; and	Can be find in section 4.1
s. 30(1)(b)	- the characteristics of the place where the system is located and of the surrounding area that may increase the risk of harm to the environment or of danger to human life or health.	- Site Description outline in section 4.1 and 4.3 of the OPEP
s. 30(2)	The emergency plan must include:	
s. 30(2)(a)	- a description of the factors considered under s. 30(1)	- See the rows above.
s. 30(2)(b)	- a description of the measures to be used to prevent, prepare for, respond to, and recover from any emergency that may cause harm to the environment or danger to human life or health;	- OPEP: s. 10 Spill Procedures s. 10.2 Spill Reporting s. 11 Spill Scenarios and Responses; s. 12 Spill Prevention; s. 12.1 Spill Training; .
s. 30(2)(c)	- a list of the individuals who are required to carry out the plan and a description of their roles and responsibilities;	- OPEP: s. 9 Roles and Responsibilities s. 9.1 First Responder s. 9.2 Emergency Control Group Figure 3. response Management System.

Table 1. Cross-reference of STS Regs, s. 30 to 32, to this emergency plan (continued)

STS Regs reference	Information required	Location of information in this emergency plan
s. 30(2)(d)	- identification of the training required for each of the individuals listed under s. 30(2)(c);	- OPEP s. 12.1 Training and Appendix I Mock scenario
s. 30(2)(e)	- a list of the emergency response equipment included as part of the plan, and	- OPEP s. 7 Equipment and PPE

	the equipment's location; and	
s. 30(2)(f)	- the measures to be taken to notify members of the public who may be adversely affected by the harm or danger referred to in s. 30(2)(b)	- OPEP s. 8.1.1 Communication with the Public
s. 30(3)	The owner or operator of a storage tank system must ensure that the emergency plan is ready to be implemented:	
s. 30(3)(a)	- in the case of a storage tank system that is installed before the coming into force of these Regs, no later than two years after the day on which these Regs come into force (i.e. by 12 Jun 2010); and	N/A
s. 30(3)(b)	- in any other case, before the day on which the first transfer of petroleum products or allied petroleum products into any tank of the storage tank system occurs.	- OPEP v.1.1 Sept 2017 - Spill Contingency Plan v6 March 2017
s. 31(1)	The owner or operator of a storage tank system must keep: - the emergency plan up-to-date and - keep a copy of it readily available for the individuals who are required to carry it out, - as well as a copy at the place where the storage tank system is located if that place is a place of work.	- OPEP is reviewed annually prior every shipping season and a hard copy is available at the Rankin Inlet Marshalling facility during transfer operations - Spill Contingency Plan is reviewed annually season and a hard copy is available at the Rankin Inlet Marshalling facility during transfer operations
s. 31(2)	The owner or operator must notify the Minister of the civic address of each location where the emergency plan is kept.	- No civil address, coordinates are at page ii of this document.

Table 1. Cross-reference of STS Regs, s. 30 to 32, to this emergency plan (continued)

STS Regs reference	Information required	Location of information in this emergency plan
s. 32(1)	If the owner or operator of a storage tank system has prepared an emergency plan with respect to the system on a voluntary basis or for another government or under an Act of Parliament and the plan meets the requirements of s. 30(1) and (2), they may use that plan for the purposes of meeting those requirements.	- OPEP and Spill Contingency Plan
s. 32(2)	If the plan does not meet all of the requirements of s. 30(1) and (2), the owner or operator may use the plan if they amend it so that it meets all of those requirements.	- OPEP and Spill Contingency Plan

Natural Recovery of Tundra Vegetation Following Exploration Drilling at Meliadine, Nunavut

Prepared for Agnico Eagle Mines Limited

November 2018

Dr. Katherine Stewart and Dr. Alix Conway

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Preface

On June 1, 2018 Agnico Eagle Mines and the University of Saskatchewan were successful in receiving a Natural Sciences and Engineering Research Council (NSERC) Collaborative Research and Development grant. The grant entitled "Tundra Restoration: Niche construction in early successional plant-soil systems" will support on-site and laboratory research from June 2018 to June 2022. The primary objective of this research is to address Term and Condition no. 41 of the Project Certificate for the Meliadine site: *"Prior to the commencement of operations, the Proponent shall develop a progressive re-vegetation program for disturbed areas that are no longer required for operations, such program to incorporate measures for the use of test plots, reseeding and replanting of native plants as necessary."* Several additional scientific objectives that support this primary objective will also be examined: i) Characterization of initial and realized niches of biological soil crusts and tundra vascular plants across a chronosequence of naturally recolonized drilling waste dumps; ii) Characterization of initial and realized niches of actively restored biological soil crusts on disturbed substrates iii) Characterization of initial and realized niches of actively restored tundra vascular plants on disturbed substrates. In addition to the scientific work, the project will include the development of a youth education program and local community engagement in Rankin Inlet and Baker Lake, NU.

Below is a summary timeline for key project activities and deliverables. For a timeline including all activities and deliverables see Appendix A.

Milestone	Description of activities	Anticipated starting date	Anticipated completion date
Natural recolonization of drilling wastes	Study natural recolonization of drilling waste dumps 2-17 yrs old by biological soil crusts and vascular plants. Specific recommendations of species for restoration will be developed.	2018-06-01	2019-08-31
Active restoration with tundra surface layers	Transplanting of tundra plugs, shredded surface layers and biological soil crusts onto disturbed substrates. Specific recommendations of restoration practice and species for restoration will be developed.	2019-06-01	2021-08-31
Youth education program	Collaboratively develop and deliver an education program on-site for one week in 2019 and 2020 for youth from Rankin Inlet and Baker Lake, NU. The program will focus on arctic ecology, restoration and skills in environmental monitoring and research.	2019-01-31	2021-01-31
Community meetings	We will hold community meetings in Rankin Inlet and Baker Lake. Working with Agnico's community relations department we will identify key groups to host. Our research and restoration of tundra environments will be presented and discussed.	2019-06-01	2021-08-31
Website development	Creation of project website providing information to restoration practitioners and the public on general arctic ecology and restoration practice in the North, as well as key findings from the research.	2019-08-31	2022-06-01

Technical reports for Agnico Eagle	Detailed technical reports for AEM on the restoration techniques examined. Guidelines and standard operating procedures for on-going monitoring will be included. Preliminary report January 2021, final report January 2022. Yearly progress reports November 2018-2021.	2018-11-30	2022-06-01

Executive Summary

This technical report directly addresses the first of several objectives associated with a Natural Sciences and Engineering Research Council (NSERC) Collaborative and Research Development grant held by Agnico Eagle Mines and the University of Saskatchewan. The grant entitled "Tundra Restoration: Niche construction in early successional plant-soil systems" will support on-site and laboratory research from June 2018 to June 2022. The primary objective of this research is to address Term and Condition no. 41 of the Project Certificate for the Meliadine site: "*Prior to the commencement of operations, the Proponent shall develop a progressive re-vegetation program for disturbed areas that are no longer required for operations, such program to incorporate measures for the use of test plots, reseeding and replanting of native plants as necessary.*" The specific objective addressed in the following technical report is the characterization of initial and realized niches of biological soil crusts and tundra vascular plants across a chronosequence of naturally recolonized drilling waste dumps. This work was completed in summer 2018.

A total of 25 drilling waste sites were examined across a range of ecotypes including low-lying hummock-hollow complexes dominated by sedges, upland hummock-hollow complexes dominated by heath and upland lichen-heath often with frost boil features. Following delineation of each drilling waste site, a transect was placed along the long axis of the waste site and three survey plots ($1m^2$) were placed at the center of this transect. In addition, at each site a control transect was placed at least 10 m from the edge of the drilling waste and three adjacent 1 m^2 plots were placed in undisturbed vegetation of the same type, slope and aspect as the disturbed area. The percent cover of all vegetation species present was estimated by eye and the drilling waste and organic matter depth was measured in the center of each plot.

We found that natural revegetation of drilling wastes is occurring at the Meliadine site. The community composition between drilling wastes and the paired undisturbed tundra was similar 20-25 years post disturbance and species richness recovered within 6 years. Due to the different life history characteristics of tundra plants, individual species responses to disturbance were observed. While sedges and mosses may recover more rapidly on these drilling wastes, dwarf shrubs and lichens may require longer to recover. These trends in natural recovery are important for guiding future restoration efforts and techniques. Specifically, targeting sedge and moss species for transplanting and/or seeding of disturbed substrates may be a highly effective strategy for initiating the development of early successional tundra communities.

Based on our findings we provide the following suggestions to improve and/or maintain the relatively rapid natural revegetation of the drilling wastes: i) Placement of drilling wastes on the landscape that allow for remnant patches or islands of intact tundra throughout the disturbed area; ii) Apply drilling wastes in thin layers to allow for vegetative establishment; and iii) Promote establishment of bryophyte communities in the early stages of revegetation to support long-term ecosystem recovery.

Given the findings of this study we suggest that active restoration of the drilling wastes is likely not required for the recovery of the tundra plant communities, if the timeline for recovery is ~20 years. Therefore, in our on-going work to develop tundra restoration techniques, we suggest developing active restoration trials at other disturbed areas on the Meliadine site.

Drilling Waste Site Description

Ecotypes

A total of 25 drilling waste sites were examined across a range of ecotypes including low-lying hummock-hollow complexes dominated by sedges, upland hummock-hollow complexes dominated by heath and upland lichen-heath often with frost boil features. Low-lying hummock-hollow complexes dominated by sedges were characterized by high soil moisture, often with standing water surrounding hummock-hollow complexes of approximately 30 cm in height. The primary vegetation found in this ecotype was *Dryas integrifolia*, *Carex aquatilis*, and *Scorpidium scorpioides*. Upland hummock-hollow complexes were similar in size to low-lying complexes, however due to a high landscape position had drier soil conditions and were dominated by *Rhododendron lapponicum, Loiseleuria procumbens, Cassiope tetragona,* and species of *Cetraria* lichen. The upland heath ecotype were typically associated with upper slope locations and well developed frost boil features. The primary vegetation in the upland heath ecotype was *Alectoria ochroleuca*, *Cassiope tetragona, Tomentupnum nitens,* and species of *Cetraria* lichen.

Drilling waste sites were grouped by time since drilling and included sites created in 1993, 1997-1998, 2008, 2012-2013 and 2017 (n=5 per age group) (Figure 1). Of the sites surveyed, 5 were low-lying sedge, 9 upland heath, 7 transitional between low-lying sedge and upland heath, and 4 lichen-heath ecotypes (Figures 2 and 3, Table 1). Ecotypes were not equally represented across age categories because drilling tended to be localized within the landscape for a given year. Older sites (1993, 1997-1998) occurred more frequently in low-lying sedge and sedge-heath transitions, while four of the five 2017 sites were in lichen-heath tundra. Due to the nature of drilling, some sites we sampled were spatially clustered together (i.e. 2008 and 2017 sites).

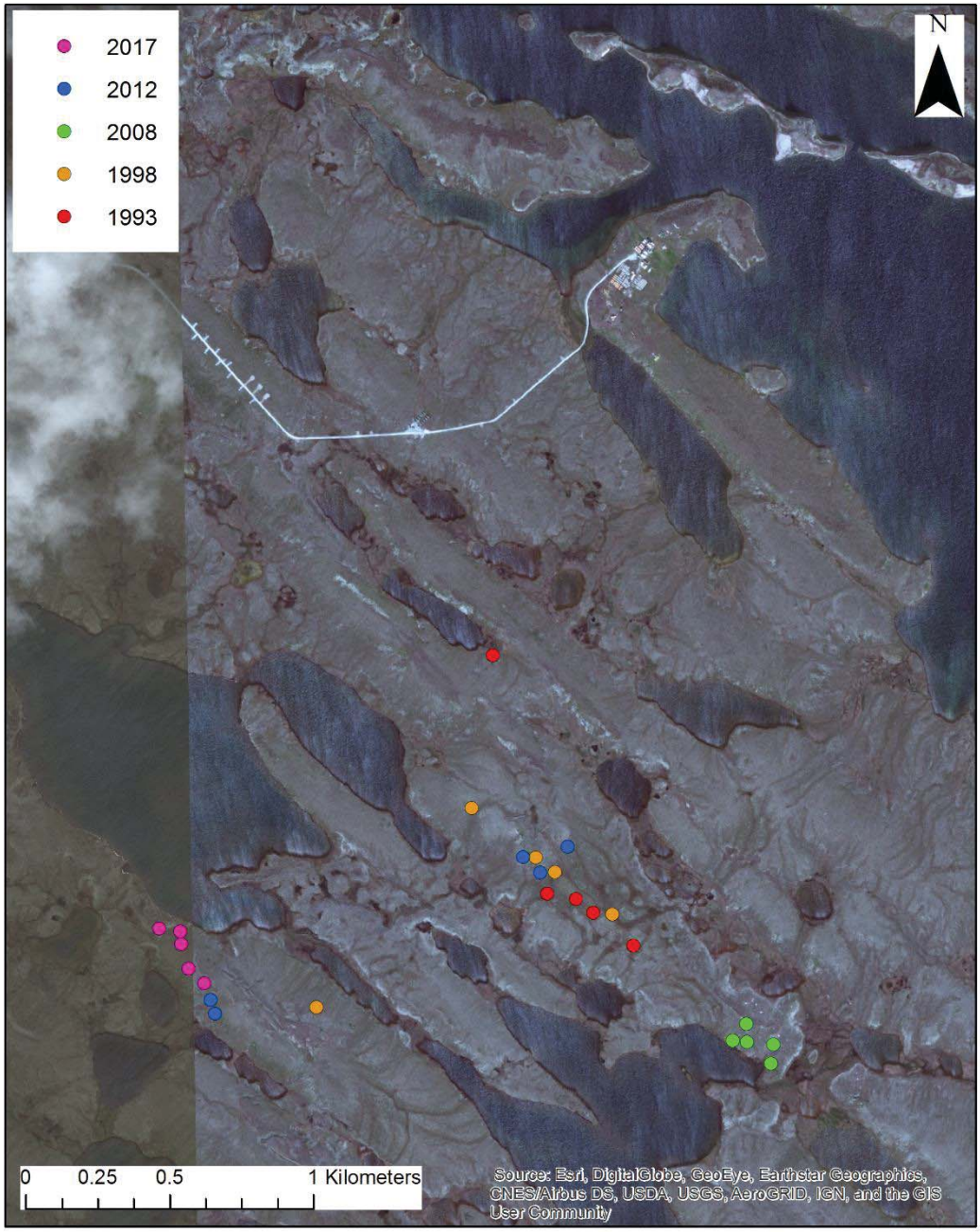

Figure 1. Map of drilling waste areas sampled in 2018. The year of drilling is given for each of the sites surveyed. The Meliadine site is shown for reference and all drilling waste sites were outside of the mine footprint.

Table 1. Drilling waste areas surveyed for natural revegetation. Site name, location, year and ecotype of each area surveyed is included. Ecotypes are described as low-lying sedge hummock-hollow (SH), upland heath hummock-hollow (HH) and upland lichen-heath (LH). Some drilling waste areas were in transitional areas between ecotypes (SH/HH).

Site	Location (UTM)	Year	Ecotype
W93-29	15V 0541749 6986813	1993	SH
W93-30	15V 0541809 6967640	1993	SH
W93-32	15V 0541948 6986649	1993	SH
W93-40	15V 0541439 6987661	1993	SH/HH
W93-44	15V 0541647 6986830	1993	SH
M97-155	15V 0540844 6986435	1997	HH
M98-230	15V 0541609 6986957	1998	HH
M98-242	15V 0541675 6986906	1998	SH/HH
M98-243	15V 0541385 6987129	1998	SH/HH
M98-244	15V 0541874 6986759	1998	SH
M08-729	15V 0542342 6986377	2008	HH
M08-734	15V 0542295 6986320	2008	SH/HH
M08-735	15V 0542344 6986314	2008	SH/HH
M08-740	15V 0542435 6986305	2008	HH
M08-741	15V 0542427 6986240	2008	HH
M12-1528	15V 0541565 6986959	2012	HH
M12-1860	15V 0541625 6986905	2012	HH
M12-1863	15V 0541720 6986994	2012	HH
M13-1948	15V 0540492 6986413	2012	SH/HH
GT13-71	15V 0540477 6986460	2013	SH/HH
M17-2394	15V 0540298 6986710	2017	LH
M17-2395	15V 0540375 6986656	2017	LH
M17-2396	15V 0540500 6986571	2017	LH
M17-2398	15V 0540455 6986519	2017	LH
M17-2415	15V 0540371 6986700	2017	HH

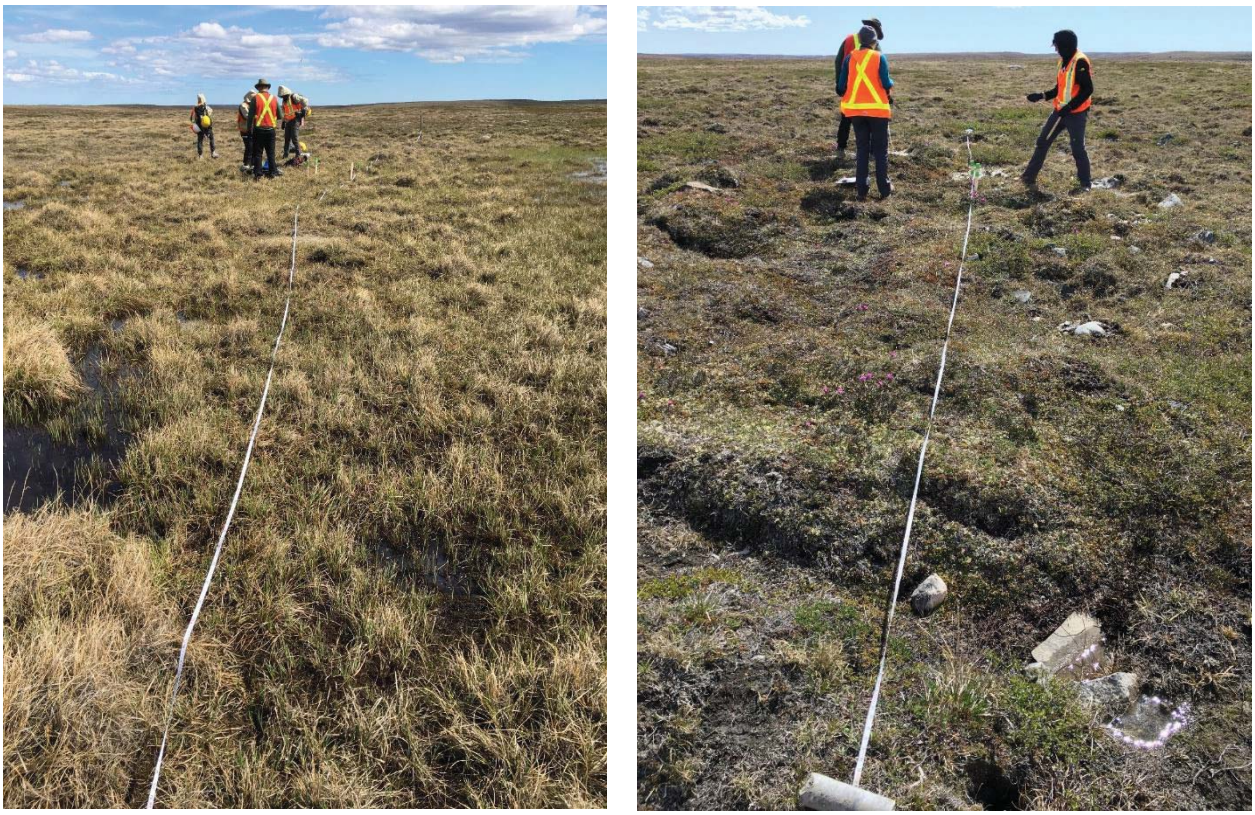

Figure 2. Low-lying sedge hummock-hollow (M93-30) (left) and upland heath hummock-hollow (M12-1860) (right).

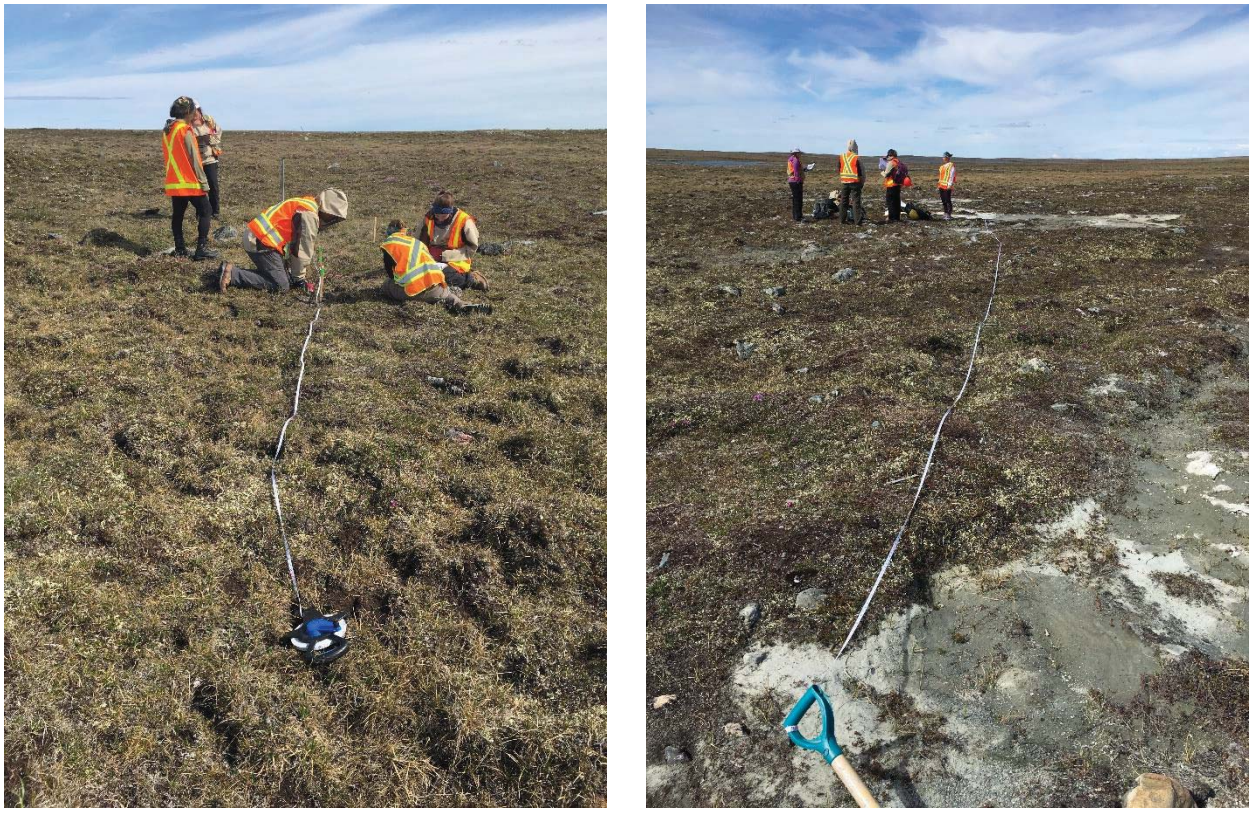

Figure 3. Transitional form low-lying sedge hummock-hollow to upland heath (M08-735) (left) and upland lichen heath (M17-2396) (right).

Delineation of Drilling Waste Sites

The approximate area of each drilling waste site was delineated by determining the extent of drilling waste at each location. The presence of drilling waste was either observed on the surface or below the surface by digging up to ~15 cm in depth. The average size of the drilling waste sites was 21 m x 9 m or 189 m^2. The largest drilling waste area sampled was from 1993 (W93-32) with an area of 1472 m^2. On average the 2008 drilling waste sites surveyed had the smallest area (77 m^2). In general, older drilling waste sites were covered with more vegetation and at times were difficult to locate. However, even at sites created in 1993 small patches of drilling waste were present at the surface (Figure 4). Newer drilling waste sites (i.e. 1-5 years old) generally had large patches of waste visible at the surface (Figure 5).

Figure 4. Small pockets of drilling waste evident at the surface of older sites (Left M93-30, Above M93-40).

Figure 5. Larger patches of drilling waste evident at the surface on newer drilling sites (left M12-1863; right M17-2398).

Sampling Design

Following delineation of each drilling waste site (see description above), a transect was placed along the long axis of the waste site and three survey plots were placed at the center of this transect (Figure 6). The three plots were each 1 m^2 and were placed immediately adjacent to one another. In each plot percent cover was estimated by eye for all species present. Following completion of the vegetation survey, a soil/drilling waste sample was taken in the center of each plot and the depth of both drilling waste and organic matter were measured.

At each drilling waste site a control transect was placed at least 10 m from the edge of the drilling waste. Along the transect three adjacent 1 m^2 plots were placed in undisturbed vegetation of the same type, slope and aspect as the disturbed area. In control plots, percent cover was estimated by eye for all species present and a soil sample was taken in the center of each plot to determine the depth of the organic matter. For all statistical analyses the average across the three plots either on the drilling wastes or in the control plots was used for each site.

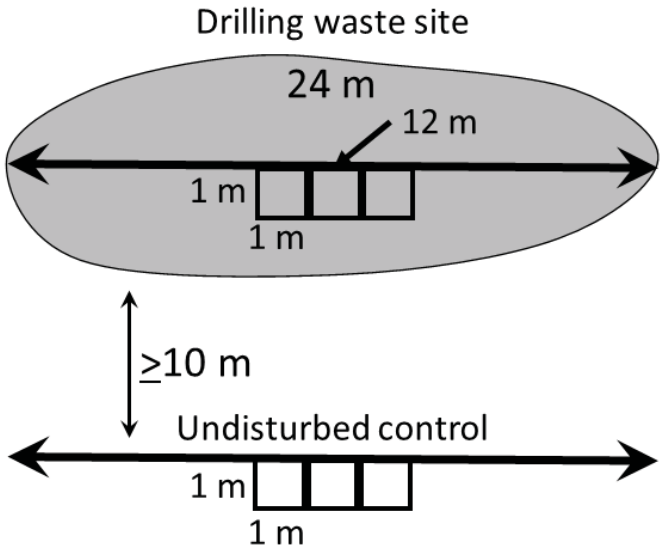

Figure 6. Sampling design at each drilling waste site. Three 1 m^2 plots were placed directly adjacent to one another at the center of the long axis of the delineated drilling waste area (ex. at a drilling waste area 24 m long, the center sampling plot would be placed from 11.5-12.5 m). At each site an undisturbed control transect was placed at least 10 m from the edge of the drilling wastes and 3 control plots (1m^2 each) were placed in undisturbed vegetation.

Vegetation Community Recovery

Community-level Differences

Recovery of the tundra vegetation at the drilling waste sites was examined through comparison of vegetation in disturbed and undisturbed survey plots at each site, as well as, examination of vegetative recovery over time (i.e. across time since disturbance). Community differences between drilling wastes and undisturbed controls over time were explored using non-metric multidimensional scaling ordination (NMDS). NMDS provides an ordination based on a distance or dissimilarity matrix, therefore objects that are ordinated closer to one another are more similar than those that are far apart (McCune and Grace, 2002). Overlap between drilling sites from 1993 and 1998 and their respective controls were evident (i.e. overlapping black and red squares and circles) suggesting that 20-25 years following disturbance the plant communities on drilling wastes are similar to undisturbed tundra (Figure 7). More recently disturbed sites from 2008, 2012 and 2017 had distinct communities (i.e. black and red triangles,

crosses and x's are separated along the axes) suggesting that >10 years is required for disturbed tundra communities to naturally recover.

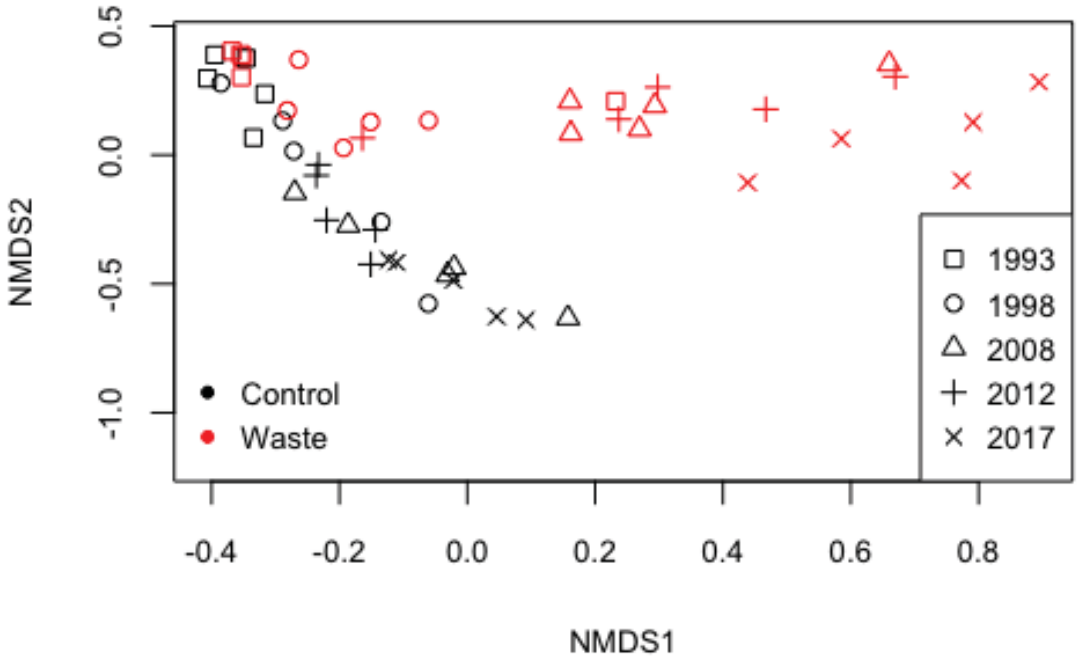

Figure 7. Non-metric multidimensional scaling ordination of species percent cover data on drilling wastes (red) and undisturbed control sites (black) in the disturbance years of 1993 (squares), 1998 (circles), 2008 (triangles), 2012 (crosses) and 2017 (x's). A stress value of $\leq$ 0.05 indicates a good fit. The stress value for the above ordination was 0.047.

To test for the effect of drilling wastes on community composition over time a PERMANOVA with Euclidean distances was used (Okasanen et al., 2015). PERMANOVA is a non-parametric multivariate analysis of variance that uses distance matrices. Treatment (i.e. drilling waste or control), year (i.e. 1993, 1998, 2008, 2012, 2017) and the interaction of treatment and year were fixed effects in the analysis and species cover was the response. All fixed effects were significantly different indicating that the plant communities are different between drilling wastes and control sites, as well as with time since disturbance ($p < 0.05$). A significant interaction between treatment and year is consistent with the NMDS since we observed that plant communities at older sites (1993, 1998) were similar between the drilling waste and control sites, but more recently disturbed communities were not.

Species Richness

Species richness was compared between the disturbed drilling wastes and the undisturbed control plots for each year included in the study. There were significant differences in species richness over time ($df=4$, $F=2.96$, $p=0.03$), between drilling waste and undisturbed controls ($df=1$, $F=19.763$ $p < 0.001$), and the interaction between time and drilling waste/control ($df=4$, $F=3.24$, $p=0.02$). Sites disturbed in 2017 had significantly lower species richness compared to their respective controls ($p < 0.001$), however, there were no significant differences in species richness between disturbed and undisturbed plots for sites

from 1993, 1998, 2008 and 2012 (Figure 8). Natural recovery of the tundra ecosystem results in similar species richness within 6 years. This trend is encouraging as it suggests that species richness can recover quickly and similar numbers of species are able to colonize the disturbed area. However, individual species may still be excluded on these recovering drilling wastes due to differences in the life history traits (i.e. growth form, reproduction and growth rate) of arctic vegetation.

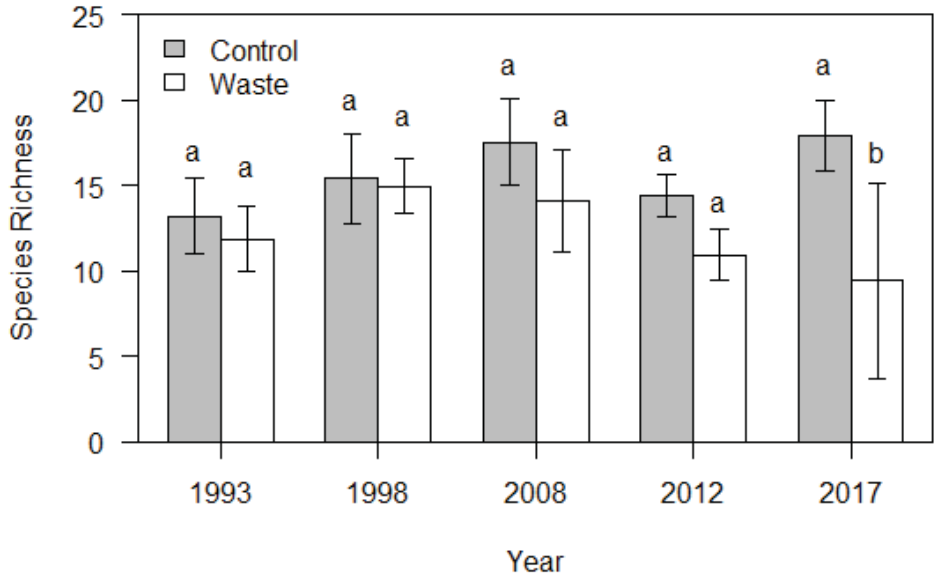

Figure 8. Species richness of drilling wastes and undisturbed control plots in different disturbance years. Both treatment (drilling waste and control) and year (1993, 1998, 2008, 2012, 2017) were significantly different (ANOVA, p<0.0f). Different letters represent significant differences (p <0.05) between control and waste sites within each year from a Tukey HSD post-hoc test. Bars present means with standard deviation (n=5).

Individual Species Response

Delayed dwarf shrub establishment was observed in recently disturbed sites, with the three most abundant ericaceous dwarf shrubs (*Cassiope tetragona, Dryas integrifolia* and *Loiseleuria procumbens*) having lower cover 1-2 years following disturbance (Table 2). Although there was variability across years since disturbance, in general, low-lying shrub cover increased over time with similar dwarf shrub cover present following 20 years of natural recovery.

Table 2. Difference in the percent cover of species between the drilling waste and paired undisturbed control plots. Values are the average % differences with standard error across all sites within a given year and only species with >5% differences in at least one year are included. Negative values indicate lower cover on the drilling wastes compared with the control and positive values indicate higher cover on the drilling waste compared to the control.

Year	Difference in Species percent cover (average % difference)				
	Dwarf Shrubs			**Sedge**	
	Cassiope tetragona	*Dryas integrifolia*	*Loiseleuria procumbens*	*Carex aquatilis*	
2017	**-9.0 (3.4)**	-4.3 (1.7)	-1.2 (1.2)	**8.6 (0.8)**	
2012	**5.3 (1.8)**	-2.4 (1.6)	0 (0)	1.5 (0.7)	
2008	1.6 (1.0)	2.9 (1.4)	**-9.6 (4.6)**	-0.7 (1.4)	
1998	4.1 (3.7)	**8.4 (3.8)**	0 (0)	-0.3 (3.0)	
1993	-0.6 (0.5)	-1.3 (2.4)	-1.2 (0)	0 (4.5)	
	Mosses		**Lichens**		
	Bryum spp.	*Scorpidium scorpioides*	*Cetraria* sp.	*Alectoria ochroleuca*	Fruticose Lichen
2017	-1.3 (1.2)	-0.3 (0.3)	**-20 (7.7)**	**-6.3 (1.3)**	**-8.7 (4.2)**
2012	4.1 (4.3)	-0.1 (0.1)	**-7.2 (3.1)**	0 (0.6)	-0.4 (0.4)
2008	**8.3 (2.3)**	0 (0)	**-14 (4.7)**	**-7.7 (3.0)**	**-4.1 (0.8)**
1998	**5.3 (2.9)**	-0.3 (0.2)	**-6.4 (3.2)**	-2.2 (1.4)	-1.9 (1.7)
1993	0.9 (1.5)	**-13 (5.4)**	-1.5 (1.1)	0.1 (0.1)	-0.9 (0.4)

Higher cover of *Carex aquatalis* in the early years of recovery are not surprising since sedges can often rapidly establish on disturbed arctic sites. Previous revegetation studies from Alaskan tundra found that native sedges established on disturbed sites in 5-10 year and had an aboveground biomass equal to undisturbed tundra (Chapin and Chapin, 1980). Sedges are often more dominant in lower-lying landscape positions in tundra ecosystems. Higher sedge cover on drilling wastes were observed only in 2012 and 2017. The 2012 sites were located in sedge (n=2) or heath (n=3) dominated hummock-hollow complexes, whereas, 2017 sites were in heath dominated hummock-hollow (n=1) and lichen heath (N=4) ecotypes. Therefore, sedge establishment of disturbed substrates may be occurring naturally across ecotypes indicating that these species could be useful for active restoration efforts.

One to two years following disturbance both mosses and lichens had a lower cover on the drilling wastes than the undisturbed controls. However, some moss species, such as *Bryum* spp. appear to recover quickly and establish at higher percentages on drilling wastes than the undisturbed tundra. *Bryum* sp. are acrocarpous, or carpet forming, are tolerant of high levels of solar radiation and are known to establish on disturbed substrates, especially slightly alkaline substrates (McKnight et al., 2013). Other moss species, such as *Scorpidium scorpioides*, have lower establishment on the disturbed substrates. *S. scorpioides* are pleurocarpous, or branched, and tend to be found in moist depressions in the landscape. In addition, saline conditions are known to inhibit or prevent growth of S. *scorpioides* (Vitt et al., 1993). Salinity associated with the drilling waste materials may be inhibiting the establishment of *S. scorpioides* over time. Lichen cover was lower across almost all ages of drilling wastes which is not surprising as

lichens are commonly regarded as slow-growing (Werner, 1990; Seminara et al., 2018). Despite the lower percent cover of lichens on the drilling wastes there was a clear trend of increasing cover over time. This is exemplified by *Cetraria* sp. that had 20% less cover on the drilling wastes 1-2 years following disturbed but only 1.5% less cover 25 years following disturbance.

Sedges and mosses may be important early colonizers and appear to establish relatively rapidly under natural recolonization. Dwarf shrubs and lichens are likely to require more time for natural recolonization and these growth forms may require active restoration efforts if shorter revegetation timelines (i.e. < 20 years) are required.

Presence/absence of plant species had similar trends to those observed for the percent cover differences (Table 3). Investigating presence/absence data is critical to understanding specific species response, because it reveals species that could be excluded from the disturbed sites. Dwarf shrubs (*Cassiope tetragona* and *Dryas integrifolia)* including *Salix* spp. were absent from 60-80% of recently disturbed drilling waste sites (i.e. 2012, 2017) (Table 3). Similarly, several moss and lichen species were absent from 60-100% of drilling waste sites that were disturbed within the last 10 years. As discussed above the slow-growing nature of these species likely accounts for the slow rates of colonization. It also appears that there may be some *Carex* spp. that are absent from the drilling wastes even after 25 years of natural recovery.

Table 3. Species presence/absence on the drilling wastes compared with paired undisturbed control plots. Negative values represent the total percentage of sites where a species was present in the paired control plots but not on the drilling waste. Positive values represent the total percentage of sites where a species was present on the drilling waste but not the paired control plots. All values are expressed as a percentage of sites where a species was present/absent (i.e. x/5*100). Only species where presence/absence differences were found at > 2 sites (>40%) are included.

Year	Presence/absence of species on drilling wastes vs. paired controls (% of sites)						
	Shrubs	**Dwarf Shrubs**				**Sedge**	**Forb**
	Betula glandulosa	*Cassiope tetragona*	*Dryas integrifolia*	*Salix spp.*	*Salix reticulata*	*Carex spp.*	*Pedicularis sp.*
2017	0	**-80**	**-80**	20	-20	-20	0
2012	20	**-60**	0	**-60**	**-80**	0	0
2008	0	0	40	0	-20	0	-20
1998	**60**	-40	0	40	-40	-20	**60**
1993	0	-40	20	0	40	**-60**	-40
	Mosses		**Lichens**				
	Tomenthypnum nitens	*Distichium spp.*	*Alectoria ochroleuca*	*Dactylina arctica*	*Thamnolia spp.*	*Xanthoparmelia spp.*	
2017	**-60**	-40	0	**-100**	**-60**	**-60**	
2012	**-60**	-40	-20	-20	-40	-20	
2008	**-60**	**-60**	**-80**	**-60**	**-80**	-20	
1998	0	0	-40	-40	20	-20	
1993	-20	20	0	-0	-20	-20	

Only two species were found to occur on the majority of drilling waste sites in comparison to the paired control plots: *Betula glandulosa and Pedicularis sp* (Table 3). Both species were found on 60% of the drilling waste at sites disturbed in 1998, and *B. glandulosa* was also found on 20% of the drilling waste sites in 2012. It is possible that both of these species benefit from the exposed substrate and high light conditions on the drilling waste surfaces. A survey of more sites across the landscape is needed to support these initial results, but it is clear that there are species that may be excluded from the drilling wastes and others that may benefit from the disturbance.

Overall tundra disturbed by the deposition of drilling wastes at the Meliadine site appears to recover relatively rapidly (i.e. within 20 years) without any active restoration. The community composition between drilling wastes and the paired undisturbed tundra was similar 20-25 years post disturbance and species richness recovered within 6 years. Due to the different life history characteristics of tundra plants, individual species responses to disturbance were observed. While sedges and mosses may recover more rapidly on these drilling wastes, dwarf shrubs and lichens may require longer to recover. These trends in natural recovery are important for guiding future restoration efforts and techniques. Specifically, targeting sedge and moss species for transplanting and/or seeding of disturbed substrates may be a highly effective strategy for initiating the development of early successional tundra communities.

Invasive Species

We examined 25 drilling wastes sites ranging in age from 1-25 years across the landscape at Meliadine, NU (Figure 1). At each of these sites we surveyed all species present in six $1m^2$ plots (3 on drilling wastes, 3 in undisturbed tundra). Within these 150 survey plots no invasive species were detected. In addition, no invasive species were noted at any other location on site, however, no systematic survey was conducted.

The University of Saskatchewan will conduct invasive plant surveys once a year during the summers of 2019, 2020, and 2021. We will provide and implement "*protocols for reducing Project-related effects to plant populations and communities, primarily through the mitigation and management of invasive species, and includes both environmental and follow-up monitoring"* as required by the Project Certificate (No.006, Condition 37) for the Meliadine site. These surveys will allow for early detection of any non-native invasive species present on the Meliadine site and provide the distribution and abundance of any invasive species found. A targeted monitoring approach, which focuses on high probability sites of initial invasive species establishment will be used.

Invasive plant monitoring will follow the survey protocol outlined by Oldham 2006 for exotic plants along Northwest Territories highways. Our survey study area will include the footprint of the Meliadine mine, as well as, the main access road from Rankin to the Meliadine site. Road surveys will consist of driving at a low speed (30km/hr on the road into site, and posted speed limits within the mine footprint) along all roadways in the study area. During road surveys, we will be looking for any invasive plants. All roads will be driven twice, to ensure both roadsides are surveyed.

On the main access road, we will stop every 2km for an informal roadside walking survey. At each informal roadside survey, we will record latitude and longitude, walk 50 meters along both sides of the road and record if any invasive species are encountered (location, pictures). Within the mine

footprint, areas of high likelihood of invasive species colonization, such as intersections, will be surveyed through formal roadside surveys. At each formal roadside survey location, we will record the latitude and longitude, describe the local habitat with reference to native species nearby, and walk 50m in all directions looking for invasive species. Additional locations with a high likelihood of invasive species colonization within the mine footprint, such as the exploration camp and main camp, will also be surveyed by the formal approach with a focus on the perimeter of the disturbed area. We will consult with the AEM environment team for other targeted locations (storage buildings, gravel pits) while ensuring we are only conducting surveys in safe areas clear of mining related activity.

Based on a 2010 report from the Canadian Endangered Species Conservation Council, there are 14 non-native plant species that have been recorded in Nunavut (Table 4). While looking for species previously recorded as invasive in Nunavut, we will take samples of any plants we cannot identify in the field to confirm their identification.

Table 4. Non-native invasive plant species identified by the Canadian Endangered Species Conservation Council that have been found in Nunavut.

Scientific name	**Common name**
Carum carvi	Wild Caraway
Taraxacum officinale	Common Dandelion
Sonchus arvensis	Field Sow Thistle
Leucanthemum vulgare	Oxeye Daisy
Thlaspi arvense	Field Pennycress
Capsella bursa-pastoris	Shepherd's Purse
Barbarea vulgaris	Yellow Rocket
Amaranthus retroflexus	Green Amaranth
Hordeum vulgare	Common Barley
Puccinellia distans	Spreading Alkali Grass
Vicia cracca	Tufted Vetch
Papaver somniferum	Opium Poppy
Plantago major	Common Plantain
Polygonum aviculare	Prostrate Knotweed

Colonization of Drilling Wastes

Bryophytes played an important role in the initial and early colonization of drilling wastes across the landscape. Moss species, particularly *Bryum* spp. were found on 88% of the drilling waste sites and were only absent at three sites all of which were disturbed in 2017. In addition, *Bryum* spp. had higher cover on the drilling wastes compared with the paired undisturbed tundra controls 10-20 years following disturbance. These early colonizing acrocarpous moss species appear to be the first macro biological soil crust component to establish. Biological soil crusts (BSCs) are communities of mosses, liverworts, lichens, bacteria, cyanobacteria and fungi that are commonly found throughout the arctic, especially on recently disturbed soils (Bowker et al, 2018). Mature BSCs appear to naturally develop approximately 10 years following disturbance with BSCs present on all but one drilling waste site from the disturbance years 1993-2008. These early colonizers and the subsequent development of mature biological soil crusts (Figure 9) likely play an important role in increasing water hold capacity and maintaining soil moisture at the surface, which is critical for soil nutrient cycling processes and germination of vascular plants from seed (Forbes and Jefferies 1999; Stewart et al. 2011a,b,c). In addition, early bryophyte colonizers provide surface roughness that can trap wind blown seed (Belnap and Harper, 2003). Through wetting and drying cycles moss mats can also provide a significant input of carbon, nitrogen and phosphorus that in turn promote key ecosystem processes, such as carbon and nitrogen cycling (Stewart 2011a,b).

Figure 9. Early acrocarpous moss establishment on 4-5-year-old drilling waste (left GT13-70) and mature biological soil crust 20-year-old drilling wastes (right M98-230).

On-going work is being completed in the laboratory at the University of Saskatchewan to examine the development and function of BSC assemblages in relation to soil physical, chemical and microbial properties. We are also working to develop successional models of BSCs based on the realized niche of primary macro and micro BSC phyla. This will allow us to assess the primary factors that determine the initial colonization of the disturbed substrates and the subsequent development and function of these critical early successional communities.

BSC and underlying substrate samples were collected from three drilling waste sites for each of the following disturbance years: 1998, 2008 and 2013. Five samples of crust and the underlying

substrate were collected by pushing a 7 cm diameter by 6.5 cm deep cylindrical sampling cup into the ground, cutting around it with a knife and extracting the sample. Samples were then tapped out of the sample jar, turned upright and returned to the cup and closed tightly. Samples were stored in coolers until brought to the university, where they were then housed in the PhytoTRON (Diurnal cycle of 18.5 hrs light/5.5 hrs dark with 15°C during light and 5°C during dark with relative humidity ~50%) and watered regularly with approximately 125 ml of water (MilliQ ®Ultra-Pure). Subsamples of each crust surface (~ 2.5 cm) and underlying substrate (> 2.5 cm to depth of sample) were collected within 1 week of return from the field and were stored at -80°C until analysis. DNA will be extracted (DNeasy PowerPlant Pro Kit, Qiagen) from these BSCs and underlying substrate. Molecular analysis will be conducted using Illumina MiSeq sequencing. Bryophytes and lichens, bacteria (16S) and fungal ITS will be examined for each BSC and underlying soil sample. In addition, BSC and substrates immediately underlying BSCs will be characterized for pH, ammonium (NH_4), nitrate (NO_3), dissolved organic nitrogen and dissolved organic carbon.

To better understand the role these early colonizing communities have in driving recovery of ecosystem function, gas flux measurements and enzyme assays have and will be completed. Gas flux measurements of all sampled BSCs were measured in August 2018. A Fourier Transform InfaRed-Multicomponent Gas Analyzer was used to determine carbon dioxide (CO_2), methane (CH_4) and nitrogen dioxide (N_2O) flux under both dark and light conditions. Measurements of N_2 fixation were made using acetylene reduction assays (Stewart et al., 1967). For the subsequent years of sampling (2019 and 2020), a series of enzyme assays to measure mineralization (chitinase and protease assays, following Hendel & Marxsen (2005)), nitrification (potential nitrification assay, following Hoffman et al. 2007)) and denitrification (potential denitrification assay, following Luo et al., 1996)) will be performed.

Finally, two microclimate monitoring stations were deployed on drilling wastes from 2013. At each site, two zones were established; one with exposed drilling waste and no BSC establishment and the other colonized by BSCs. In each zone, soil surface temperature is being monitored with fine wire copper constant thermocouples, BSC moisture is being monitored with impedence clips (Coxson, 1991) and soil moisture sensors were inserted to measure below surface moisture conditions. PAR (Photosynthetically Active Radiation) sensors were installed to measure light intensity and Leaf Wetness Smart sensors were deployed to provide the percent wetness just above the surface of the BSCs. These instruments were connected to a dataloggers (CR1000X Campbell Scientific Inc or HOBO loggers) and hourly means are being recorded until 2020. Additionally, an inventory of BSC was conducted by use of $5cm^2$ grids in a $25cm^2$ quadrats to measure surface cover by visual estimates. This will allow us to examine the microclimatic conditions associated with these developing BSC communities.

Substrate Characterization

The average depth of drilling waste and organic matter in impacted sites was 3.7 $\pm$ 3.2 and 2.4 $\pm$ 3.2 respectively (Figure 10). The average depth of organic matter in control sites across the landscape was 7.7 $\pm$ 2.9 cm. The deepest deposits of drilling waste were > 15 cm and found at 1993 sites, M93-40 and M98-230. The deepest organic layer depth was found in a control site at 20 cm. While drilling waste depth was similar across the differently aged sites, higher organic matter accumulation was evident at older sites (Figure 11).

Figure 10. Drilling waste ~3 cm in depth underlain by an organic soil horizon (left) and organic matter accumulation over drilling waste (right).

The depth of drilling waste and organic matter (OM) was assessed at each site by measuring the depth of each substrate type within the center of each 1 m^2 vegetation survey plot. Drilling waste depth was similar across all disturbance years and OM in undisturbed control plots was also similar across the landscape (Figure 11). The highest amount of OM found on drilling wastes was found in sites >25 years old (i.e. 1993), while very low to no OM was found on recently disturbed sites (i.e. 2017).

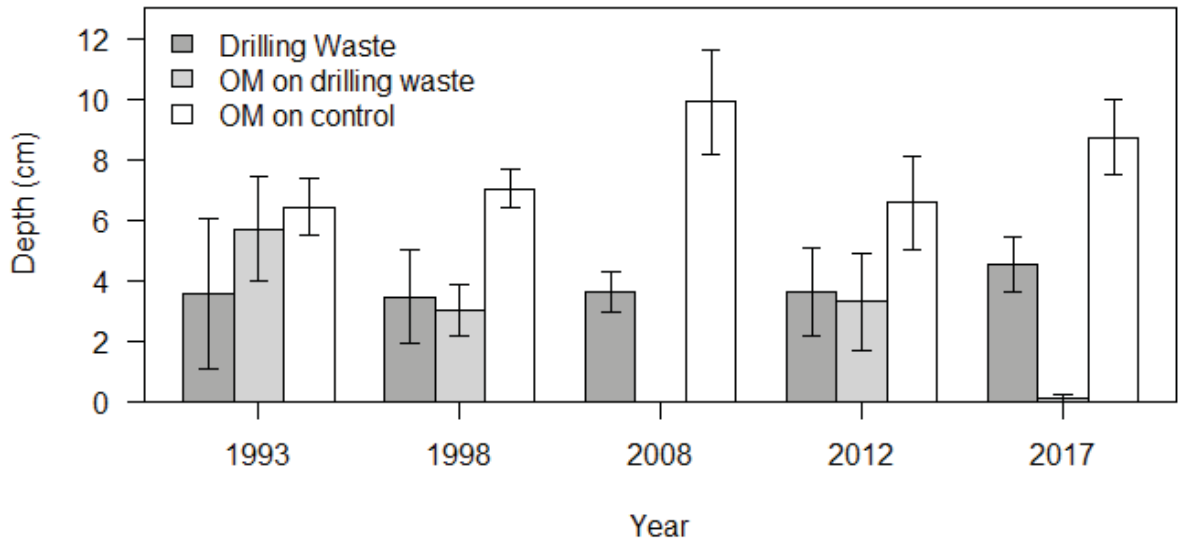

Figure 11. Depth of drilling waste, organic matter found over drilling waste and depth of organic matter in undisturbed controls plots. Bars are means with standard error (n=5).

Sites surveyed in 2008 were an anomaly with no OM depth detected (Figure 11). It possible that our sampling design biased placement of survey plots to areas with exposed drilling waste. However, we also found lower percent cover of several species (Table 2) and the highest number of absent species on drilling wastes (Table 3) at 2008 sites. The lack of organic matter accumulation could be due to the physicochemical properties of the drilling wastes inhibiting vegetative establishment or may be associated with the landscape position of 2008 sites. All 2008 sites were in close proximity to one another and were the most south-easterly sites sampled (Figure 1). Differences in landscape conditions (i.e. moisture, aspect, soil properties) in this area may impact natural revegetation. The 2008 sites were classified as heath hummock-hollow or transitional sites between heath hummock-hollow and sedge hummock-hollow. The mid-slope position of these sites would likely contribute to drier soil conditions, which may be limiting vegetative growth and hence OM accumulation. To confirm if/why lower OM accumulation is occurring in 2008, further survey of 2008 drilling waste sites in other landscape locations and assessment of the physicochemical characteristics of these drilling wastes is needed.

The relatively high OM depth measured at 2012 sites is also unexpected (Figure 11). Accumulation of OM in tundra ecosystems is generally considered to occur very slowly due to the short growing season and relatively low biomass production each year (Hobbie et al. 2002; Hugelius et al. 2010). It is very unlikely that approximately 4 cm of OM would accumulate within 6 years. We noted that on several drilling waste sites, wastes were found in depressions or hollows, with hummocks remaining intact above the level of the wastes. It is highly possible that some slumping is occurring in these hummock-hollow landscapes that could result in the burial of drilling wastes and appearance of OM accumulation on the drilling waste surface. These results should be interpreted with caution both due to the possible biasing of measurement due to the sampling design and the low numbers of replication (i.e. n=5) in each age category.

Best Practices to Promote Natural Recovery on Drilling Wastes

Based on the characterization of drilling waste sites and the tundra vegetation present on drilling wastes ranging from 1-25 years it is evident that natural revegetation is occurring on these wastes. Sources of vegetative materials for recolonization and depth of drilling waste appear to be two of the primary driving factors in determining the extent of recovery. Given these driving factors we suggest the following practices to promote natural revegetation processes.

1. Leaving areas of intact tundra vegetation dispersed throughout the area where drilling wastes are contained is essential. In hummock-hollow tundra, dispersal of drilling wastes into hollows, allows for hummocks to stay intact and act as source population for revegetation. Hummocks provide not only aboveground islands for revegetation but also maintain connectivity with intact belowground soil systems.

2. Thinly spread drilling wastes appear to undergo revegetation processes more quickly. In general, a depth of ~3 cm allowed for natural recolonization to proceed. Whereas depth of drilling waste > 15 cm can impede ecosystem recovery with little recovery observed even 20 years after disturbance. Underlying microtopography of drilling waste sites should be considered in managing wastes with an emphasis placed on limiting drilling wastes.

3. Direct colonization of drilling wastes in the first ~5 years is primarily driven by the colonization of acrocarpous mosses. Establishment of these early colonizing moss communities appears to facilitate the development of cohesive and diverse biological soil crusts in later years (~10-20 years). Mature biological soil crusts may act to further stabilize exposed drilling wastes and promote establishment of vascular plant species. **Promoting bryophyte cover in early stages may be beneficial to long-term tundra vegetation establishment.** Surface moisture is essential for establishment of early bryophyte communities and therefore practices that promote retention of surface moisture may assist in recovery.

Conclusions

Natural revegetation of drilling wastes is occurring at the Meliadine site. In our initial project proposal, we had proposed to examine active restoration on drilling waste sites. The first step in preparing to conduct active restoration was to examine a chronosequence of drilling waste sites across the landscape. This approach allows us to determine patterns of natural recolonization and use this information to inform active restoration practice. From the 25 drilling waste sites with paired undisturbed controls that were examined, we found that the community composition between drilling wastes and the paired undisturbed tundra was similar 20-25 years post disturbance and species richness recovered within 6 years. Due to the different life history characteristics of tundra plants, individual species responses to disturbance were observed. While sedges and mosses may recover more rapidly on these drilling wastes, dwarf shrubs and lichens may require longer to recover. These trends in natural recovery are important for guiding future restoration efforts and techniques. Specifically, targeting sedge and moss species for transplanting and/or seeding of disturbed substrates may be a highly effective strategy for initiating the development of early successional tundra communities.

Drilling waste depth was similar across all disturbance years and OM in undisturbed control plots was also similar across the landscape. The highest amount of OM found on drilling wastes was

found in sites >25 years old (i.e. 1993), while very low to no OM was found on recently disturbed sites (i.e. 2017). However, we found surprisingly large depths of OM on the drilling wastes in a short time period (ex. ~4 cm in 6 years). This trend warrants further investigation to determine the source and cause of this OM.

Based on our findings we provide suggestions to improve and/or maintain the relatively rapid natural revegetation of the drilling wastes. Placement of drilling wastes on the landscape that allow for remnant patches or islands of intact tundra throughout the disturbed area are essential for recolonization. Applying drilling wastes in thin layers may also assist with more rapid vegetative establishment. Finally, promotion of bryophyte communities in the early stages of revegetation may have long-term benefits for ecosystem recovery. Over the next three summers we will continue to monitor, survey and conduct laboratory trials to better understand the initial colonization and succession of species on these drilling wastes, particularly by bryophytes, lichens and biological soils crusts.

Finally, given the findings of this study we suggest that active restoration of the drilling wastes is likely not required for the recovery of the tundra plant communities, if the timeline for recovery is ~20 years. Therefore, in our on-going work to develop tundra restoration techniques, we suggest developing active restoration trials at other disturbed areas on the Meliadine site.

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Appendix A

Project Timeline and Deliverables

Dates have been modified to reflect that the grant was not awarded until June 1, 2018. Modification of research activities and additional reporting are also indicated.

4 (RPP)

Personal identification no. (PIN)	Family name of applicant
441262	Stewart

ACTIVITY SCHEDULE
(Refer to instructions to see if this section applies to your application. Use additional page(s) if necessary.)

Milestone	Description of activities	Anticipated starting date	Anticipated completion date
Milestone 0.1: Hiring HQP and field season preparation	All HQP will be hired and preparation for the field season completed. Preparations will include start-up meetings with the project team including AEM representatives. Planning of project logistics for year 1 and development of field plans.	2018-01-01 2018-06-01	2018-05-31 2018-07-01
Milestone 1.1: Natural recolonization of drilling wastes	Study natural recolonization of drilling waste dumps 2-17 yrs old by biological soil crusts and vascular plants. Specific recommendations of species for restoration will be developed.	2018-06-01 2018-07-01	2019-08-31 2018-11-30 Initial Technical report
Milestone 1.2: Development of HOF models	Hierarchical logistic regression modelling or Huisman Olff Fresco (HOF) models will be applied to examine optima and niche ranges of key naturally recolonizing foundational and early successional tundra species.	2018-09-01	2019-09-01
Milestone 1.3: Belowground niche ranges on waste dumps	Root density of key naturally recolonizing vascular plants will be plotted against key physicochemical parameters to determine niche ranges. This information will be used to further define HOF models in Milestone 1.2.	2018-09-01	2019-09-01
Milestone 0.3: Youth Education program	Collaboratively develop and deliver an education program on-site for one week in 2019 and 2021 for youth from Rankin Inlet and Baker Lake, NT. The program will focus on arctic ecology, restoration and skills in environmental monitoring and research.	2019-01-31	2020-01-31
Milestone 3.3: Assesment soil propagules in donor materials	The soil propagule bank in homogenized and plugs for transplant with be assessed. Specific recommendations on species present for restoration in local tundra will be developed.	2019-06-01	2020-01-01
Milestone 2.1: Active restoration with BSCs waste dumps	Transplanting of biological soil crusts on 10 drilling waste dumps. Specific recommendation of restoration practice and species for restoration will be developed. Active restoration of drilling wastes not required. Site of active restoration TBD. BSC development on drilling wastes will be examined through a chronosequence but not active restoration.	2019-06-01	2021-08-31

Personal identification no. (PIN)	Family name of applicant
441262	Stewart

ACTIVITY SCHEDULE
(Refer to instructions to see if this section applies to your application. Use additional page(s) if necessary.)

Milestone	Description of activities	Anticipated starting date	Anticipated completion date
Milestone 2.4: Active restoration with BSCs Waste Rock	Transplanting of biological soil crusts on 5 waste sites. Specific recommendation of restoration practice and species for restoration will be developed. This will be included in active restoration trial, location TBD.	2019-06-01	2021-08-31
Milestone 3.1: Active restoration with vascular plants	Transplanting of tundra plugs on 25 drilling waste dumps. Specific recommendation of restoration practice and species for restoration will be developed. This will be included in active restoration trial, location TBD.	2019-06-01	2021-08-31
Milestone 3.2: Belowground niches ranges at donor sites	The belowground niches ranges at undisturbed donor sites will be determined for key tundra vascular plants.	2019-06-01	2021-08-31
Milestone 2.3: Recovery of ecosystem function restored BSCs	Role of BSCs in recovery of key ecosystem services will be determined through examining community composition of actively restored BSCs with indicators of ecosystem function (ex. N and C fixation).	2019-06-14	2021-09-01
Milestone 0.4: Community meetings	We will hold community meetings in Rankin Inlet and Baker Lake. Working with Agnico's community relations department we will identify key groups to host. Our research and restoration of tundra environments will be presented and discussed	2019-08-01	2021-08-31
Milestone 2.2: Niche ranges of restored BSCs	Initial and realized niches of actively restored BSCs will be determined on drilling waste dumps and waste rock.	2019-09-01	2021-09-01
Milestone 0.6: Technical reports for Agnico Egale	Detailed technical reports for AEM on the restoration techniques examined. Guidelines and standard operating procedures for on-going monitoring will be included. Preliminary report January 2021, final report January 2022. Additional dates of yearly updates/technical reports on project progress.	2020-01-01 2018-11-30 2019-11-30	2022-01-01

Personal identification no. (PIN)	Family name of applicant
441262	Stewart

ACTIVITY SCHEDULE
(Refer to instructions to see if this section applies to your application. Use additional page(s) if necessary.)

Milestone	Description of activities	Anticipated starting date	Anticipated completion date
Milestone 0.5: Website development	Creation of project website providing information to restoration practitioners and public on general information on arctic ecology and restoration practice in the North, as well as key findings from the research.	2020-01-31 2019-06-01	2022-01-31
Milestone 3.4: Belowground niche ranges restored vasculars	The belowground niches of transplanted tundra species will be delineated on drilling waste dumps that were actively restored. Specific recommendation of restoration practice and species for restoration will be developed.	2020-06-01	2022-01-01

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Canada

AGNICO EAGLE

Meliadine Division

Sediment and Erosion Management Plan

MARCH 2019
VERSION 1

EXECUTIVE SUMMARY

This document presents the Sediment and Erosion management plan (the Plan) at the Meliadine Gold Project. The purpose of this Plan is to provide consolidated information on the management and monitoring of potential areas subjected to erosion. This is accomplished by reviewing the potential effects of total suspended solids (TSS) and turbidity, the Federal guidelines and the license requirements, followed by the periods and types of activities subjected to erosion, and the specific monitoring and mitigating measures.

General findings on the effects of TSS on fish and fish habitat have been listed, such as sublethal and lethal effects on fish and their eggs. Federal TSS Guidelines have been cited, distinguishing the short-term and long-term exposure thresholds. Turbidity guidelines are also discussed in the present document. The Plan presents the monitoring and mitigating actions related to three (3) specific periods of activity: Periods of construction near water – during construction and operation; periods of freshet or significant runoff events – during construction, operation and closure; periods of potential impact to waterbodies – during operation. The proposed monitoring and mitigating measures are discussed for those periods of activity.

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DOCUMENT CONTROL

Version	Date (YM)	Section	Page	Revision
1	March 2019	ALL	-	Comprehensive plan

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Acronyms

Agnico Eagle	Agnico Eagle Mines Limited – Meadowbank Division
CCME	Canadian Council of Ministers of the Environment
DFO	Fisheries and Oceans Canada
NIRB	Nunavut Impact Review Board
NTU	Nephelometric Turbidity Units
NWB	Nunavut Water Board
Plan	Sediment and Erosion Management Plan
TSS	Total Suspended Solids

UNITS

h	hour
km	kilometre
km^2	square kilometre
mg/L	milligram per litre

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit owned lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

As presented in Table 1.1, there are four phases to the development of the Tiriganiaq deposit: 3.5 years construction (Q4 Year -5 to Q2 Year -1), 8.5 years mine operation (Q2 Year -1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Table 1.1 Overview of Timeline and General Activities

Phase	Year	General Activities
Construction	Year -5 to year -1	• Construct site infrastructure • Develop the underground mine ramp • Stockpile ore
Operations	Year -1 to 8	• Mining operations • Stockpile ore • Dry stack tailing deposition
Closure	Year 9 to 11	• Decommission of underground mine surface opening • Cover on top of tailings • Decommission non-essential mine infrastructure • Fill open pits with active pumping
Post-Closure	Year 11 forwards	• Site and surrounding environment monitoring

This document presents the Sediment and Erosion Management Plan (the Plan). The purpose of this Plan is to provide consolidated information on the management and monitoring of potential areas subjected to erosion. This is accomplished by presenting first a review of the potential effects of total suspended solids (TSS) and turbidity, the Federal guidelines and the license requirements, followed by the periods and type of activities subjected to erosion, and the specific monitoring and mitigating measures.

As per Nunavut Impact Review Board (NIRB) Meliadine Project Certificate No.006 Condition 28, the Sediment and Erosion Management Plan should be developed to prevent or minimize the effects of destabilization and erosion that may occur due to Project activities. The plan should also detail sediment control plans to prevent and/or mitigate sediment loading into surface water within the Project area.

The objectives of the plan are:

- To prevent the release of sediment into streams and waterbodies during construction activities;
- To reduce and mitigate erosion and the release of sediment during operations activities;
- To specify erosion and sediment control measures that, if implemented and maintained, will help Agnico Eagle maintain compliance with the Federal Fisheries Act, specifically with Section 36(3) of the Act, which prohibits the deposition of deleterious substances into waterbodies frequented by fish; and
- To provide references to approvals, relevant standards, control plans and procedures for training, communications, investigation and corrective action, and audits that are required under the Project Agreement.

SECTION 2 • TOTAL SUSPENDED SOLIDS/TURBIDITY EFFECTS, FEDERAL GUIDELINES AND LICENSE REQUIREMENTS

2.1 Effects of Total Suspended Sediments on Fish Habitat

Suspended sediments, and associated effects on water clarity, have the potential to affect fish and fish habitat in a variety of ways, including but not limited to:

- Smothering of deposited eggs or siltation of spawning habitats;
- Smothering of benthic invertebrate communities;
- Decreased primary productivity caused by reduced light penetration;
- Reduced visibility, which may decrease feeding efficiency and/or increase predator avoidance; and
- Clogging and abrasion of gills.

Moreover, the general findings for effects of TSS on fish and fish habitat indicate the following:

- Effects of TSS depend on both the concentration of TSS and duration of exposure;
- Effects of TSS can also be influenced by the size and shape of suspended particles;
- Lethal concentration of TSS on fish over acute exposure ranges from hundreds to hundreds of thousands of mg/L;
- Sublethal effects on fish (reduced growth, changes in blood chemistry, histological changes) associated with chronic exposures tend to be exhibited at TSS concentrations ranging from the tens to hundreds of mg/L;
- There is considerable uncertainty about potential effects of low TSS concentrations over long time periods;
- Overall, the most sensitive group of aquatic organisms to TSS appears to be salmonids, and guidelines are developed to protect this group;
- Adult salmonids are generally more sensitive to short durations of high concentrations of suspended sediments than juvenile salmonids; and
- Low suspended sediment levels are known to cause egg mortality (40 %) to rainbow trout at long durations (7 mg/L at 48 days). Guidelines for long-term exposure reflect these findings.

More details are located in the report from Fisheries and Oceans Canada (DFO) on the effects of sediments on fish and their habitat (Fisheries and Oceans Canada, 1999).

2.2 Federal Guidelines

2.2.1 TSS Guidelines

The Canadian Council of Ministers of the Environment (CCME) specifies separate guidelines for TSS for clear and high flow periods. The guidelines are derived primarily from Caux *et al*. (1997), with application intended mainly for British Columbia streams. In the case of the application to the Meliadine Project lakes, the clear flow guidelines would be most relevant; even during freshet. The

lakes would not expect to see large natural fluctuations in TSS except in localized areas for short periods.

The guidelines put forth by the CCME recognize that the severity of effects of suspended sediments is a function of both the concentration of suspended sediments and the duration of exposure. Guidelines are intended to protect the most sensitive taxonomic group and the most sensitive life history stages.

Table 2.1 Existing Federal TSS Guidelines (after Agnico Eagle, 2018)

Source	Short-Term Exposure	Long-Term Exposure
CCME (1999)	Anthropogenic activities should not increase suspended sediment concentrations by more than 25 mg/L over background levels during any short-term exposure period (e.g., 24-h).	For longer term exposure (e.g., 30 days or more), average suspended sediment concentrations should not be increased by more than 5 mg/L over background levels.
MMER (2002)	Maximum authorized concentration in a composite effluent sample = 22.5 mg/L. Maximum authorized concentration in a grab sample of effluent = 30 mg/L.	Maximum authorized monthly mean effluent concentration = 15 mg/L.

2.2.2 Turbidity Guidelines

Turbidity guidelines put forth by the CCME (1999) are based on extrapolation from the TSS guidance above, adjusted by a factor of about 3:1 (a typical average ratio for TSS: turbidity). In the case of turbidity for clear water, CCME (1999) recommends a maximum increase of 8 Nephelometric Turbidity Units (NTU) from background levels for a short-term exposure (e.g., 24-hour period), and a maximum average increase of 2 NTU from background levels for a longer term exposure (e.g., 30-day period).

CCME (1999) notes that in some cases short-term resuspension of sediments and nutrients in the water column can augment primary productivity, and in other cases, changes in light penetration may be inconsequential if a system is limited by other factors such as nutrients. The Caux *et al*. (1997) study considered effects of suspended sediment not only on fish but also on algae and zooplankton. In summary, the recommendations put forth by Caux *et al*. (1997) are based mainly on the most sensitive taxonomic group, which is salmonids.

However, research has shown that widespread, chronic turbidity can result in reduced light penetration and subsequent reductions of primary productivity (Fisheries and Oceans Canada, 1999; Canadian Council of Ministers of the Environment, 1999; Lloyd, Koenings, & Laperriere, 1987). Consequently, water clarity is of concern at broader spatial scales and longer time frames. It should be noted that DFO's report on effects of sediment on fish and their habitat (DFO, 1999) endorses the guidelines for TSS put forth by the CCME (1999), but does not recommend following guidelines for turbidity. Rather, turbidity may be used as a surrogate for suspended sediment only when the relationship between the two parameters is established for a particular waterbody.

2.3 License Requirements for the Protection of Fish and Fish Habitat at Meliadine

The Nunavut Water Board (NWB) Type A Water License for the Meliadine Project includes:

All surface runoff and/or discharge from drainage management systems, at the Monitoring Program Stations MEL-SR-1 to MEL-SR-TBD referred to in Part I, Item 11, during the Construction/Operation of any facilities and infrastructure associated with this project, including laydown areas and All-weather Access Road, where flow may directly or indirectly enter a Water body, shall not exceed the Effluent quality limits in Table 2.3.

Table 2.3 Effluent Quality Limits

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Suspended Solids (TSS) (mg/L)	50.0	100.0
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	Between 6.0 and 9.5	Between 6.0 and 9.5

SECTION 3 • SEDIMENT AND EROSION MONITORING AND MITIGATION

3.1 Sediment and Erosion During Specific Periods

The purpose of the Plan is to ensure that Agnico Eagle will successfully monitor signs of sedimentation and erosion and minimize its resulting effects. This plan presents the monitoring and mitigating actions related to three (3) specific periods of activity for Meliadine:

- Periods of construction near water – during construction and operation;
- Periods of freshet or significant runoff events – during construction, operation and closure;
- Periods of potential impact to waterbodies – during operation.

The construction of water management infrastructure could potentially lead to excess TSS. Therefore, erosion control methods must be considered during construction of water management infrastructure. In addition, erosion control must be considered during any dewatering activity.

The freshet season at Meliadine occurs approximately from mid-May until the end of June. In addition, there can be periods of high water flow due to rainfall events from late May – early October. As most site construction has been completed at the Meliadine site there are new areas and infrastructure that have become potentially vulnerable to excess water during the freshet season and in response to rainfall, such as, but not limited to:

- Culverts and other water management infrastructures;
- Newly constructed embankments, such as roads and berms;
- Water channels; and
- Surface runoff.

Water transfer and water discharge during operation can also lead to erosion and sedimentation.

3.2. Erosion and Sediment Monitoring

In order to monitor potential erosion and sedimentation, smaller water management infrastructure such as culverts, cross drains, surface runoff and ditches are inspected daily during freshet, on a monthly basis thereafter and daily after significant rain events. Larger culverts and bridges are inspected more often if they represent a risk for daily operations, for the receiving environment or for the health and safety of workers. More specifically, the following aspects are monitored during visual inspections:

- Accumulation of debris near the inlet of the crossings, impeding the free flow of water at those locations;
- Bed erosion upstream and downstream of watercourse crossing structures;
- Scour under bridge abutments and abutment foundations; and
- Erosion along cutslopes and fillslopes of embankments (rill and gully erosion), etc.

Newly excavated channels are inspected on a regular basis and after significant rain events. Erosion signs along the channel flow are monitored and documented. Inspections are carried out during the spring when surficial ice moves towards the inlet of the diversion channels to ensure that no ice

blockage causes water buildup upstream of the channel, which could lead to subsequent erosion problems. It is important to develop a database to determine if adverse trends are occurring. If adverse trends are observed, then mitigation will be undertaken to prevent a major incident.

The frequency of water and turbidity sampling are in accordance with the requirements of the Type A Water License. The frequency will be increased if required during the freshet season or during heavy rainfall events. Procedures for turbidity monitoring include:

- Collection of water at the site of sediment entrance (exposure), and at a reference site (i.e., in the same watercourse/waterbody in an area unaffected by the sedimentation [upstream, at least 50 m away where water does not appear to be impacted]).
- Analyze samples for turbidity using a field turbidity meter and compare the exposure sample to the reference sample.
- If the exposure sample results are higher than the reference then mitigation will be undertaken (ie installation of silt fencing, silt barrier booms, etc) to prevent any impact to watercourses.

If Agnico Eagle is actively working in an area with elevated turbidity – the work will stop until the level of clarity returns to an acceptable level.

Monitoring will be documented with site photographs and inspection forms.

3.3 Mitigating Measures

The following mitigation measures could be used, if required, to reduce risks associated with erosion and sedimentation.

- Riprap or clean non-acid generating/non-metal leaching rockfill could be used to armor shorelines, bridge abutments, culverts inlets and outlets and toe berms;
- Ditches managing high volumes of water could be armored for erosion control and reduce the speed of water flow;
- Sedimentation basins could be constructed at sensitive locations to allow settlement of finer sediments;
- Ditches, culverts and other water crossing structures should be maintained free of debris to allow free flow of runoff water;
- Installation of erosion control material such as turbidity barriers, silt curtains or straw booms;
- Site-specific erosion issues may arise during the mine operation that require specific local corrective actions;
- In-stream construction during periods when streams are expected to be dry or frozen to the bottom (i.e., during winter or fall). Isolation methods will be used for work below the high water mark for streams with flowing water at the time of construction;
- Materials installed below the high water mark (i.e., riprap) will be cleaned prior to installation to avoid adding deleterious substances to watercourses. Where concrete is installed, it will be allowed to cure fully prior to installation;

- Riparian areas will be maintained whenever possible to minimize erosion and impacts to fish habitat, with vegetation removal limited to the width of the workspace footprint. Disturbed areas along the streambanks will be stabilized and allowed to re-vegetate upon completion of work to minimize future erosion;
- Debris and excess materials resulting from construction will be removed from the work site to prevent them reaching water bodies; and
- When using equipment that creates tracks on the surface, run the equipment slowly to create grooves running perpendicular the slope and not parallel to the slope. This type of texture on slopes can slow the speed of runoff and reduce the amount of erosion and sediment transported downhill. This method must also be combined with an additional method of catching sediment at the base of the slope, such as a silt fence, straw log, etc.

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AGNICO EAGLE

MELIADINE GOLD MINE

Shipping Management Plan

MARCH 2019

VERSION 8

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	December 2012			First draft of the Shipping Management Plan	John Witteman, Env. Consultant, AEM
2	March 2013			DEIS re-submission; rebranding	
3	April 2014	1.1	1	Anticipated increased shipping traffic	John Witteman, Env. Consultant, AEM
		1.2	4	Updated Figure 1-1	
		3	10-11	Added details on AWPPA and regs. and Shipping Safety Control Zone	
		4	14	Mention of marine birds and ship track data	
		4.2	16	Distance of release from Itivia Spill vs marine wildlife	
4	January 2016	1.1	1	Decrease in shipping traffic	Phil Rouget, Golder Associates Ltd.
		1.3.3	6	Added details for cyanide	
		2.3	7	Update spill support	
		2.4	8	Added details to SOPEP	
		4.1	13-14	Reference to Spill Risk	
		4.2	14-15	Assessment	
		4.3	15-16	Updated mitigation and reference to MEMP and MMSO program in accordance with Project Certificate conditions.	
		9.2	23	Updated monitoring activities and reference to MEMP and MMSO program.	
		10	24	Removed last paragraph	
		A-B		Update to safety	
		A-D		Added Revised Marine Baseline Assessment	
		A-E		Added Marine Environmental Management Plan (MEMP)	
				Added Revised Spill Risk Assessment	
5	August 2016	1.3.3	6	Up to date Safety Bulletin in relation to vessels	Katelyn Zottenberg, Golder Associates Ltd.
				Added that ammonium nitrate is listed under schedule 1 of the Environmental Emergency Regulations.	
		Table 3-1	12	Update to Navigation Protection Act.	

				Added Section 36(3) of the *Fisheries Act.*	
		4.2	15	Updated wording "Subject to safe navigation…" Footnote added to include how vessel wake was assessed in the FEIS. Updated to wording around marine mammal mitigation. (changed to 500 m buffer zones).	
		Appendix D	2.2.1.2	Added Government of Nunavut as lead management responsibility for polar bears.	
		Appendix D	Table D-4	Changed wording regarding the handling of birds during a spill.	
		Appendix D Appendix B Figure B3	1.0	Updating wording to state the intent of the MMSO program. Revised	
6	February 2017	Appendix D	2.1.3	Updated to include more detailed protocols for marine mammal and seabird surveys/observations (specifically the ECSAS protocols for seabirds as request by ECCC)	Katelyn Zottenberg, Golder Associates Ltd.
		Figure 1-1 Executive Summary Sections 1.0, 4.0, 11, 12 and 13	4 vi 1, 14, 26, 30, 28	Updated text to reflect comments received from dry cargo shipping contractor (Desgagnes Transarktic). Key edits related to shipping of dry cargo shipping operations included (description of lightering operations, potential anchor location (dry cargo vessels only), number of vessel, and potential nighttime operations).	
6	March 2017	Throughout the Shipping Management Plan		Minor wording updates to the text to reflect comments received from dry cargo shipping contractor (Desgagnes Transarktic).	Katelyn Zottenberg, Golder Associates Ltd.
7	March 2019	Throughout the Shipping Management Plan		Updated wording to reflect current management status.	Dan Gorton
		Section 4.3	17	Updated to address NIRB condition 127.	

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EXECUTIVE SUMMARY

The Shipping Management Plan was developed in accordance with federal legislation, notably the *Canada Shipping Act* and the *Arctic Waters Pollution Prevention Act,* and associated regulations. It also recognizes the international conventions and protocols signed by Canada. Agnico Eagle provides the necessary human, material and financial resources to meet or exceed the legal requirements attributable to the company that arise from shipping-related activities. Shipping contractors are encouraged to do the same. Agnico Eagle and its shipping contractors carry third party liability insurance.

All shipping is carried out during the open water season and follows the recommended shipping routes that are presently in use for the annual sea lift to Rankin Inlet and other Kivalliq communities. Ice breaking is not conducted to extend the shipping season.

Upon arrival at Rankin Inlet, all vessels anchor either outside or inside Melvin Bay. Dry cargo is lightered onto barges for transport through the access passage using tugs. The barges then transport the dry cargo by barge to the existing gravel ramp used by the hamlet of Rankin Inlet during the annual sealift to dock. Large fuel tankers anchor outside of Melvin Bay. Ship-to-ship fuel transfer is the first step in moving the fuel to the Itivia tank farm. The small tanker navigates the access passage and anchors off Itivia where a ship-to-shore floating hose transfers the fuel to the tank farm.

It is Agnico Eagle's intent to prioritize the road transport of hazardous materials, including explosive-related materials, to the Meliadine site to avoid having such cargo remain in storage at the Itivia laydown yard. Other contingency measures associated with shipping-related activities include the Spill Contingency Plan, Risk Management and Emergency Response Plan, and the Oil Pollution Emergency Plan (OPEP). Risk and hazard assessments of shore-based marine response activities are undertaken as part of training the Emergency Response Team (ERT).

Agnico Eagle personnel and the Master of the ship are responsible for security matters related to the shipping-related activities. While it is anticipated that the RCMP will not be involved in security matters, all criminal activities or matters of a grave nature (e.g., smuggling) will be referred to the RCMP in Rankin Inlet. Mitigation measures to prevent smuggling are in place. Mitigation measures are also employed to minimize potential negative socio-economic effects from shipping-related activities; positive socio-economic impacts are anticipated.

Navigation through the Labrador Sea, Hudson Strait and Hudson Bay is not challenging during the open water season. No major hazards were identified along the shipping and tug-barge routes under normal conditions. Shipping can be carried out without pilotage as the shipping routes entail minor hazards not significantly reducing ship safety.

All ships, tugs and tankers use electronic charts and other electronic navigational aids to provide safety in transit, reduce the risk of accidents, and remain within the recommended shipping routes.

Traffic through the access passage is coordinated to avoid shipping conflicts, and speed is reduced to ensure safety. To maximize the safety of the persons travelling in boats near the Rankin Inlet access passage, Agnico Eagle informs the community of the shipping activities, promotes actions that will allow the ship and the small boats to see one another, and, through the Community Liaison Committee, recommends that all those in small boats wear personal floatation devices.

On board waste management (solid and hazardous wastes, sewage) is the responsibility of shipping contractors. Agnico Eagle requires the shipping contractors to conform to the *Ballast Management Control and Management Regulations*, which should reduce the risk of invasive species being introduced as a result of shipping activities. Agnico Eagle expects to contract vessels that meet applicable environmental requirements in addition to being reliable and having a superior safety record.

Care is taken to avoid disturbing marine mammals within the shipping routes as much as possible. As part of shipping companies' standard operating procedures, ship crew monitors the shipping routes for marine mammals from the Hudson Strait to Rankin Inlet. Mitigation measures may comprise, if safe to do so, slowing the ship and stay at distance from marine mammals.

Vessels contracted by Agnico Eagle are required to have an approved Shipboard Oil Pollution Emergency Plan (SOPEP). If an environmental emergency occurs along the shipping routes, the SOPEP is activated. Close coordination is maintained with Agnico Eagle's shore-based supervisors who can activate Agnico Eagle Emergency Response Plan and OPEP to provide assistance to a vessel. Accidents or malfunctions during transit will be reported to Transport Canada, in accordance with provisions under the *Canada Shipping Act* (CSA 2001) and subsequent regulations. Spills would also be reported to the Environmental Emergencies 24-Hour Report Line and, if necessary, advice would be requested from the Regional Environmental Emergencies Team (REET). Assistance could be sought from nearby ships and the Canadian Coast Guard (CCG).

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
BWMP	Ballast Water Management Plan
CCG	Canadian Coast Guard
ECCC	Environment and Climate Change Canada
EIA	Environmental Impact Assessment
ERP	Emergency Response Plan
ERT	Emergency Response Team
IMO	International Marine Organization
MARPOL	International Convention for the Prevention of Pollution from Ships
MEMP	Marine Environmental Management Plan
MMSO	Marine Mammal and Seabird Observer
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
RCMP	Royal Canadian Mounted Police
REET	Regional Environmental Emergencies Team
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
TEU	Twenty-foot Equivalent Unit, a measure used for capacity in container transportation (sea can)
TK	Traditional Knowledge
WSCC	Workers' Safety Compensation Commission

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) gained extensive experience in shipping fuel and dry cargo to the Meadowbank Gold Mine (Meadowbank) since its construction began in 2008 and commercial production in 2010. Similar shipping, lightering and ship-to-shore fuel transfer procedures developed and in use for Meadowbank are employed for the Meliadine Gold Mine in Rankin Inlet.

Dry cargo barges undergo lightering operations at the existing gravel ramp used by the hamlet during the annual sealift in Itivia Harbour[1]. A tank farm, sea can storage and a laydown yard is also located at Itivia (Figure 1-1).

1.1 Shipping Needs

A total of approximately 40,000 tonnes of dry cargo (equipment and supplies) and 50 million litres of diesel fuel is required annually for the operations of the Meliadine Mine. To meet these needs, approximately 8 vessels annually deliver dry goods and up to 6 tankers will annually deliver diesel fuel. At this time, dry cargo shipping operations have been contracted to Desgagnes Transarktic.

All shipping is carried out during the open water season (typically from early July to late October) and follow the recommended shipping routes presently in use for the annual sea lift to Rankin Inlet and other Kivalliq communities. There will not be any ice breaking to extend the shipping season.

The priorities in shipping dry cargo and fuel are:

- The protection of the crew and others in small boats that the ship may come across;
- The protection of the marine environment; and
- The preservation of the ship and its cargo.

All ships, tugs and tankers are equipped with electronic navigational aids. Ships are not serviced in Rankin Inlet and arrive with enough fuel for the return voyage south.

The Meliadine Mine is anticipated to contribute to shipping in Hudson Strait and Hudson Bay by about 14 ships during construction and 8 to 12 ships during operations. This represents an increase in ship traffic in Hudson Strait, Hudson Bay and to Rankin Inlet, and extra care is required in regards to marine safety. This includes ensuring there is adequate spill response equipment on the ships and at the Itivia

[1] The current plan is to lighter cargo using the existing gravel ramp in Itivia Harbour. This ramp is currently used by the Hamlet of Rankin Inlet during the annual sealift. The assessment of potential effects related to the use of this ramp are consistent with those discussed in Section 8.3.4 of the FEIS (e.g., propeller wash from nearshore Mine vessels berthing at the landing ramp may result in adverse effects to marine water quality with associated indirect effects on marine wildlife). The conclusions of the assessment remain the same.

Oil Handling Facility. Spill response personnel need to have adequate training and equipment to effectively respond to a spill in the marine environment[2].

1.2 Shipping Routes

The marine transport of dry cargo is comprised of four main segments, all within the recommended shipping routes:

- Bécancour, Québec on the St. Lawrence River, along the coast of Labrador to the Hudson Strait;
- Through Hudson Strait to Hudson Bay (see Appendix A for marine hydrographic charts showing the shipping routes);
- Across Hudson Bay to Marble Island, this being approximately 45 km offshore Rankin Inlet; and
- From Marble Island to the barrier islands, through the islands to an anchoring point either inside or outside of Melvin Bay and Itivia. Access to anchoring locations inside Melvin Bay occurs through the access passage (Figure 1-1).

Dry cargo and transport barges are loaded onto ocean-going container ships in eastern ports, almost exclusively Bécancour, and delivered directly to Rankin Inlet[3]. The first vessels of the year normally arrive in Rankin Inlet in early July or August. This first container ship includes two (2) transport barges to transport dry cargo to shore, and two (2) tugs.

Up to twelve (12) container ships arrive throughout the open water shipping season delivering dry cargo[4]. All ships follow the recommended shipping routes and are equipped with complete electronic navigation aids for navigation in restricted waters.

The port of departure for transporting fuel is different from that for dry cargo. The first leg of the voyage is from an east coast refinery along the coast of Labrador to the Hudson Strait with the remainder of the voyage being the same as for the ships carrying dry goods.

1.3 Lightering Procedures

1.3.1 Dry Cargo

Sea cans, large equipment, machinery, general cargo and vehicles are lightered onto the barges (that arrived during the first dry cargo trip) for transport to shore using tugs and then lightered to shore using the existing gravel ramp in Itivia Harbour. During lightering operations, attention is directed to

[2] Oil Pollution Emergency Plan details spill response at the Itivia Oil Handling Facility.
[3] Agnico Eagle's shipping routes within Nunavut are non-compulsory pilotage areas during the ice free shipping season.
[4] To this point there are no alternative routes under consideration, however future routing may include Churchill to Rankin Inlet on occasion.

stabilizing the barges at the gravel ramp, with due consideration being given to the prevailing and expected wind, weather, and tide conditions.

Most dry cargo is transported in marine shipping containers (TEUs; Twenty-foot Equivalent Unit) of general cargo vessels fitted with cranes. Most materials arrive in sea cans, which are stacked in the Itivia laydown yard or moved immediately to site. The use of sea cans provides secondary protection against spills and facilitates rapid transfer from ship to shore.

The tug-barge used to ferry the dry cargo to shore is highly manoeuvrable and capable of transiting the access passage with its changing current patterns. The tidal current in the area is half a knot (0.93 km/h). Navigation proceeds at a slow speed in periods of low visibility. Traffic through the access passage is coordinated through communication between the tugs to avoid shipping conflicts and to ensure safety.

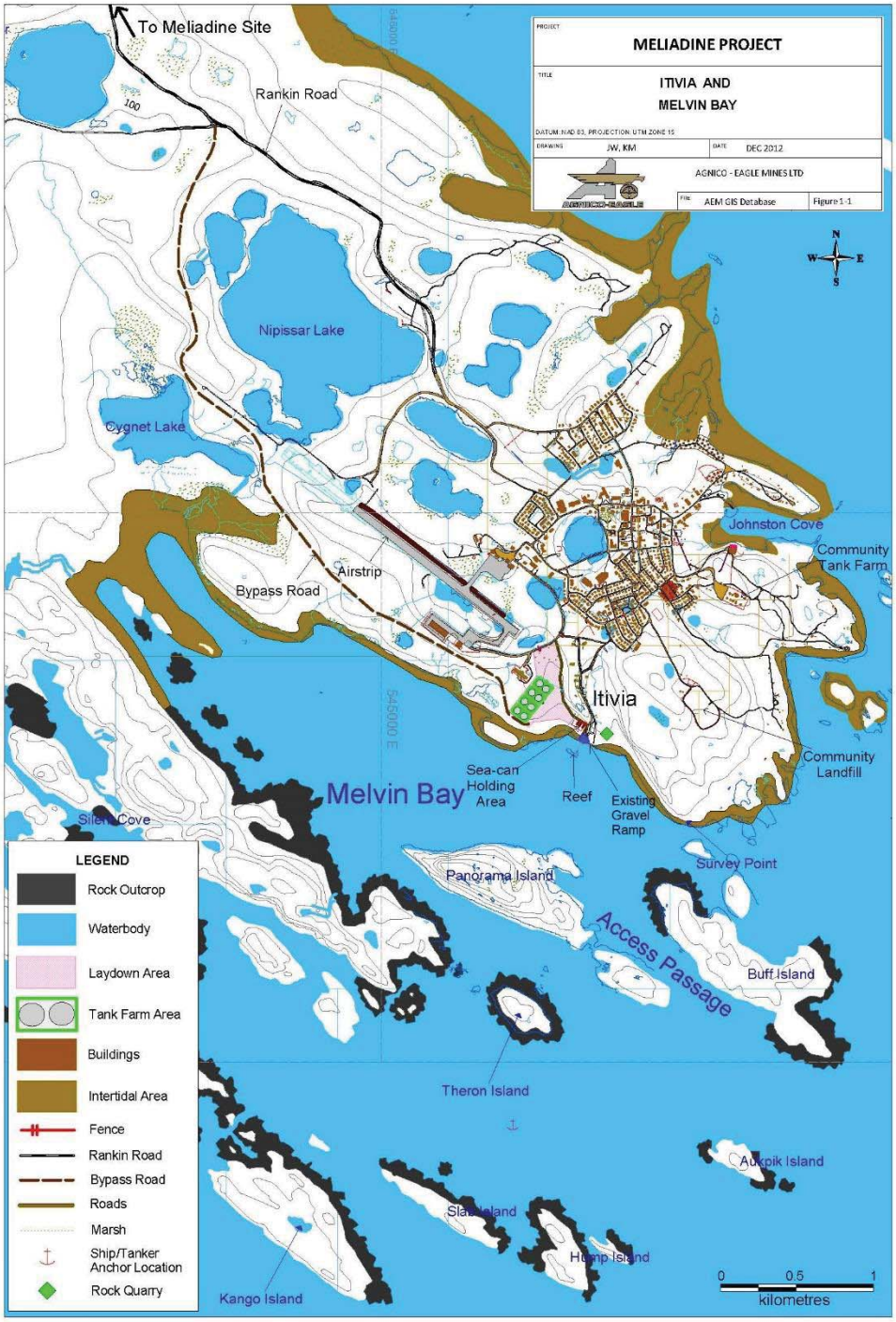


Figure 1.1 Itivia and Melvin Bay

Masters of tugs, large and small tankers, and dry cargo ships are responsible for their vessels at all times – for the safe navigation of their vessels from the port of departure to Rankin Inlet. For tugs this also includes responsibility for the barge they are towing or pushing. When a barge is laid alongside a dry cargo vessel for lightering containers or equipment from the cargo ship to the barge, a loading supervisor on the ship takes charge of the barge. When a cargo barge is stabilized at the gravel ramp for lightering to shore, a shore supervisor takes charge of the cargo barge.

The shore crew then conducts a "roll-on/ roll-off' operation using wheel loaders equipped with forks, trucks and trailers to unload the cargo from the barges. Cargo is stockpiled on the laydown area before being transported to the Meliadine Mine.

For the majority of the shipping season, outgoing cargo is loaded onto lightering barges and subsequent container ships for the return trip to southern ports. Outgoing cargo could include construction equipment being demobilized following the completion of construction and/or hazardous or other waste being sent to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction. No barges, fuel vessels or tugs remain at Rankin Inlet over the winter; all return to southern ports.

1.3.2 Diesel Fuel

Large tankers delivering diesel fuel anchor in the same general location as the dry cargo vessels (Figure 1-1). Ship-to-ship transfer of fuel occurs at this location from the larger tanker to a smaller tanker that can navigate the access passage. The carrying capacity of the small tanker will be either 7,300 m^3 or 10,500 m^3. The one selected at any one time is subject to its availability when a large fuel tanker is set to deliver fuel to Agnico Eagle. The smaller tankers are able to navigate the access passage into Melvin Bay while the large tanker cannot. The small tanker anchors opposite Itivia[5]. From there a floating hose of some 300-500 m is connected to a shore-based pipeline for transfer of fuel to the tank farm. Contingency measures related to the transfer of fuel are described in the Oil Pollution Emergency Plan.

1.3.3 Explosives and Hazardous Materials

Part of the dry cargo received each year is ammonium nitrate, which is used on site to manufacture explosives. Bulk ammonium nitrate is shipped as prill, which is inert and does not require special handling during transit. The ammonium nitrate remains in sea cans at the mine site until needed[6]. Other needed raw materials and blasting related products arrive in sea cans and are stored in secure locations at the mine site. Ammonium Nitrate (to be used as an explosive) is also listed in schedule 1 of the *Environmental Emergency Regulations* under the *Canadian Environmental Protection Act*. Further information related to transport of ammonium nitrate is provided in the Explosives

[5] The anchoring location will vary based on a number of factors such as tide, wind and draught of the small tanker.
[6] An on-site Emulsion Plant has been constructed for the manufacturing of explosives. More details on that subject are available in the Explosives Management Plan.

Management Plan (Agnico Eagle 2018). Agnico Eagle notified Environment and Climate Change Canada of the expected quantity of ammonium nitrate to be shipped by barge and stored on site, and received a response from ECCC indicating that Agnico Eagle has met the requirements of the E2 registration.[7]

It is Agnico Eagle's intent to prioritize the road transport of hazardous materials, including explosive-related materials, to the Meliadine site to avoid having such cargo remain in storage at the Itivia laydown yard. Sensitive products such as explosives, boosters and caps are transported directly to the Meliadine Mine. However, in the eventuality of a delay in their transit to the mine site, these products will be temporarily stored in Rankin Inlet according to applicable regulations which include locked storage under constant surveillance. All handling, transport, storage, manufacture and use of explosives are subject to federal approval under the *Explosives Act*, and the *Nunavut Mine Health and Safety Act*. In addition, the latest Ship Safety Bulletin issued by Transport Canada's Marine Safety Directorate is followed when loading and unloading explosives.

Sodium cyanide is used to optimize gold recovery from the ore. This product is used at the Meliadine site. Due to transportation restrictions, normally a full year's supply of sodium cyanide is transported and stored on site. The product is transported, stored, handled, transferred and used in compliance with appropriate legislation and applicable Best Management Practices. Agnico Eagle is a signatory to the International Cyanide Management Code.

Hazardous waste and contaminated soil is managed on a yearly basis; consequently there will be little to no accumulation of such wastes at the mine site during operations, subject to seasonal shipping considerations. Hazardous waste that cannot be managed on site is appropriately packaged for transport in sea cans and sent via a dry cargo vessel to a certified hazardous waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction. Agnico Eagle contracts shipping companies that are certified under the IMDG code (International Maritime Dangerous Goods).

Itivia is presently connected to the hamlet by a municipal road and a private bypass road, which is used for the transport of all its dry cargo and fuel around the community. This includes explosives, cyanides and dangerous goods.

[7] E-mail submitted by Martin Theriault of Agnico Eagle to ECCC on September 13, 2018 and an e-mail received by Martin Theriault of Agnico Eagle from Christina Firth of ECCC, September 13, 2018.

SECTION 2 • RELATED DOCUMENTS

The Shipping Management Plan covers the scope of shipping activities for the Meliadine Mine. It is part of the Environmental Management and Protection Plan.

Management and monitoring plans for the Meliadine Mine that provided input to the Shipping Management Plan include the following:

- Spill Contingency Plan;
- Risk Management and Emergency Response Plan;
- Oil Pollution Emergency Plan;
- Shipboard Oil Pollution Emergency Plan (shipping companies); and
- Occupational Health and Safety Plan.

2.1 Spill Contingency Plan

The cornerstone of spill contingency planning for Agnico Eagle is the Spill Contingency Plan covering all spills on land, water and ice. It forms part of the Environmental Management and Protection Plan. The Spill Contingency Plan, coupled with the Risk Management and Emergency Response Plan, describes the processes to be followed when responding to a spill to the environment.

2.2 Risk Management and Emergency Response Plan

The Risk Management and Emergency Response Plan focuses on responding to all emergencies in a timely and adequate manner. It commits Agnico Eagle to being prepared for and providing adequate resources - qualified personnel and equipment - to handle a wide variety of emergency situations.

Risk and hazard assessments of shore-based marine response activities are undertaken as part of training for Emergency Response Team (ERT).

2.3 Oil Pollution Emergency Plan (OPEP)

The Oil Pollution Emergency Plan complements the Spill Contingency Plan and should not be construed as superseding it. The OPEP only provides contingency planning for the Oil Handling Facility (OHF) at Itivia.

The OPEP complies with the requirements for procedures, equipment and resources as set out in the *Canada Shipping Act* (s.s. 660.2(4)) specific to the fuel handling facility, the bulk incoming transfer of fuel from ship-to-shore and spill scenarios directly relating to this operation. Further, the OPEP provides direction to Agnico Eagle personnel and/or contractors and to Agnico Eagle's ERT in emergency spill response situations. It also contributes in developing oil pollution scenarios, defining the roles and responsibilities of management and responders, and outlining the measures taken to prevent spills. The OPEP seeks to minimize potential health and safety hazards, environmental damage and cleanup costs.

Spills resulting from ship-to-ship fuel transfer will be the responsibility of the ships contracted by Agnico Eagle and ship's Master. Agnico Eagle will provide assistance wherever possible in these instances.

2.4 Shipboard Oil Pollution Emergency Plan

The Shipboard Oil Pollution Emergency Plan (SOPEP)[8] contains all information and operational instructions as required by the International Marine Organization's "*Guidelines for the Development of the Shipboard Marine Pollution Emergency Plan*". Vessels contracted by Agnico Eagle will be required to have an approved SOPEP. The preparation of the SOPEP is the responsibility of the shipping company and is maintained by the vessel's Master. However, close coordination is maintained with Agnico Eagle's shore-based Itivia supervisors who can activate the Emergency Response Plan (ERP) and OPEP in providing assistance to a vessel in the near-shore area. These two plans have close links to the SOPEP and, as required, include training exercises at regular intervals to ensure ship and shore can cooperate in responding to any spill of fuel or any other hazardous product in the immediate vicinity of Itivia. SOPEP(s) arerequired to include how vessel contractor(s) maintain spill equipment and the frequency and framework for training vessel personnel in vessel-based spill response. This includes, but is not limited to:

- Spill equipment audits;
- Maintaining posted list of spill equipment;
- Requirements for spill response drills; and
- On-going training refreshers (e.g. annual renewals).

Accidents or malfunctions during transit will be reported to Transport Canada, in accordance with CSA 2001 and subsequent regulations. If the accident involves the loss of fuel or chemicals, the SOPEP would be activated and on-board spill response materials and equipment put to use. Spills would also be reported to the Government of Nunavut Spill Line and to the Environmental Emergencies 24-Hour Report Line and, if necessary, advice would be requested from the Regional Environmental Emergencies Team. Assistance could be sought from nearby ships and the Canadian Coast Guard (CCG). Spill response resources such as those maintained by the Canadian Coast Guard at select locations along the Kivalliq coast could be dispatched to the spill site. A sea can with spill response materials is maintained by the CCG in Rankin Inlet. Permission to use this material will have to be obtained from CCG before usage.

Outside help could be requested for major accidents such as accidental grounding/stranding of a vessel. Under these circumstances, the safety of the crew and maintaining the integrity of the vessel would be the first priority.

[8] Spills and their effect on Marine Wildlife are addressed in Oil Pollution Emergency Plan.

2.5 Occupational Health and Safety

All activities carried out by Agnico Eagle must consider the attendant risks and be carried out with safety first in mind. Agnico Eagle will conduct all activities in accordance with the Workers' Safety and Compensation Commission (WSCC) Occupational Health and Safety legislation.

SECTION 3 • APPLICABLE FEDERAL ACTS, REGULATIONS AND GUIDELINES

The Plan was prepared in accordance with federal legislation outlined in Table 3-1. Numerous regulations exist under the *Canada Shipping Act* and these can be found at www.tc.gc.ca and www.canada.ca The regulations included here are most relevant to the environment and the Shipping Management Plan.

Table 3-2 lists international conventions and protocols signed by Canada. Canada is a signatory to International Marine Organization (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL) and International Convention for the Safety of Life at Sea (SOLAS). As such, Canadian marine laws, regulations and guidelines rules are a reflection of these international conventions, protocols and agreements.

At this time, Agnico Eagle has contracted Desgagnes Transarktic to ship to Rankin Inlet. Even so, the shipping companies could change over the construction, operation and closure phases of the Meliadine Mine. Shipping contractors used by Agnico Eagle will abide by Canadian laws and regulations, applicable MARPOL 73/70 annexes, and international conventions. Inspections carried out by federal inspectors will ensure that all applicable statutes are followed. This could include the review of required plans (SOPEP), an audit of the emergency response equipment carried by the vessel, and the means to prevent the discharge of any oil, oily water or other hazardous waste in Arctic waters. Agnico Eagle will notify Transport Canada if contracted shipping companies change.

All vessels transiting through and operating in Canadian Arctic waters are required to comply with the *Arctic Waters Pollution Prevention Act* (AWPPA), the *Canada Shipping Act* 2001 (CSA 2001), the *Marine Transportation Security Act* (MTSA), the Marine Transportation Security Regulations (MTSR), the *Marine Liability Act* (MLA), and all associated regulations, including requirements for vessel construction and operations (see Table 3-1). While the provisions of the CSA 2001 apply in all Canadian waters, vessels in Arctic waters north of 60°N and out to the 200 nautical mile limit of Canada‘s Exclusive Economic Zone are also subject to the provisions of the AWPPA. The AWPPA prohibits discharges of oil, chemicals, garbage and other wastes generated onboard vessels. It does allow for the discharge of untreated sewage[9]. The *Marine Liability Act* sets out a regime that requires vessels operating in Canadian jurisdiction, including Arctic waters, to carry insurance to pay for damages from oil spills.

Two vessel control systems are established under the *Arctic Shipping Pollution Prevention Regulations* – the Zone/Date System and the Arctic Ice Regime Shipping System, which provide for operational safety by taking into account the vessel‘s capability to operate safely by virtue of ice strengthening, and the ice conditions it will encounter[10].

[9] Ships are to only discharge gray water and treated sewage when the ship is at least 50 km from Rankin Inlet.
[10] Agnico Eagle will only ship dry goods and fuel during the open water season.

Vessels servicing the Mine will be required to comply with the AWPPA and regulations while in a Shipping Safety Control Zone[11].

Shipping companies contracted by Agnico Eagle must have an approved SOPEP, and verify that equipment and operating procedures are consistent with Canadian Marine laws, regulations and guidelines, and with IMO agreements to which Canada is a signatory. It is the responsibility of the Master of the ship to ensure safe passage through Canadian waters and to maintain up-to-date charts and publications[12].

Agnico Eagle will provide the necessary human, material and financial resources to meet or exceed the legal requirements attributable to the company that arise from shipping. The marine equipment used on the Meliadine Mine will meet task specifications for reliability, safety and capability of meeting or exceeding environmental requirements and guidelines. Shipping contractors will be encouraged to do the same.

Table 3-1 Applicable Acts, Regulation and Guidelines

Acts	Regulations	Guidelines
Federal Legislation		
Canada Shipping Act, 2001 (S.C. 2001, c. 26) [An Oil Pollution Emergency Plan is required under the Act (168(1)d)]	*Response Organizations and Oil Handling Facilities Regulations* (SOR/95-405) *Pollutant Discharge Reporting Regulations*, 1995 (SOR/95-351) *Environmental Response Arrangements Regulations* (SOR/2008-275) *Ballast Water Control and Management Regulations* (SOR/2006-129) *Vessel Pollution and Dangerous Chemicals Regulations*	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995 Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	*Transportation Safety Board Regulations* (SOR/92-446)	
Marine Liability Act (S.C. 2001, c. 6)	*Marine Liability Regulations* (SOR/2002-307)	
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	*Arctic Waters Pollution Prevention Regulations* (C.R.C., c. 354) *Arctic Shipping Pollution Prevention Regulations* (C.R.C., c. 353)	

[11] Rankin Inlet is in Zone 16.
[12] Transport Canada is not the source to provide up-to-date information on changing sea levels or on emergence of new reefs or shoals.

Acts	Regulations	Guidelines
Transportation of Dangerous Goods Act (1992, c.34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	
Marine Transportation Security Act (1994, C.40)	*Marine Transportation Security Regulations* (SOR/2004-144)	
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Oceans Act (S.C. 1996, c. 31)		
Navigation Protection Act (R.S. 1985 c. N-22)		
Canada Water Act (1985 c.11)		
Fisheries Act (R.S.C. c. F-14)	*Marine Mammal Regulations* (SOR/93-56) *Marine Mammal Regulations* (SOR/93-56) Prohibition of Depositing Deleterious Substances (Section 36[3])	
Species at Risk Act (2002 c.29)		Species at Risk Policies
Canadian Environmental Protection Act (1999 c.33)	*Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301) *Release and Environmental Emergency Notification Regulations* *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197	

Table 3-2 International Conventions and Protocols Signed by Canada

Conventions	
International Convention for the Prevention of Pollution from Ships MARPOL 73/78 Annexes	
	Objective of Annex is to Prevent Pollution from:
Annex 1	Oil from ships
Annex 2	Noxious liquid substances carried in bulk
Annex 3	Harmful substances carried by ships in packaged form
Annex 4	Sewage treatment and disposal
Annex 5	Garbage handling
Annex 6	Air Pollution from Ships
International Maritime Dangerous Goods Code	
International Convention for the Safety of Life at Sea, 1974, SOLAS 74	

SECTION 4 • MARINE WILDLIFE

> Marine mammals have been the basis of the Inuit economy for over 4,000 years. They provide meat, fat, oil, leather, tools and materials for fabrication of arts and crafts. The top layers of the skin yield "muktuk", which is still highly prized as a food rich in vitamin C and high in energy content. *(Fisheries and Oceans Canada http://www.dfo-mpo.gc.ca/Science/publications/uww-msm/articles/beluga-eng.htm)*

The reaction of marine wildlife to vessel traffic is predicted to not be significant and, providing mitigation measures are employed, should not lead to any residual effects (see Volume 8, Marine Environment and Impact Assessment). The effects of vessel traffic on marine mammals and birds were assessed in the Environmental Impact Assessment (EIA). This included a Traditional Knowledge (TK) study of the marine environment between Chesterfield Inlet and Whale Cove. Together, scientific and traditional knowledge were used to develop mitigation measures to eliminate potential residual effects. Of greatest interest in the TK study was the distance vessels remained from Marble Island, this being an important area for whales, seals, marine birds, and, on occasion, walruses.

Agnico Eagle includes in its contracts that ships must remain mindful of marine areas having a high density of marine mammals and birds and stay within the recommended shipping route, wherever possible[13]. Agnico Eagle requests that ships provide their ship track data for inclusion in annual reporting.

4.1 Interactions and Potential Effects

Vessel discharges (sewage, solid wastes, ballast water), the sight of the vessels and their movement, vessel noise, as well as accidental spills and releases have the potential to interact with and disturb marine wildlife and affect life cycle activities. Possible interactions between shipping and marine wildlife can have the following potential effects:

- Marine mammals may retreat to the water should a vessel pass too close to an island or reef where they have pulled themselves out of the water;
- The foraging of marine birds and mammals may be interrupted when vessels approach and pass them in the shipping route;
- The improper treatment and release of ballast water, grey water and bilge water could alter the water quality and contaminate the food supply;
- Marine mammal mortalities or injuries may result from collisions with the ship;

[13] Frobisher Bay and Button Islands key marine habitat sites overlap with the proposed shipping route at their southern and northern boundaries, respectively. This overlap is unavoidable as these two sites almost completely cover the entrance to Hudson Strait from the Atlantic Ocean (see Volume 8 for more details).

- Marine bird mortalities or injuries may result from collisions with the ship; and
- Fuel and/or oil spills could result in mortalities and, for marine birds, could lead to the loss of foraging and brood rearing habitat. A Spill Risk Assessment is provided in Appendix E.

4.2 Mitigation Measures

As part of shipping companies' standard operating procedures, ship crews monitor the shipping route for marine mammals from Hudson Strait to Rankin Inlet. In addition, a vessel-based Marine Mammal and Seabird Observer (MMSO) program has been implemented during all routine shipping activities in the Regional Study Area (RSA). Protocol for the MMSO program is provided in the Marine Environmental Management Plan (MEMP) in Appendix D. The MEMP is based upon the most current marine mammal and seabird baseline information available for the area impacted by shipping for the Meliadine Mine, as documented in the revised marine baseline report (Appendix B). The ship's Master will be notified if there is a concern of the ship striking a marine mammal. Ship personnel will make a decision if actions are required to avoid a possible collision. This may include, if safe to do so, slowing the ship until the animal has travelled clear of the ship's course. Subject to safe navigation and emergency response, ship personnel shall take every precaution to avoid disturbance, harassment, injury or mortality of marine wildlife by implementation of the following mitigation measures:

- Adherence to monitoring requirements as outlined in the vessel-based MMSO program (Appendix D);
- Ships will, when possible, maintain a straight course and constant speed, and avoid erratic behaviour;
- Marine mammals will be given right of away as safe navigation allows. Under no circumstances, other than in the case of an emergency, will ships approach within 300 m of a walrus or polar bear observed on sea ice[14];
- Ships will remain at least 2 km from Marble Island to avoid disturbing seals, walrus and marine birds that might be in the vicinity. This would significantly reduce interactions between marine wildlife and vessels, and also reduce the noise in near-shore areas;
- Ships will look out for marine mammals and avoid them as possible. If marine mammals are encountered, and remain in the area, effort will be made to avoid them by maintaining a 500 m buffer zone;
- Ships will maintain a minimum distance of 500 m from marine mammals engaged in feeding activities;
- Ships will avoid accelerating within 500 m of a marine mammals;
- If it is not possible for the ship to move away from or detour around a stationary marine mammal or group of marine mammals, the ship will reduce its speed and wait until the animal(s) move to the side and remain at least 500 m from the ship prior to resuming speed;

[14] As all shipping will occur during the open water season, collision with young seals in liars will not happen.

- When marine mammals appear to be trapped or disturbed by ship movements, the ship will implement appropriate measures to mitigate disturbance, including stoppage of movement until the marine mammal has moved away from the immediate area;
- The ship will not be operated in such a way as to separate an individual member(s) of a group of marine mammals from other members of the group. When weather conditions require, such as when visibility decreases, the ship will adjust its speed accordingly to avoid the likelihood of the ship striking an animal;
- Subject to ship and human safety considerations, the following mitigation techniques will be implemented to avoid impacts to migratory birds nests in low lying shoreline habitats:
    - Barge-tug or shipping vessels will travel at a slow speed (2 knots or less) when transiting through the near shore islands and reefs to reduce wake[15];
    - Barge-tug or shipping vessels would only travel through the near shore islands and reefs when there is good visibility or adjust their speed according to the conditions;
- Implementation of monitoring and reporting procedures for ship-bird collisions. Any incidents of bird mortalities associated with near-shore lighting and infrastructure, intertidal construction activities, and ship operations are to be recorded and reported to Environment Canada (Canadian Wildlife Services) as outlined in Appendix D;
- Ballast water will only be released in designated areas and if there is no marine wildlife in the area; and
- Bilge water, grey water and sewage will be properly treated and only released in areas where no marine wildlife is present and at least 50 km from Itivia.

Spills from ships in transit could affect marine wildlife coming in contact with any petroleum product spilled. In the event of a spill, the ship personnel will discourage marine wildlife from coming in contact with the spilled material. The product most likely to be spilled would be diesel fuel, which floats on the water surface and has a high rate of evaporation. However, these occurrences are expected to be rare and the activation of the SOPEP would significantly reduce their impact. Preventive and contingency measures already in place substantially reduce the risk to marine wildlife from spills.

Adaptive management will allow mitigation measures to be modified in response to new information arising from monitoring carried out by the vessel crews and from traditional knowledge. Appendix D summarizes how and when adaptive management will be implemented during shipping activities for the Meliadine Mine.

[15] Vessel wakes from nearshore Mine vessels engaged in transportation activities were assessed as a minor linkage in the FEIS. Potential effects assessed included shoreline erosion. The conclusion of the FEIS was that any wake effects from Mine related barges are expected to be within the normal variation experienced during tidal cycles and storms within Melvin Bay (see Section 8.3.4.3 of the FEIS for additional details).

4.3 Monitoring and Reporting

Agnico Eagle will discuss with contracted vessel operators the monitoring of marine wildlife. Contracted vessels by Agnico Eagle will be requested to collect incidental monitoring data during their voyage and to report it to Agnico Eagle. In addition, a vessel-based MMSO program will be implemented during routine shipping activities in the RSA. This program will be executed by trained observers stationed on-board vessel(s). A proposed protocol for this program is provided in the MEMP in Appendix D.

The MMSO program includes protocols on data collection and reporting requirements. Agnico Eagle will share the data with Inuit organizations and/or government agencies for their information. If effects monitoring identifies potential for effects on marine mammal populations along the shipping route, Agnico Eagle will provide updates and identify adaptive management measures in consultation with the Kivalliq Inuit Association and the Hunters and Trappers Organizations of the Kivalliq communities.

SECTION 5 • SAFETY OF PERSONS USING SMALL BOATS IN THE SHIPPING ROUTE

The most likely areas where interactions may occur between small boats and barges-tugs and/or ships or vessels are:

1. Melvin Bay, particularly in the access passage;
2. Where the ship is transiting through the near shore islands and reefs; and
3. The area between Marble Island and the near shore islands.

Subject to ship and human safety considerations, mitigation measures to safeguard the safety of those in small boats will include the following:

- Agnico Eagle will consult with the community members mooring or beaching their boats in Melvin Bay on the shipping activities that can be expected over the ice free shipping season. Protocols will be developed to minimize the interaction between barge-tug or ship and small boats;
- Barge-tug or ship will travel at a slow speed (2 knots or less) when transiting through the near shore islands and reefs to reduce the wake and not compromise the safety of people travelling in small boats along the shipping route. The slower speed will reduce the wake of the ship;
- Barge-tugs or ships would only travel through the near shore islands and reefs when there is good visibility or adjust their speed according to the conditions. This would allow the ship and the small boats to be in visual contact;
- Barge-tugs or ships will restrict themselves to the recommended shipping route thereby not surprising any small boat travelling outside the shipping route;
- The ship will sound its horn if a small boat seems unaware of its presence; and
- Agnico Eagle, through the Community Liaison Committee, will recommend that all those in small boats wear personal floatation devices.

SECTION 6 • SMUGGLING PREVENTION AND POLICE SERVICES

Smuggling, particularly alcohol and prohibited substances, could have negative socio-economic effects on the community. It is Agnico Eagle's intent to avoid or minimize all negative socio-economic effects.

Measures to prevent smuggling will include:

- The crew of the ship will not be allowed to take any alcohol ashore;
- Any crew member under the influence of alcohol, or attempting to take alcohol ashore will be disciplined by the ship's Master; and
- Agnico Eagle security will send any crew member having alcohol back to the ship for disciplinary action, or refer the matter to the Royal Canadian Mounted Police (RCMP) if prohibited substances are involved.

While it is anticipated that the RCMP will not be involved in security matters, all criminal activities or matters of a grave nature will be referred to the RCMP in Rankin Inlet.

SECTION 7 • IDENTIFIABLE THIRD PARTY LIABILITIES

Agnico Eagle and its shipping contractors will carry third party liability insurance. Identifiable third party liabilities related to shipping include but are not limited to:

- Hamlet of Rankin Inlet, in the event of spill in Melvin Bay that adversely impacts the marine environment;
- Hunters and trappers, should a ship or tanker run aground and adversely impact the marine environment by spilling fuel or other chemicals into the marine environment;
- Small boat owners, should a ship or tanker collide with a small boat in the shipping route; and
- Hunters and trappers, should a vessel collide with a large marine mammal such as a whale along a shipping route.

Mitigations for possible third party liabilities are identified in Section 11 of this Plan (Hazard Identification Analysis of Marine Routes).

SECTION 8 • ON BOARD WASTE MANAGEMENT

The six (6) annexes of MARPOL promote the elimination of deliberate, negligent or accidental discharge of ship-source pollutants into the marine environment (see also Transport Canada 2009). The list of harmful ship-source discharges includes: oil, noxious liquid substances and dangerous chemicals, sewage, garbage and air pollution. Canadian laws and regulations mirror the MARPOL annexes and conventions.

Agnico Eagle will contract vessels that meet applicable environmental requirements in addition to being reliable and having a superior safety record.

8.1 Sewage

Vessels are to have an approved sewage treatment plant meeting Canadian standards[16]. Holding tanks with the capacity for all grey and treated sewage while in port are expected to be part of the ship's infrastructure. Agnico Eagle will advise ships that disposal of waste water into the environment is to be avoided within 50 km of Rankin Inlet.

Sewage sludge from the sewage treatment plant can be incinerated in the on-board incinerator.

8.2 Solid Waste

Solid waste materials are to be incinerated on board, not disposed of in the marine environment. Modern incinerators operating at very high combustion temperatures are expected on all vessels. These will be capable of incinerating food and other domestic waste, residual oil separated from bilge water, waste oil and sludge. Ash from incineration will remain on board and be taken south for treatment, recycling and/or disposal in a certified waste management facility. By incinerating waste on board, the risk of introducing invasive non-aquatic species to the Rankin Inlet area is reduced. This would not be the case if the waste was transferred onshore for incineration/disposal.

The design and operation of shipboard incinerators in Canada are specified under the International Marine Organization, Marine Environmental Pollution Committee 76 (40), Annex V. Standard specifications for shipboard incinerators allow for the incineration of solid wastes approximating in composition to household waste and liquid wastes arising from the operation of the ship, e.g., domestic waste, cargo-associated waste, maintenance waste, operational waste, cargo residues, and fishing gear. Operating temperatures are similar to those for the incinerator at the Meliadine site, and flue gases are cooled rapidly to limit the *in vivo* formation of dioxins.

[16] If all sewage is to be incinerated, there will not be any need for sewage treatment.

Tugs will remain on site for the duration of the shipping season. Their waste will be incinerated with the ash stored in containers, which will be shipped south at the end of the shipping season for treatment, recycling and/or disposal in a certified waste management facility.

Hazardous waste will not be incinerated but returned south for treatment, recycling and/or disposal in a certified waste management facility.

SECTION 9 • BALLAST WATER MANAGEMENT

Ballast water is essential to control trim, list, draught, stability, and/or stresses on a vessel. Ballast water control and management regulations protect waters under Canadian jurisdiction from non-indigenous aquatic organisms and pathogens that can be harmful to ecosystems. Agnico Eagle recognises that when a new organism is introduced to an ecosystem, negative and irreversible changes may result, including a change in biodiversity. The *Ballast Management Control and Management Regulations* are intended to minimize the probability of introduction of harmful aquatic organisms and pathogens from vessels' ballast water while also protecting the safety of vessels (Transport Canada 2007).

While an exemption exists in the regulations for vessels operating exclusively in waters under Canadian jurisdiction or certain adjacent waters, any Canadian vessel that has operated outside these waters may carry harmful aquatic organisms or pathogens in their residual ballast and, as such, is not eligible to exemption.

Agnico Eagle expects to use vessels largely active in the coasting trade that operate almost exclusively in waters under Canadian jurisdiction. However, these vessels do on occasion venture into waters outside Canadian jurisdiction and, as such, will require a Ballast Water Management Plan (BWMP). The regulations require the preparation and carriage of a BWMP for each vessel, and for copies to be submitted to Transport Canada. The BWMP will be specific to the vessel.

If Agnico Eagle were to contract vessels originating from waters outside the jurisdiction of Canada, a BWMP would be required. All BWMP (reviewed by the National Administration) carried on ships of foreign origin would be based on the following international guidelines and guiding principles:

- IMO Resolution A.868(20): *Guidelines for the Control and Management of Ships Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens*, in particular Section 7.1;
- The *Model Ballast Water Management Plan* developed by the International Chamber of Shipping and the International Association of Independent Tanker Owners;
- Regulation B-1 of the IMO's *Regulations for the Control and Management of Ships' Ballast Water and Sediments*; and
- Part B of the Annex to Resolution MEPC.127 (53): *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans*.

Agnico Eagle will require contracted vessels not eligible for exemption to have a BWMP and provide Agnico Eagle with a copy.

9.1 Ballast Water Exchange

It is recognised by the IMO that the exchange of ballast water in deep ocean areas or open seas offers a means of limiting the probability that harmful aquatic organisms and pathogens be transferred from/in vessels ballast water. If it is necessary to take on and discharge ballast water in the same port to facilitate safe cargo operations, care should be taken to avoid unnecessary discharge of ballast water that has been taken up in another port as this could introduce harmful aquatic organisms. In particular, sediment found in the vessel's ballast tanks should be disposed of at sea in areas outside 200 nautical miles (370 km) from land and in water depths exceeding 2,000 m.

Vessels take on ballast water in segregated chambers for the main purpose of stabilizing the vessels by adding the weight of the water and maintaining a specified draught. Vessels laden with dry cargo or fuel will take on less ballast water than empty vessels. As all ships on the inward voyage to Rankin Inlet will be laden, they will have a minimum of ballast water. However, on the outward journey, these vessels will take on ballast water.

In the event that a ship is contracted from waters outside jurisdiction of Canada, ballast exchange is to occur before entering Canadian waters. The ballast exchange and documentations needs to be made according to the *Ballast Management Control and Management Regulations* (Transport Canada 2007).

In the case of non-transoceanic navigation, and where ballast water is taken on-board outside waters of Canadian jurisdiction, the water is to be exchanged before entering Canadian waters at a location at least 50 nautical miles offshore, in water at least 500 m deep. If this is not possible due to safety or other reasons, the ballast water exchange can occur in the alternate designated area in Hudson Strait, east of 70°west longitude, where the water is over 300 m deep.

All coastal trade vessels will in all likelihood not venture more than 200 nautical miles from shore and will not exchange ballast water outside waters of Canadian jurisdiction. All the same, ballast water exchanges for all vessels operating in waters under Canadian jurisdiction are expected to meet the provisions of the Regulations, and to follow Part A of the IMO *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans*, and the IMO *Guidelines for Ballast Water Exchange*.

SECTION 10 • SAFETY

Safety is a top priority for Agnico Eagle. It begins with all personnel (Agnico Eagle, contracted employees and contractors) wearing the appropriate personal protection equipment suitable for the task at hand and for the weather conditions at the time. Secondly, personnel must understand the hazards associated with the task, the safe procedures in carrying it out, and how not to place oneself in harm's way. Accident prevention will be supported by a proactive program to identify and correct potential hazards before an accident occurs.

Agnico Eagle or contracted supervisors will ensure that the interactions between ship and shore are carried out with the safety and the health of the employees first in mind.

SECTION 11 • HAZARD IDENTIFICATION ANALYSIS OF MARINE ROUTES

Hazard: Anything that has the potential to cause harm.

Likelihood: The probability/chance of harm occurring as a result of exposure to a hazard.

Severity: The level of harm that may occur as a result of exposure to or contact with a hazard.

Risk: The likelihood of harm occurring combined with the potential severity to produce a level of risk or risk rating.

Navigation through the Labrador Sea, Hudson Strait and Hudson Bay is not challenging during the open water season[17]. No major hazards were identified along the shipping and tug-barge routes under normal conditions. Electronic charts combined with electronic navigation aids for the shipping routes ensure the vessel remains on course where bathymetry and physical hazards are known.

Subject to ship and human safety considerations, the average speed of the vessels in open waters is expected to be less than 14 knots (26 km/h). Once ships approach the offshore islands and reefs off Rankin Inlet, and subject to ship and human safety considerations, the ship's speed will be slowed to 2 knots or less (3.7 km/h) to navigate the shipping route through the islands to their anchor point outside Melvin Bay. Shipping can be carried out without pilotage as the shipping routes entail minor hazards that do not significantly reduce ship safety. Any actions required by the crews of the ships and tugs are expected to be well within their capabilities.

At the anchor point, cargo will be lightered from the ships onto barges which will travel to the lightering location via the access passage. The tugs-barges will be highly manoeuvrable and capable of transiting the access passage with its changing currents and will not require pilotage. The tidal current in the access passage can be half a knot (0.93 km/h). Navigation will proceed at a slow speed in periods of low visibility. Traffic through the access passage will be coordinated to avoid shipping conflicts and to ensure safety.

However, out of the ordinary events have been identified that could increase the level of hazard and necessitate associated mitigation measures:

- Mechanical failure occurring on the ship or tug thereby placing it in jeopardy in the shipping route;
- Tug-barge or ship running aground due to a navigational error or mechanical failure;

[17] Agnico Eagle's shipping routes within Nunavut are non-compulsory pilotage areas during the ice free shipping season

- Loss or damage to sea cans in heavy seas;
- Barge tow line breaking in heavy seas;
- Collision of tug-barge or ship carrying dry cargo and fuel to Itivia through the access passage;
- Tug-barge or ship sinking upon hitting ice; and
- Tug-barge or ship colliding with a small boat.

The access passage deserves special attention as:

- Dry cargo for Agnico Eagle and the hamlet and fuel for Agnico Eagle could all be unloaded at the same time; and
- The access passage is 150 m wide at its narrowest point and, although two-way traffic is theoretically possible, it raises the risk of collisions and groundings. To reduce the risk, it is best that a single tug-barge or ship be in the access passage at any one time.

SECTION 12 • RISK ANALYSIS OF MARINE ROUTES

All ships, tugs and tankers use electronic charts and other electronic navigational aids to provide safety in transit, reduce the risk of accidents, and remain within the recommended shipping route presently in use for the annual sea lift to Rankin Inlet and other Kivalliq communities. For an extra measure of safety, weather warnings are updated regularly. Also, shipping companies likely to be employed by Agnico Eagle commonly sail in Hudson Bay and to Rankin Inlet and are aware of its marine hazards.

The potential severity of shipping hazards[18] cannot be changed in most circumstances, what can be reduced is their likelihood. This is possible through the application of mitigation measures. And the level of risk can be defined as the likelihood of harm posed by a hazard combined with its potential severity. The objective is, through the use of mitigation measures, to reduce the risk as low as practically possible. Residual risk is what remains after mitigation measures have been applied. And those having the highest potential residual risk would be aggressively managed.

Mitigation reduces the probability of occurrence and increases safety. The following mitigation/safety measures will be implemented subject to ship and human safety considerations:

- Where available, electronic navigation aids be used in all instances;
- Ship speeds in open water remain less than 14 knots in the absence of marine mammals, and once within the barrier islands and reefs near Rankin Inlet, 2 knots or less;
- Shipping is only carried out during the ice free season. Should ice be encountered, the vessel will either sail around it at a reduced speed or proceed slowly through the ice;
- Tug-barge or ship will remain within recommended shipping routes ;
- Fuel tankers and the fuel tanker barges will be double hulled;
- Tug-barge operations will proceed when there is good visibility from the anchor point of the ships to the barge at Itivia and/or adjust their speed according to the conditions;
- Traffic through the access passage will be coordinated to avoid conflicts and ensure safety. Communication between tugs will coordinate movement through the access passage;
- Agnico Eagle will provide emergency response equipment and materials as outlined in the OPEP if necessary. Tug or ship will also provide their own emergency response equipment.
- Crews will follow standard operating procedures and adherence to these will be monitored; and
- Tug-barge or ship crews are to be trained for responses to hazards that can normally be expected in northern waters.

[18] One hazard that can be reduced is shipping when ice is present. Agnico Eagle has opted to only ship during the ice-free season thereby greatly reducing this hazard.

Appendix C outlines the methodology used in the risk analysis of the transportation routes and how various mitigation measures reduced the risk level.

SECTION 13 • SOCIO-ECONOMIC IMPACT OF SHIPPING

Agnico Eagle does not believe that shipping activities related to the Meliadine Mine will result in an increased demand on local public service providers (i.e., fire, police, ambulance, medical, and maintenance) in Rankin Inlet. In most circumstances, any emergency response will be undertaken by Agnico Eagle personnel and/or the ship's crew. Agnico Eagle personnel and the Master of the ship will be responsible for security matters related to the shipping-related activities.

Shipping may impact socio-economic activities in Rankin Inlet. Itivia will be jointly used by the hamlet and Agnico Eagle during the ice free shipping season, which will require coordination. Mitigation measures will be employed to minimize negative socio-economic effects:

- Communication between tugs will coordinate movement through the access passage and use of the Designated Hamlet Landing Beach during lightering operations to avoid conflicts and ensure safety;
- Agnico Eagle has a separate storage area from the community.

The mitigation of negative socio-economic effects in smuggling alcohol and prohibitive substances into the community were described earlier.

Positive socio-economic effects will arise from the increased number of dry cargo and fuel tankers coming to the community. The crews of these ships will in all likelihood come ashore when the boat is anchored and contribute to the local economy through the:

- Use of restaurants, hotels and stores in the community;
- Purchase of local Inuit art; and
- Guided tours to the barrens for fishing and wildlife experiences.

SECTION 14 • PUBLIC AND MEDIA COMMUNICATIONS

When an environmental emergency occurs, the public will be provided with timely and accurate information as to the nature of the incident, the steps being taken to correct the problem, and, if necessary, what citizens should do to protect themselves. This information is intended to protect the overall community well being, including human health, to provide timely information amongst the public, to ensure cooperation from all interested parties, and to reduce the spread of concern or alarm through the dissemination of inaccurate information.

Each agency involved in a major spill event may provide its own media communications, and may designate spokespersons for such; however, from the Arctic REET's (Regional Environmental Emergencies Team) perspective, a coordinated response is preferable. To that end, the government lead Agency is expected to act as the official spokesperson for the response, with support provided by personnel within the Arctic REET, as required.

Transport Canada guidelines will be followed to ensure proper authorities are informed without delay so that appropriate action may be taken when:

- Any incident occurs involving the loss, or likely loss, of dangerous goods into the marine environment; or
- Any incident occurs giving rise to pollution or threat of pollution to the marine environment; or
- Any oil pollution incident occurs involving the loading or unloading of oil to or from tanker-to-tanker and from tanker to the OHF.

REFERENCES

Agnico Eagle Limited. 2015. Risk Management and Emergency Response Plan. Submitted in support of the Type A Water Licence Application to the Nunavut Water Board, May 2015.

Transport Canada. 2007. A Guide to Canada's Ballast Water Control and Management Regulations. Guideline TP 13617E

Transport Canada. 2009. Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants. Guideline TP 9834E.

APPENDIX A • MARINE HYDROGRAPHIC CHARTS

Chart 5002 Hudson Bay and Hudson Strait

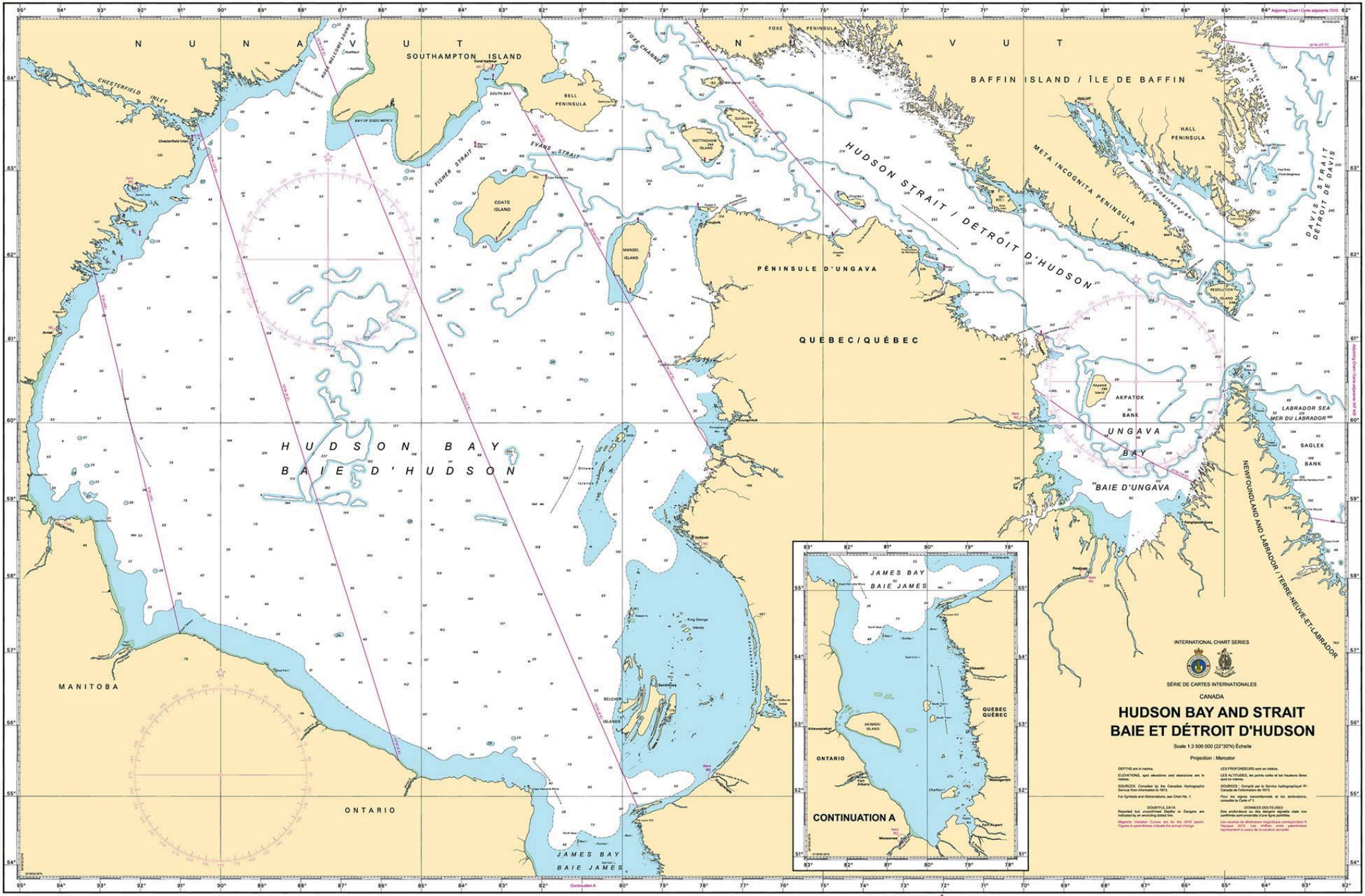
Chart 5629 Marble Island to Rankin Inlet

Chart 5628 Rankin Inlet including Melvin Bay and Prairie Bay

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

5002
INT 406



INTERNATIONAL CHART SERIES

SÉRIE DE CARTES INTERNATIONALES

CANADA

HUDSON BAY AND STRAIT
BAIE ET DÉTROIT D'HUDSON

Scale 1:3 500 000 (22°30'N) Échelle

Projection : Mercator

DEPTHS are in metres.

ELEVATIONS, spot elevations and clearances are in metres.

SOURCES. Compiled by the Canadian Hydrographic Service from information to 1973.

For Symbols and Abbreviations, see Chart No. 1.

DOUBTFUL DATA

Reported but unconfirmed Depths or Dangers are indicated by an encircling dotted line.

Magnetic Variation Curves are for the 2015 epoch. Figures in parentheses indicate the annual change.

LES PROFONDEURS sont en mètres.

LES ALTITUDES, les points cotés et les hauteurs libres sont en mètres.

SOURCES : Compilé par le Service hydrographique du Canada de l'information de 1973.

Pour les signes conventionnels et les abréviations, consulter la Carte n° 1.

DONNÉES DOUTEUSES

Des profondeurs ou des dangers signalés mais non confirmés sont encerclés d'une ligne pointillée.

Les courbes de déclinaison magnétique correspondent à l'époque 2015. Les chiffres entre parenthèses représentent la valeur de la variation annuelle.

Adjoining Chart / Carte adjacente 7016

PREVIOUS EDITIONS / ÉDITIONS ANTÉRIEURES: 1970
NEW EDITION / NOUVELLE ÉDITION: MAY/MAI 20 2015
Corrected to NOTICES TO MARINERS / Corrigée jusqu'à l'AVIS AUX NAVIGATEURS :
See Notices to Mariners for subsequent corrections on this chart and Notices to Shipping in force for hazards or changes essential for the safety of navigation. / Voir les Avis aux navigateurs pour les corrections subséquentes sur cette carte et les Avis à la navigation en vigueur pour les dangers ou les changements essentiels pour la sécurité de la navigation.

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Les cartes marines protègent la vie, la propriété et l'environnement marin

METRIC/MÉTRIQUE

Charts may vary / Variations des cartes
WWW.CHARTS.GC.CA

Fisheries and Oceans Canada / Pêches et Océans Canada

Canada

5629

CANADA

NUNAVUT

HUDSON BAY/BAIE D'HUDSON

MARBLE ISLAND TO/À RANKIN INLET

Scale 1:60 000 (62°48'N) Echelle

Projection : Mercator

DEPTHS are in metres and are reduced to Chart Datum (Lowest Normal Tide), which at Marble Island is 13 metres below Mean Water Level (MWL).

ELEVATIONS and spot elevations are in metres above Mean Water Level (MWL). Elevations of conspicuous objects are shown in bold type; spot elevations are in italics. Natural drying areas are in metres above Chart Datum. Topographic contours are in metres above Mean Sea Level. The contour interval is 75 metres.

HORIZONTAL DATUM North American Datum 1983 (NAD 83), which is equivalent to WGS 84.

SOURCES The hydrographic data are shown in the SOURCE CLASSIFICATION DIAGRAM. Topography is from National Topographic System maps.

For Symbols and Abbreviations, see Chart No. 1.

LES PROFONDEURS sont en mètres et sont réduites au zéro des cartes (le niveau normal de la pleine basse), lequel à Marble Island est de 13 mètres au dessous du niveau moyen de l'eau (NME).

LES ALTITUDES et les points cotés sont en mètres au-dessus du niveau moyen de l'eau (NME). Les altitudes remarquables sur les zones asséchables ou entre parenthèses cotes des entités découvrantes sont en caractères gras; les points cotés sont en italiques. Les courbes topographiques sont en mètres au-dessus du niveau moyen de la mer. L'équidistance des courbes est de 75 mètres.

SYSTÈME GÉODÉSIQUE Système de référence nord-américain de 1983 (SCRS), qui équivaut au WGS 84.

SOURCES Les données hydrographiques sont présentées dans le DIAGRAMME DE CLASSIFICATION DES SOURCES. La topographie provient des cartes du Système national de référence cartographique.

Pour les signes conventionnels et les abréviations, consulter la carte n° 1.

SOURCE CLASSIFICATION DIAGRAM/DIAGRAMME DE CLASSIFICATION DES SOURCES

Area/Zone	Origin/Origine	Date	Line Spacing/Espacement des lignes
a	CHS/SHC	1954	914m
b	CHS/SHC	1995-96	100m
c	CHS/SHC	1958	460m
d	CHS/SHC	1957-58	300m

Larger-scale chart/Carte à plus grande échelle

TIDAL INFORMATION / RENSEIGNEMENTS SUR LES MARÉES

LOCATION / LOCALITÉ	Elevation above Chart Datum / Altitude au-dessus du zéro des cartes				
	Large Tide/Grande marée		Mean Tide/Marée moyenne		Mean Water Level / Niveau moyen de l'eau
	HIGH/PLEIN	LOW/BAS	HIGH/PLEIN	LOW/BAS	
	metres/mètres	metres/mètres	metres/mètres	metres/mètres	metres/mètres
Marble Island Panorama Island	3.7 4.6	0.0 0.0	3.1 3.9	0.6 0.7	1.9 2.4

CHART/CARTE 5629

Adjoining Chart/Carte adjacente 5630

MAGNETIC COMPASS ROSES / COMPAS MAGNÉTIQUE INSTRÉS

MARBLE ISLAND

MIRAGE ISLANDS

PANGERTOT PENINSULA

Rankin Inlet

Corbett Inlet

Thomsen Island

Horseshoe Deep

Prairie Bay

Hudson Bay

Marble Island

Quartzite Island

Knight Harbour

Rescue Cove

Crane Island

Tern Shoals

Joy Cove

Tapik Point

Outer Shoals

South Shoals

Fairway Shoals

Middle Shoals

Caldwell Bank

Tyrrell Channel

Thomsen Passage

Rankin Passage

Chesterfield Passage

Prairie Bay

Sanderling Island

Jackson Island

Tern Islands

Scarab Pt

Gull Rock

Little Gull Rk

Red Rk

Big Gull Rk

Nelson Rock

Ptarmigan Rock

Caribou Rock

Seal Rk

Ringed Seal Rk

Arctic Char Rk

Walrus Rk

Beluga Rk

Narwhal Rk

Polar Bear Rk

Musk Ox Rk

Caribou Rk

Arctic Fox Rk

Lynx Rk

Wolf Rk

Wolverine Rk

Ptarmigan Rk

Grizzly Rk

Lemming Rk

Ermine Rk

Hare Rk

Fox Rk

Seal Rk

Ringed Seal Rk

Arctic Char Rk

Walrus Rk

Beluga Rk

Narwhal Rk

Polar Bear Rk

Musk Ox Rk

Caribou Rk

Arctic Fox Rk

Lynx Rk

Wolf Rk

Wolverine Rk

Ptarmigan Rk

Grizzly Rk

Lemming Rk

Ermine Rk

Hare Rk

Fox Rk

NEW CHART / CARTE NOUVELLE OCT 01 2006

NOTICES TO MARINERS / AVIS AUX NAVIGATEURS 2006-09 NP

See Notices to Mariners for subsequent corrections on this chart and Notices to Shipping in force for hazards or changes essential for the safety of navigation. / Voir les Avis aux navigateurs pour les corrections subséquentes sur cette carte et les Avis à la navigation en vigueur pour les dangers ou les changements essentiels pour la sécurité de la navigation.

METRES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	METRES
FEET	4	6	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	FEET
FATHOMS	2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	FATHOMS

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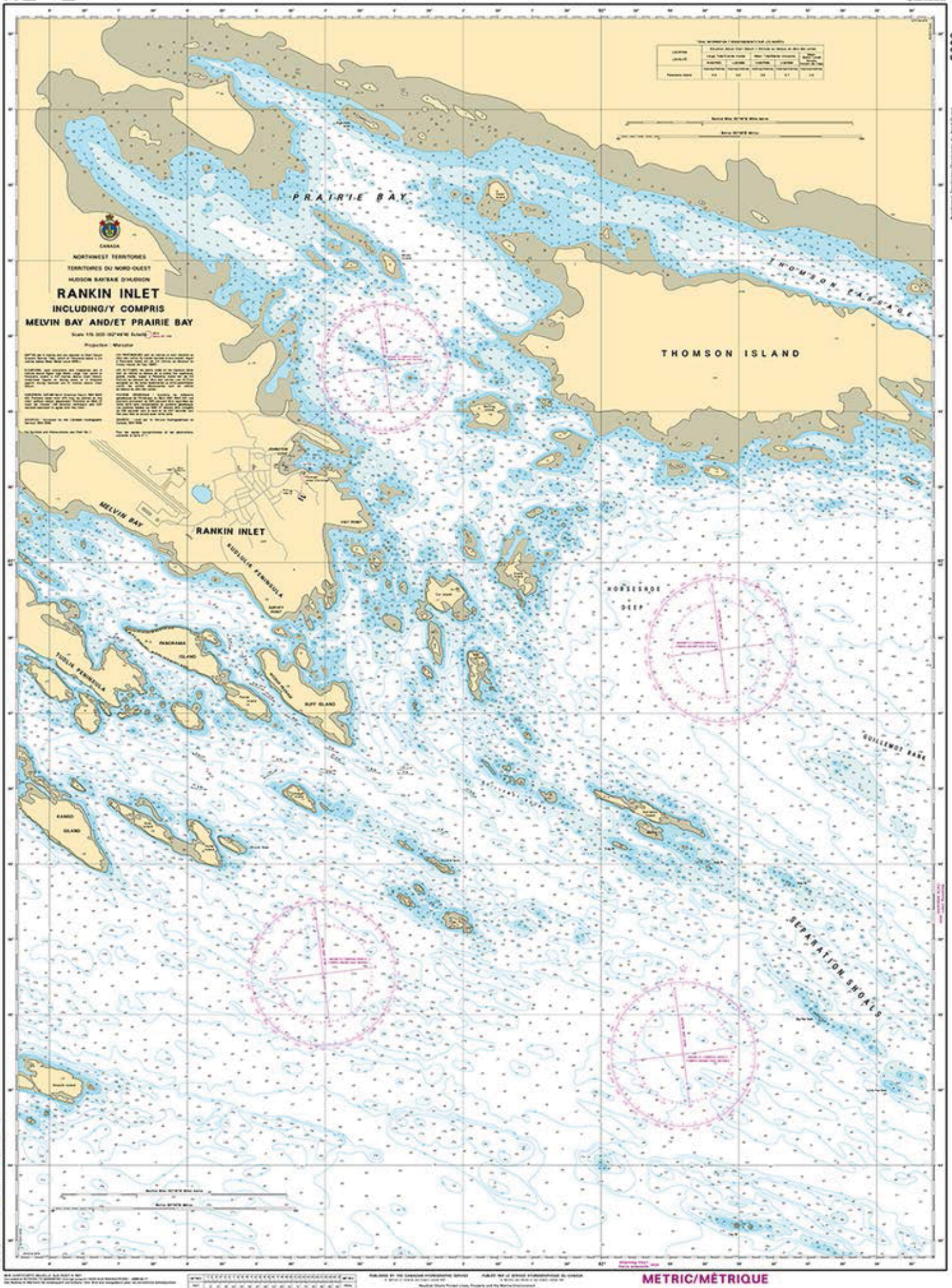
METRIC/MÉTRIQUE

Nunavut
Hudson Bay/Baie d'Hudson
MARBLE ISLAND TO/À RANKIN INLET

5629

Ocean data / Données océaniques
www.chs-shc.dfo-mpo.gc.ca


5628
CANADA
NORTHWEST TERRITORIES
TERRITOIRES DU NORD-OUEST
HUDSON BAY/BAIE D'HUDSON
RANKIN INLET
INCLUDING/Y COMPRIS
MELVIN BAY AND/ET PRAIRIE BAY
PRAIRIE BAY
THOMSON PASSAGE
THOMSON ISLAND
MELVIN BAY
RANKIN INLET
EGGLULIK PENINSULA
HORSESHOE DEEP
PANORAMA ISLAND
TIGLIK PENINSULA
RUFF ISLAND
GUILLEMOT BANK
KANGO ISLAND
SEPARATION SHOALS
METRIC/MÉTRIQUE

APPENDIX B • REVISED MARINE ENVIRONMENTAL BASELINE

August 10, 2016

REVISED MARINE ENVIRONMENTAL BASELINE REPORT

Appendix B

Submitted to:
Agnico Ealge Mines Limited
10200, Route de Preissac
Rouyn-Noranda QC
Stephane Robert, Manager Regulatory Affairs

REPORT

Report Number:

Distribution:

1 copy - Agnico Ealge Mines Limited
2 copies - Golder Associates Ltd.

Golder Associates

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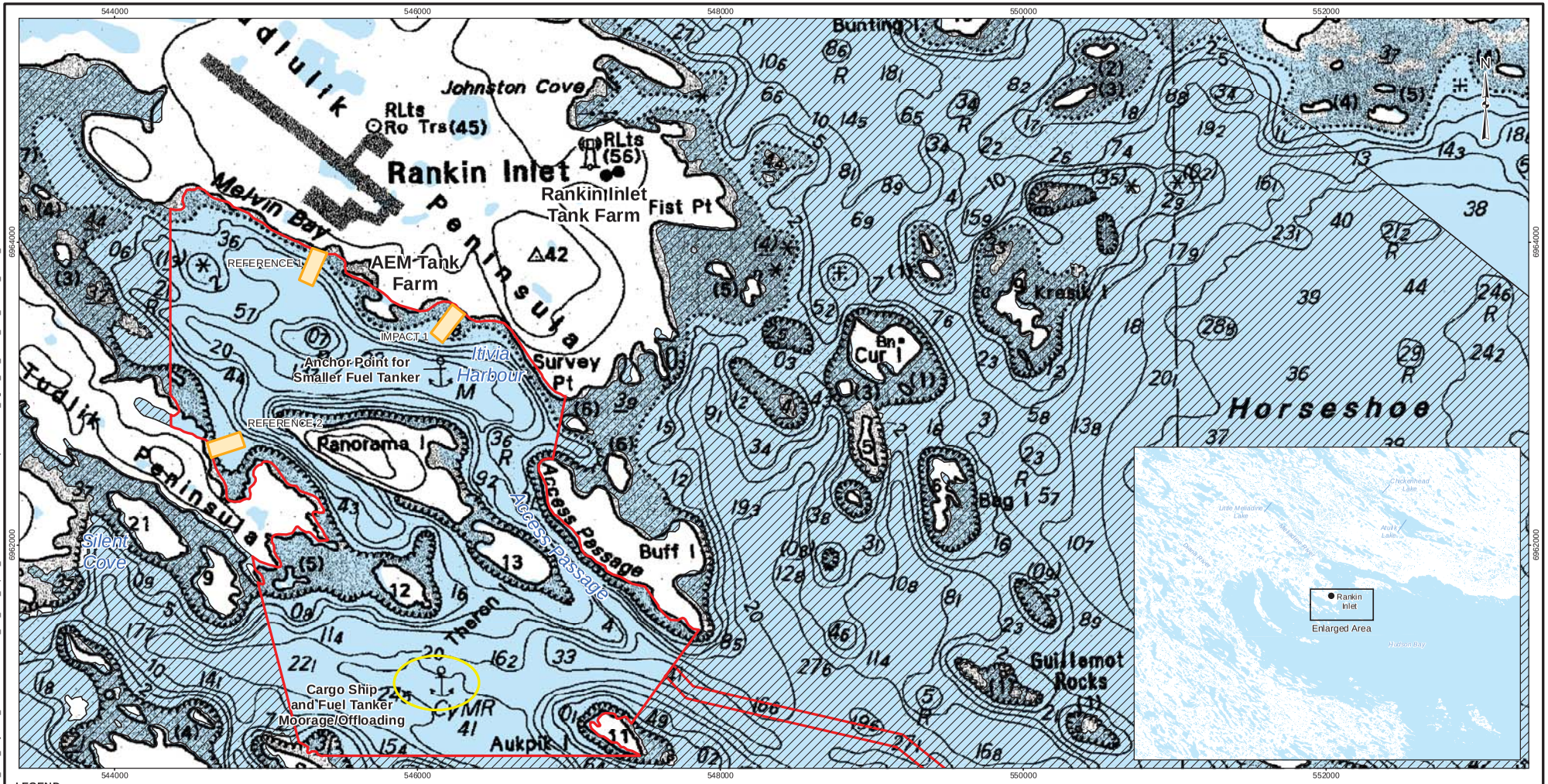
1.0 MARINE ENVIRONMENT REVISED BASELINE

1.1 Purpose and Scope

This report represents an update to the marine baseline information originally presented in Agnico Eagle's Final Environmental Impact Statement (FEIS). These revisions have been undertaken in accordance with Meliadine Gold Project (Project) Certificate Condition 79, which states the following:

"Prior to any Project-related shipping, the Proponent will update its marine baseline information to ensure that it includes the most recent information on marine wildlife abundance and distribution, carefully considers seasonal distribution patterns of marine wildlife, and incorporates western scientific and Inuit Qaujimajatuqangit knowledge sources. The updated marine baseline should be made available to appropriate authorities for feedback, then incorporated into the Proponent's Shipping Management Plan (SMP), with continued updates on a regular basis as new information becomes available."

This report was updated with new environmental information now available in the public domain (as of January 2016), as well as information provided through consultation with regulators and as a result of technical responses prepared by the proponent in response to information requirements (IRs) submitted as part of the FEIS review process. The majority of the new information provided relates specifically to the abundance and distribution of marine wildlife species in the Local Study Area (LSA) and Regional Study Area (RSA) (Figure B-1 and Figure B-2) and incorporates best available science with Inuit Qaujimajatuqangit. Information presented in this report should be reviewed in conjunction with the Marine Environmental Management Plan (MEMP) (Appendix D) and the Spill Risk Assessment (Appendix E), to inform monitoring, mitigation and adaptive management strategies for the Project.



LEGEND

- BASELINE SAMPLING AREA
- MOORAGE AND OFFLOADING
- MARINE REGIONAL STUDY AREA (MARINE RSA)
- MARINE LOCAL STUDY AREA (MARINE LSA)
- BATHYMETRIC DEPTH CONTOUR
- WATERBODY

REFERENCE

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DATUM: NAD 83 PROJECTION: UTM ZONE 15

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

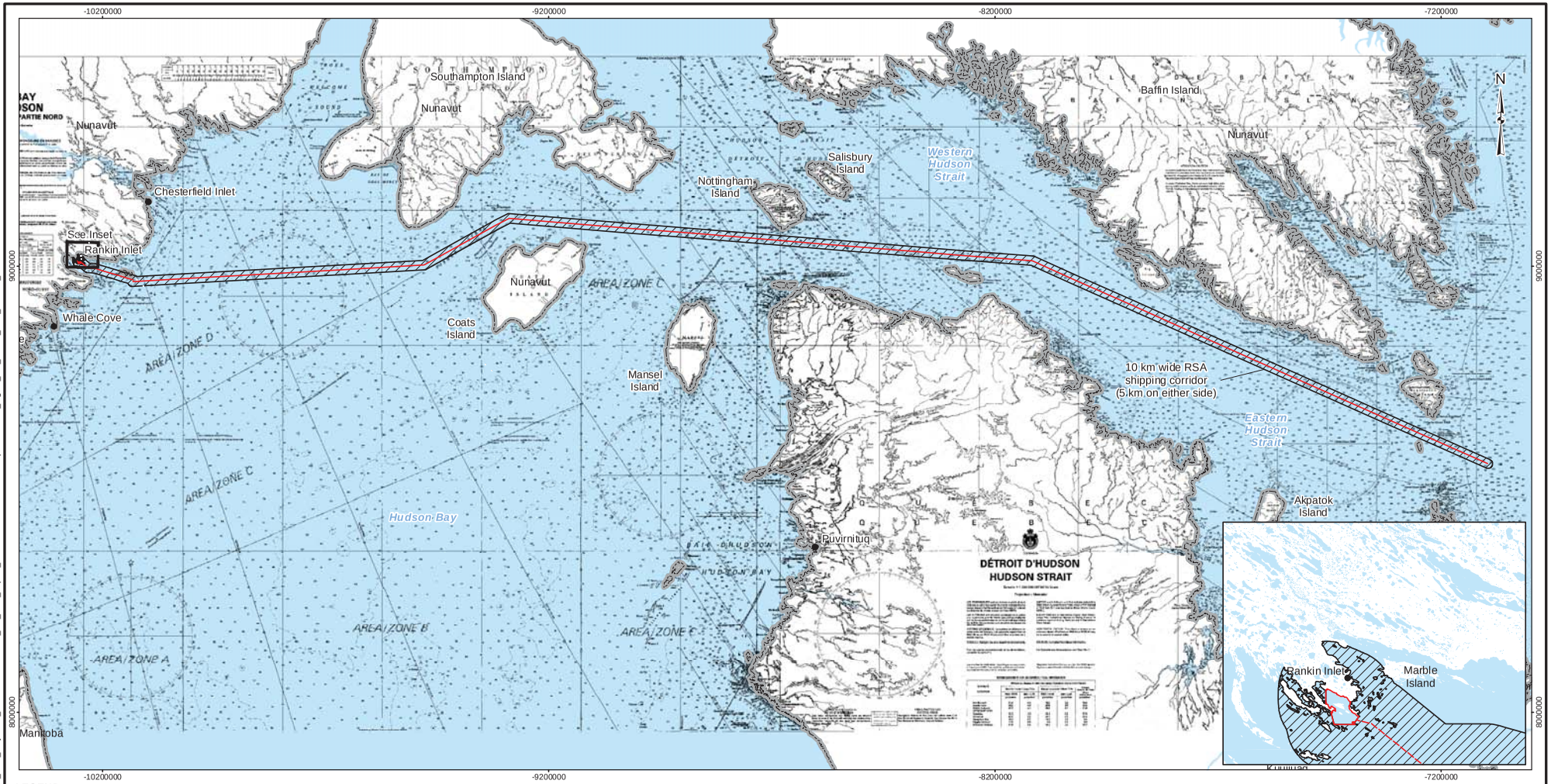
TITLE
MARINE LOCAL STUDY AREA

Golder Associates

PROJECT NO.	1535029		FILE No.	
DESIGN	AK	25 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	MH	15 Mar. 2018		
CHECK	PR	18 Jan. 2013		
REVIEW	DW	18 Jan. 2013		

FIGURE B-1

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1535029_WL_Tech_Sup\02_PRODUCTION\5000\MXD\Report\1535029_Figure_B-1_Marine_LSA_Nautical_Charts_rev1.mxd



LEGEND

- MARINE REGIONAL STUDY AREA (MARINE RSA) (SEE INSET)
- MARINE LOCAL STUDY AREA (MARINE LSA)
- COMMUNITY
- WATERBODY

REFERENCE

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DATUM: WGS 84 PROJECTION: WORLD MERCATOR

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
MARINE REGIONAL STUDY AREA

Golder Associates

PROJECT NO.	1535029		FILE No.	
DESIGN	AK	16 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	18 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-2**	
REVIEW	DW	18 Jan. 2013		

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1.2 Existing Environment in Melvin Bay / Itivia Harbour

In August 2011, a field program was conducted by Nunami Stantec at Itivia and at two nearby reference sites in Melvin Bay (Figure B-1). The objective of the field program was to collect physical and biological baseline information in the marine LSA (Figure B-1), with a focus on the Project footprint corresponding with the proposed floating dock facility (landing barge). The field program investigated bathymetry, water and sediment chemistry, aquatic lower-trophic organisms (phytoplankton, zooplankton, and benthic invertebrates) and fish and fish habitat. Results from Nunami Stantec's field program are provided in detail in Appendix 8.2-A of the FEIS, with a general summary provided below for bathymetry, water, and sediment chemistry (Agnico Eagle 2014).

1.2.1 Physical Environment

Depth soundings were collected along shore-perpendicular transects in the LSA. Water depths at Itivia and in Melvin Bay were determined to be shallow, with maximum depths in the Project footprint reaching 6.6 metres (m). A large rocky reef is present approximately 125 m offshore of the high water mark near the proposed landing barge facility. Cobble and gravel were the dominant substrates in the nearshore environment of the Project footprint (Figure B-3).

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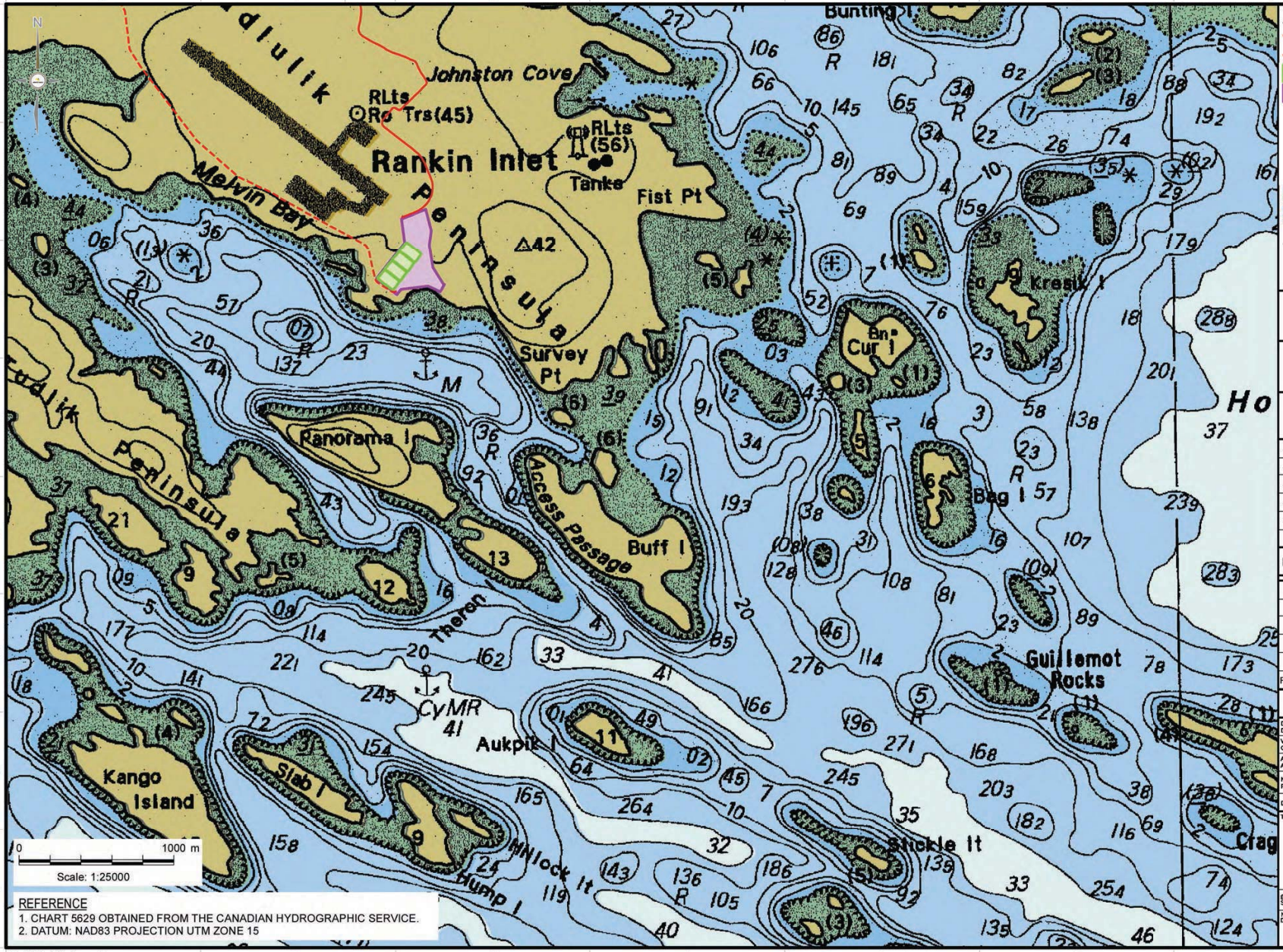

REFERENCE
1. CHART 5629 OBTAINED FROM THE CANADIAN HYDROGRAPHIC SERVICE.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

LEGEND

- RANKIN ROAD
- BYPASS ROAD
- TANK FARM AREA
- LAYDOWN AREA
- SHIP/TANKER ANCHOR LOCATION
- M MUD
- Cy CLAY
- R ROCK, ROCKY
- LOW WATER LINE
- ROCKY AREA, WHICH COVERS AND UNCOVERS

AGNICO EAGLE

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REVISIONS

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AGNICO EAGLE – MELIADINE DIVISION
FIGURE B3 SHORELINE TYPES
IN ITIVIA HARBOUR AND MELVIN BAY

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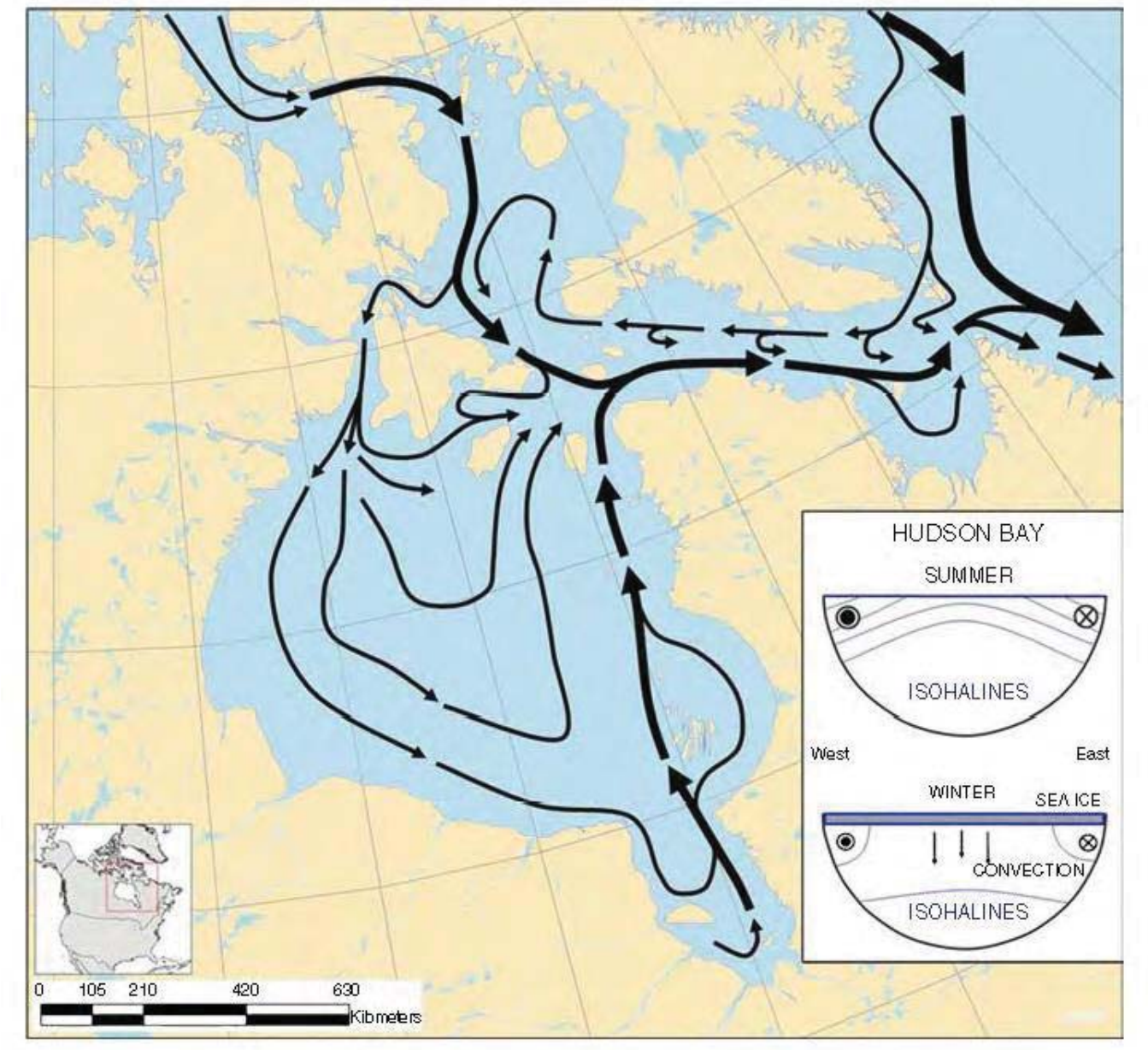


Figure B-4: Summer circulation of water in the Hudson Bay Complex (extracted from Stewart and Barber 2010; inset after Ingram and Prinsenberg 1998)

Water quality profiles were collected at one location in the LSA with an YSI 600QS multi-meter. Parameters measured included temperature, conductivity, pH, dissolved oxygen, salinity, and oxidation-reduction potential. Mean surface water temperature (at 1 m depth) in the harbour was 8.86 ± 0.52 degrees Celsius (°C), with a salinity of 29.32 ± 0.03 ppt, and a pH of 8.08 ± 0.03. Bottom water was slightly colder than surface water at 8.49 ± 0.57°C; with similar salinity and pH values. No thermal stratification was observed. The pH was near constant across the LSA (range from 8.05 to 8.10) and throughout the water column (range from 8.05 to 8.10).

Mean conductivity ranged from 45.6 ± 0.1 mS/cm at the surface to 45.7 ± 0.1 mS/cm at the bottom. Dissolved oxygen ranged from 114.5 ± 1.0% at the surface to 114.1 ± 1.2% at the bottom.

Water samples were collected for chemistry analysis at one location in the LSA using a Van Dorn sampler deployed at mid-depth. Parameters analyzed included major anions, alkalinity, total suspended solids, total dissolved solids, pH, conductivity, total metals, total Kjeldahl nitrogen, ammonia, nitrate and nitrite, total phosphate, and total organic carbon. Results were compared to Canadian Council of Ministers of the Environment (CCME) guidelines (maximum levels) for Protection of Marine Aquatic Life (PMAL). Total alkalinity in the marine LSA ranged from 142 to 144 milligrams per litre (mg/L), with bicarbonate (HCO3-) as the major representative ion. Nitrate, nitrite, total Kjeldahl nitrogen, dissolved orthophosphate, and total phosphorus were below detection limits (typically <0.050 mg/L). Total organic carbon values were low (ranging from 2.8 to 3.6 mg/L). Approximately 78% of all analyzed metals (33 of 42) were below detection limits. All sample parameters for which CCME PMAL guidelines exist were within acceptable limits.

Sediment samples were collected for chemistry analysis at 3 locations in the marine LSA footprint using a petite ponar grab. Metal concentrations were compared to CCME Interim Sediment Quality Guidelines (ISQG). Sediment chemistry was near constant across the LSA. Metal concentrations were variable and ranged from below analytical detection limits to exceeding CCME ISQCs. Chromium slightly exceeded the CCME ISQG of 52.3 milligrams per kilogram (mg/kg) at all sample stations, with average (±SD) concentrations in the marine LSA footprint measured at 55.8 ± 5.89 mg/kg. The precision analyses (CV) indicate some heterogeneity of marine sediments in the study area.

1.2.2 Biological Environment

Plankton

Phytoplankton abundance, richness, and diversity were similar across all sites within the marine LSA, and a total of 33 taxa were recorded. Dinoflagellates were the dominant taxa at all sites and included Peridinium/Gonyaulax spp. and Dinophysis spp. The ciliate *Tintinnida* was present at low percentages at 2 of the sites.

Zooplankton abundance, richness, and diversity differed between sites, and a total of 44 taxa were recorded. An unidentified rotifer species, possibly Notommatidae, was identified as the dominant taxa at all sites. Calanoid copepods were also present at all 3 sites.

Benthic Invertebrates

Benthic invertebrate abundance, richness, and diversity differed amongst sites. Polychaetes were the dominant taxa at all sites and included Polychaeta: Sedentaria (burrowing or tube-dwelling), Capitellidae, and Cirratulidae and/or Paraonidae. Polychaeta: Errantia (free-swimming) were the next dominant taxa and included Nephtyidae, Syllidae, and Pholoidae. Also present was nematode subclass Hoplonemertea, the Myidae and Tellinidae clams, the amphipod families of Ischyroceridae, Oedicerotidae, and Zopfiaceae, as well as 11 additional polychaete families. At 1 site, a single sponge (*Porifera*), 2 hydrozoan taxa, 1 flatworm (*Playhelminthes*), Terebellidae and Opheliidae polychaetes, 3 gastropod, and 3 bivalve taxa, several crustaceans (copepod, amphipod, decapods), and one sea squirt (*Urochordata*) were also identified.

Benthic species are not thought to occupy the intertidal zone in Hudson Bay on a permanent basis; rather, they occur seasonally when the habitat is not influenced by ice (Stewart and Lockhart 2005). Baseline studies completed in the LSA support this assumption (Nunami Stantec Ltd. 2012). Few invertebrate species were observed in the nearshore habitat, and abundance was low. Most of the individuals observed were less than 1 cm, suggesting a low biomass. Nearshore macrophyte coverage was found to be equally sparse (ranging from 2 to 5% coverage).

Fishes

Six species of marine fish (n=156) were identified during gill net and beach seine sampling in the marine LSA, including Greenland cod (*Gadus ogac*) (52%), slender eelblenny (*Lumpenus fabricii*) (27%), fourhorn sculpin (kanayok in Inuktitut) (*Myoxocephalus quadricornis1*[1]) (15%), unidentified sculpin (possibly juvenile; 3%), Arctic staghorn sculpin (*Gymnocanthus tricuspis*) (2%), and Arctic sculpin (*Myoxocephalus scorpioides*) (1%). The range of total lengths of the dominant fish taxa were 118 to 520 mm for Greenland cod, 180 to 210 mm for slender eelblenny, and 205 to 315 mm for fourhorn sculpin species. Arctic char were not observed during the baseline field study but were reported to be in the area at the time of the field study (west of Melvin Bay near the Barrier Islands).

Marine Birds

A black guillemot (*Cepphus grylle*) and a pair of sandhill cranes (*Grus canadensis*) were identified in the LSA during the baseline field program.

Marine Mammals

No marine mammals were observed in the LSA during the baseline field program.

1.3 Existing Environment within Hudson Bay / Hudson Strait Shipping Corridor

Golder conducted a comprehensive literature review to characterize the physical and biological environment in the proposed shipping corridor in Hudson Bay and Hudson Strait (Figure B-2). The following information sources were reviewed:

- available records of consultation with regulatory agencies, public stakeholders, and Inuit communities;
- available scientific literature / data reports;
- DFO Integrated Fisheries Management Plans;
- DFO Stock Status Reports;
- DFO's Mapster database;
- DFO's Ocean Data Inventory;

[1] Referenced by it's European (Triglopsis quadricornis) name in Appendix 8.2-A of the FEIS - Nunami Stantec Marine Baseline Report for Itivia Harbour, Rankin Inlet, NU

- Environment Canada's Key Marine Habitat for Migratory Birds;
- Fisheries and Oceans Canada's (DFO) Mapster database;
- governmental and non-governmental environmental resources including:
- Important Bird Areas (IBAs) spatial database;
- Marine Baseline Report - Itivia and Melvin Bay, Rankin Inlet, NU produced by Nunami Stantec Ltd. (2012);
- NIRB Guidelines for the Preparation of an Environmental Impact Statement for the Agnico Eagle Mines Ltd. Meliadine Project (NIRB File No. 11MN034) (NIRB 2012);
- Nunavut Planning Commission web resources including the Nunavut Wildlife Resource and Habitat Values final report (2008);
- Nunavut Wildlife Management Board Reports / Guidance Documents;
- OBIS-Seamap database (Duke University);
- previous marine-based environmental impact statements completed in the Project area (e.g., AREVA and others as available);
- regional fisheries catch statistics (e.g., DFO annual catch data);
- federal Species at Risk Act (SARA) database;
- The Canadian Circumpolar Institute and the Tungavik Federation of Nunavut, Nunavut Atlas (1992); and
- Inuit Qaujimajatuqangit (IQ) collected for local coastal areas.

1.3.1 Physical Environment

Hudson Bay is one of the world's largest inland seas, with a total surface area of approximately 830,000 square kilometres (km^2) (Prinsenberg 1984). It is connected to the Atlantic Ocean by Hudson Strait and the Labrador Sea; and to the Arctic Ocean by the Foxe Basin, Fury and Hecla Strait. Hudson Bay is a relatively shallow waterbody, with an average depth of approximately 100 m. The oceanographic regime in Hudson Bay is complex and manifests all the features of an Arctic system (Macdonald and Kuzyk 2011). It is highly influenced by the influx of cold saline waters (between approximately 32.5 and 33.5 ppt) from the Arctic Ocean and Baffin Bay, through Foxe Basin and Hudson Strait, by wind-stress during both the open-water and ice-cover season, by powerful tides (Stewart and Barber 2010), and by a large freshwater input from both runoff and ice melt (Stewart and Lockhart 2005; Ingram and Prinsenberg 1998). Less saline surface outflows occur along the eastern shores of James Bay and Hudson Bay north to Hudson Strait. In Hudson Bay, estimates of average residence time of water range from 1.0 to 6.6 years (Ingram and Prinsenberg 1998).

Water in the region freezes over each winter and becomes ice-free each summer, with sea-ice first forming in late October and continuing to expand until a maximum ice cover is reached by the end of April. In winter and early spring, the ice floes that cover most of Hudson Bay are kept in constant motion by wind forces. A shore lead system develops along the land-fast ice that forms from the coast of Hudson Bay as a result of wind blowing

seaward (Barber and Massom 2007). Major polynyas (stretches of open-water surrounded by sea ice) are found in the northwest sector (including Foxe Basin) and in the vicinity of the Belcher Islands in Eastern Hudson Bay. The northwestern region of Hudson Bay, encompassing part of the Project LSA and RSA, is an area where there is a large and persistent reoccurring polynya (Saucier et al. 2004).

Waters in the Hudson Bay region are characterized by moderate to strong semidiurnal tides of Atlantic origin, a marked summer pycnocline, and greater mixing inshore than offshore (Stewart and Lockhart 2005; Ingram and Prinsenberg 1998). Although marine productivity in Hudson Bay proper is low in comparison with other oceans of similar latitudes, productivity in Hudson Strait is typically twice higher than in other oceans of similar latitudes because of the sustained nutrient availability supplied by tidal mixing throughout an extended ice-free season (Ferland et al. 2011; Sibert et al. 2011).

The southern James Bay region is shallower and influenced to a much greater extent by freshwater runoff, thus supporting a wider variety of temperate-water species that are rare or absent elsewhere in Canada's Eastern Arctic waters (Stewart and Lockhart 2004). Seasonal ice cover also occurs in James Bay, with ice beginning to recede in late May, and the area becoming ice-free by the end of July. Polynyas are found predominantly along both coasts of James Bay during winter.

The Hudson Bay marine ecosystem is abnormally cold relative to other regions of the same latitude, and its climate is characterized by long and cold winters and cool summers (Stewart and Lockhart 2004). The entire area exhibits extreme temporal (seasonal and annual) and spatial variations in the range of average temperatures and average precipitation. Northwestern Hudson Bay experiences the greatest influence of cold Arctic air masses and has the harshest climate, with typical strong winds and persistent low temperatures. Other areas of the bay have less extreme conditions affected by moderate southern or marine influences. There is also a strong average precipitation gradient across the region, from less than 200 millimetres (mm) per year in the northwest to over 800 mm per year in the southeast (Stewart and Lockhart 2004). The upper air circulation of weather systems over Hudson Bay water is mainly related to the persistent, counter-clockwise air flow around a low pressure vortex that is situated over Baffin Island in winter, but weakens and retreats northward in summer (Stewart and Barber 2010).

There is considerable seasonal variation in Hudson Bay with respect to water circulation. In summer, surface water in Hudson Bay moves cyclonically (counter clockwise), influenced by cold saline Arctic water from Foxe Basin that enters in the northwest via Roes Welcome Sound (Prinsenberg 1986a; Tan and Strain 1996). During the transit, surface water is diluted by meltwater and runoff from the land, warmed by the sun, and mixed by the wind as it circulates, thus generating strong vertical stratification of the water column. Most of the river runoff water remains in the nearshore coastal regime in summer, with limited exchange into the interior of the Bay (Granskog et al. 2011). These water masses move eastward along the southern coast and are subsequently deflected northward and exit to the northeast into Hudson Strait (Figure B-2). About half of the freshwater transport from Hudson Bay to Labrador Sea is the result of water pulses associated with anticyclonic, surface-trapped eddies that propagate through Hudson Strait as a result of storms and/or local instability processes (Sutherland et al. 2011).Deep water in Hudson Bay moves in the same general direction as surface water, although it is influenced by bottom topography (Ingram and Prinsenberg 1998; Wang et al. 1994). Intermittent flow of this dense water (approximately 34.1 ppt) over the sill that separates Foxe Channel from Hudson Bay likely maintains the homogeneous bottom layer in Hudson Bay (Stewart and Barber 2010). The incursion of

Arctic waters creates Arctic oceanographic conditions in Hudson Bay, which extend farther south than elsewhere in North America and serve as the main driver of the Hudson Bay ecosystem (Stewart and Lockhart 2004).

The residual currents in Hudson Bay that are independent of tides are wind-driven and density-driven. Monthly mean current velocities are in the range of 4 to 6 centimetres per second, with stronger currents occurring in summer than in winter and more variability occurring at the surface than at depth (Prinsenberg 1986b). Winds are generally weaker and more variable in summer than in fall when strong northwesterly winds occur. The density-driven component is stronger in early summer when surface freshwater input from runoff and ice melt is highest (Prinsenberg 1982), and weakest in late winter/early spring when surface runoff input is lowest, local salinity is offset by salt excreted by the growing sea-ice, and wind-driven mixing of surface waters is not possible due to ice cover.

The tidal regime in Hudson Bay is influenced by powerful tides from the Atlantic Ocean that surge twice a day via Hudson Strait (Stewart and Barber 2010). These tides move as a Kelvin wave and propagate counter clockwise around Hudson and James Bay following the shoreline contour and overshadowing local tides and the Arctic tidal influence (Freeman and Murty 1976). In general, both tidal amplitude and range decreases as one moves counter-clockwise along the coast. The semidiurnal tidal amplitude ranges from 1.50 m along the western shore at Churchill to 0.10 m along the eastern shore near Inukjuak (Prinsenberg and Freeman 1986; Prinsenberg 1988a). The range in height between high and low water also varies, ranging from 0.5 m at Inukjuak (Inoucdjouac) and 2 m along the east side of James Bay to as high as 4.6 m along the west coast of Hudson Bay (Dohler 1968).

Hudson Bay is nearly entirely covered by ice in winter and is free of ice in summer. Depending on the weather, timing of sea ice formation or breakup may occur earlier or later by up to a month, but the general patterns remain similar. The ice formation in Hudson Bay usually begins in the north-western part (Repulse Bay) in October and spreads rapidly southward along the western coast during November (Cohen et al. 1994). By mid-December, from 90 to 100% of Hudson and James bays are covered with ice. Maximum ice cover usually occurs in April and May, and maximum ice thickness can occur between late February and early June and can reach 285 centimetres (cm) (Loucks and Smith 1989). The ice breakup begins in June in southern James Bay and Chesterfield Inlet and the region is usually entirely ice free in the first week of August (Stewart and Lockhart 2004; Cohen et al. 1994). Ice cover is an important feature of the Hudson Bay marine ecosystem. Ice distribution determines the distribution of marine biota and affects marine ecological processes in the water column and near the ice edge (Melnikov 1980). During ice formation, most of the seawater salt is expelled from the ice. This increases the salinity of the surface water, thereby increasing its density and deepening its layer (up to 100 m) and enhancing mixing of the water column (Prinsenberg 1988b). Formation of dense deep water is facilitated in the shore lead polynya system within which increased brine rejection is able to overcome buoyancy in the surface layer. This provides a mechanism to shunt approximately 6 to 16% of river runoff inputs into deeper waters that have an apparent residence time of about 4 to 14 years (Granskog et al. 2011).

As the pack-ice forms in northwestern Hudson Bay, predominant northwest winds continuously push it to southeastern Hudson Bay. The pack-ice forms rafts and ridges and increases in overall ice thickness, which increases freshwater input in this area in the spring (Prinsenberg 1988b). In northwest Hudson Bay, in contrast, the ice is constantly formed and removed continuing the salt input into the water column. This constant removal of the ice by northwest winds and tidal mixing develops leads and recurring polynyas. There are several polynyas that form close to shore, such as in Roes Welcome Sound, at the northern tip of Coats Island, and at

Akimiski Island, which is one of the most southerly polynyas in Canadian waters. These polynyas provide important habitat for various species of marine birds, such as the Hudson Bay eider, which overwinters in this region (Martini and Protz 1981; Nakashima 1988).

The Hudson Bay marine ecosystem is characterized by strong vertical stratification of the water column in spring and summer, particularly offshore (Roff and Legendre 1986; Anderson and Roff 1980; Prinsenberg 1986a). The vertical stratification is caused by a dilution of cold Arctic saline surface water by freshwater runoff and sea-ice melt, which is subsequently warmed by the sun, and mixed by the wind. The stratification results in a strong vertical density gradient between fresh, warm water at the surface and cold, saline deeper water. The vertical density gradient impedes vertical mixing, thereby limiting nutrient input to surface waters and lowering biological productivity. A strong summer pycnocline can be observed at depths between 15 and 25 m (Anderson and Roff 1980; Prinsenberg 1986a; Ferland et al. 2011). Heating of the surface layer and freshwater input decrease as summer progresses. This increases the depth of the pycnocline. In winter, the vertical stratification is the weakest due to the increase in density of surface water and, therefore, there is an increase in vertical mixing.

Physical conditions that promote large-scale mixing or upwelling in the region during spring and summer remain limited, but ice edges along the well-developed shore lead system (where the coastal fast ice and mobile pack ice meet) correspond with areas of upwelling and associated stimulation of nutrient fluxes and primary production (Stewart and Barber 2010). In the area where the shore lead prevails (nearshore), the isotopic composition of phytoplankton during summer suggests the presence of an open system influenced by the upwelling of deep waters and related nutrient replenishment (Kuzyk et al. 2010). Another key process that supports the re-injection of nutrients in surface waters in Hudson Bay is the vertical mixing driven by tidal currents (Sibert et al. 2011). Tides in the region are known to enhance marine productivity (Stewart and Barber 2010) and to contribute to the development of local biological hotspots that are used by marine mammals as summer habitats, such as in the northwest region of the Bay (Higdon and Ferguson 2010).

At a deep-water station in southeastern Hudson Bay, surface salinity ranged from 24 ppt in August to 28 ppt in April, and surface temperature ranged from -1.5°C in April to 8°C in August (Figure B-5). At depths below 50 m, water temperature and salinity were relatively stable throughout the year. As water depth increased, water temperature progressively decreased as salinity increased, with mean water temperature below -1.4°C and salinity greater than 33 ppt at approximately 100 m water depth (Ingram and Prinsenberg 1998).

Freshwater runoff, wind-driven mixing, and tidal influence have great effects on water column characteristics in the Hudson Bay ecosystem. Vertical stratification near large river plumes varies seasonally and spatially. It is usually directly related to the runoff volume and inversely related to the tidal kinetic energy (Freeman et al. 1982). The water column stratification is stronger during freshet and weaker with distance from the river mouth. The salinity and temperature gradients are usually weaker when wind-driven mixing and tidal energy are strongest. The volume of the freshwater runoff in the region is high, with a mean discharge rate of 30 900 cubic metres per second for all rivers combined (The Canadian Encyclopaedia). These high runoff volumes determine oceanographic conditions in the area by creating very low surface salinities and strong vertical density gradients.

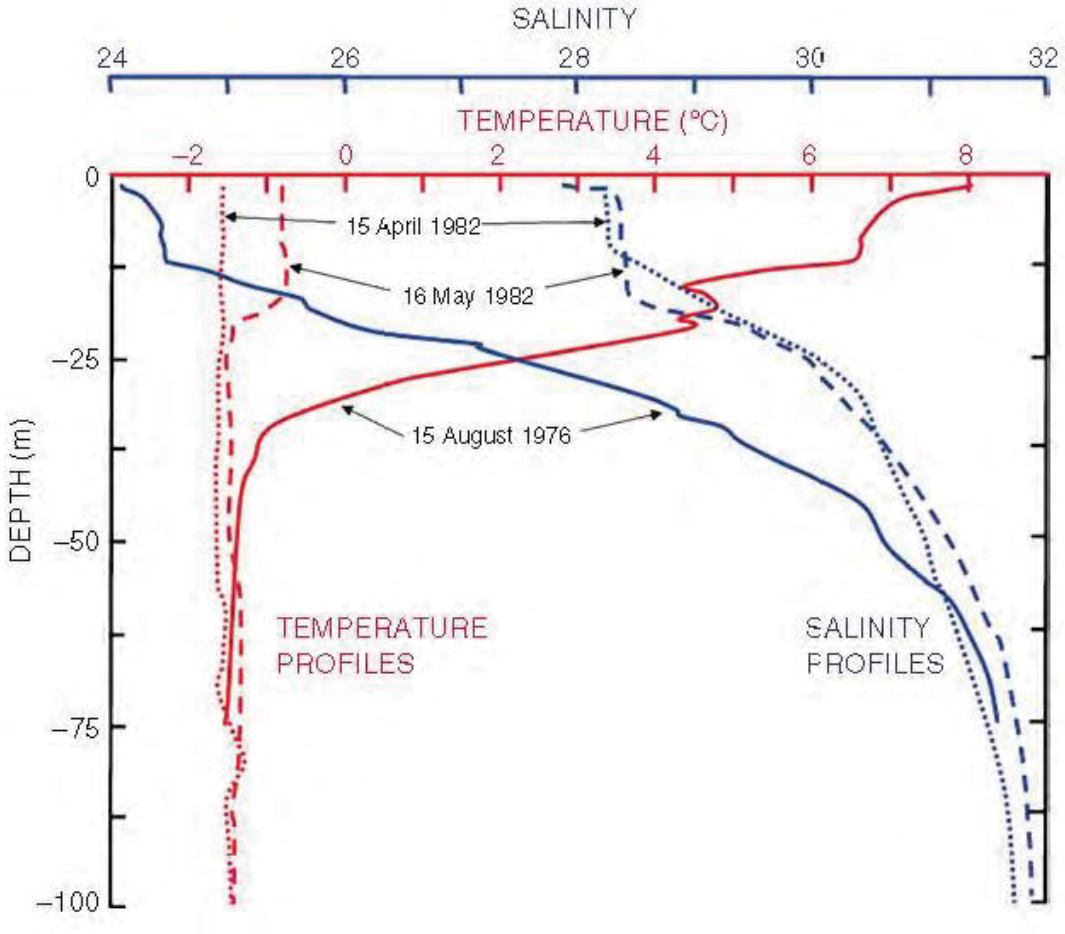


Figure B-5: Representative Vertical Profiles of Temperature and Salinity in Southeastern Hudson Bay in April (dashed line), May (dashed-dotted line), and August (solid line) (extracted from Stewart and Barber 2010; Redrawn from Ingram and Prinsenberg 1998)

High freshwater runoff volumes are also partly responsible for the difference between inshore and offshore oceanographic conditions in Hudson Bay during summer. In general, salinity and temperature in Hudson Bay increases with distance from shore (during summer). For example, surface salinity in Hudson Bay ranged from 10 ppt near major rivers to 30 ppt in offshore locations of the bay, and surface temperature ranged from 4°C in nearshore areas to 11°C in offshore locations (Anderson and Roff 1980; Prinsenberg 1986a). Lower salinities in the inshore region are due to dilution effects, whereas lower nearshore temperatures in western Hudson Bay are due to strong northwesterly wind effects causing upwelling of colder deep water to the surface (Figure B-6). In southern Hudson Bay, lower temperatures are a result of pack-ice, which lingers along the shore well into summer. Higher temperatures offshore cause stronger vertical stratification. During periods with low water temperatures (−1.75°C to 1.25°C), considerably higher rates in both bedload and suspended sediment transport are observed along the shore in comparison with a summer situation (9°C to 17°C), with similar wave heights and current velocities (Héquette and Tremblay 2009). The winter increase in suspended sediment transport is likely due to lower sediment settling velocities resulting from significant increases in fluid kinematic viscosity at low temperature. Hudson Strait is a wide, deep-water channel (on average 150 km wide, 750 km long, and

400 m deep) that connects Hudson Bay and Foxe Basin with the Labrador Sea and Davis Strait (Harvey et al. 2001). It acts as a transition zone between brackish waters in Hudson Bay and more oceanic waters of the Labrador Sea. Hudson Strait is covered with ice from mid-December to July (Hudon et al. 1993). The oceanographic regime in Hudson Strait is affected by strong tidal currents (up to 2 to 3 m/s) and high tidal elevations (tidal amplitudes are 6 to 9.5 m). These tides cause intensive vertical mixing in the water column, disrupting vertical density stratification and, therefore, enhancing biological productivity by increasing nutrient availability in the surface layer (Drinkwater and Jones 1987; Drinkwater 1986, 1990; Harvey et al. 2001).

The physical processes in Hudson Bay and Hudson Strait have a strong influence on the oceanographic and biological processes over the Labrador Shelf, affecting the water temperature and salinity characteristics in the area (Drinkwater and Harding 2001). At the eastern entrance of Hudson Strait, low salinity waters from Hudson Bay and Foxe Basin flowing eastward converge with cold Baffin Land Current waters from the north and warmer deep West Greenland Current waters. The Hudson Strait strong tidal currents result in intensive vertical mixing of these waters and the residual current carries the resulting mixture eastward onto the Labrador Shelf (Drinkwater and Jones 1987). This results in increased mixing over the Labrador Shelf, with reduced vertical density stratification relative to the Baffin Island Shelf to the north (Lazier 1982). Primary productivity is subsequently enhanced by elevated surface nutrient concentrations in eastern Hudson Strait (Drinkwater and Jones 1987) and on the northern Labrador Shelf (Kollmeyer et al. 1967).

Since 2005, recurrent expeditions of the CCGS Amundsen in Hudson Bay (Arcticnet 2014) have supported the collection of ambient noise and acoustic backscattering data. The primary dataset is composed of records obtained with a SIMRAD EK60 3-frequency split-beam echosounder that was operated continuously during the field campaigns (Polar Data Catalogue 2014). In parallel, AURAL-M2 (Autonomous Underwater Recorder for Acoustic Listening-Model 2) passive hydrophones were attached on mooring arrays deployed nearby Churchill and Great Whale River to document the seasonality of underwater sound, including marine mammal vocalizations and ambient noise (Polar Data Catalogue 2014).

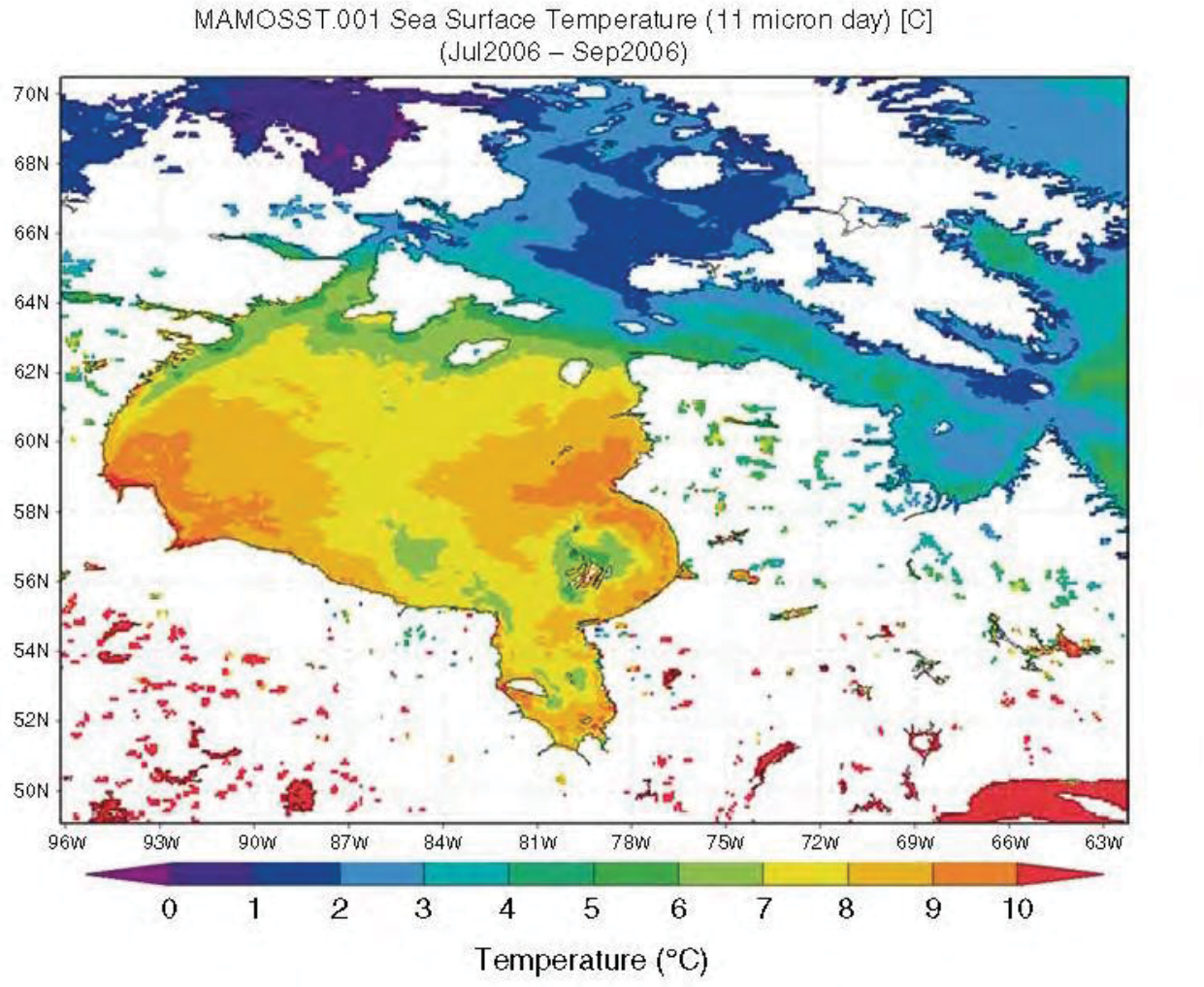


Figure B-6: Summer (July to September) sea surface temperature in 2006 (Stewart and Barber 2010)

1.3.2 Biological Environment

The marine ecosystem of Hudson Bay encompasses a large geographical area that includes James Bay, Hudson Bay, Fox Basin, and Hudson Strait. Four important features characterize this unique ecosystem:

1) an extreme southerly penetration of Arctic marine water from the north;

2) a very large volume of freshwater runoff that enters the Hudson Bay watershed each year from land;

3) seasonal coverage of sea-ice; and

4) the dynamic coastal geomorphology of the coastal zone where exposure of new shoreline (made up of coastal salt marshes and wide tidal flats) presently occurs at a rate of up to 15 m/year (horizontal) as part of an isostatic rebound of the land from the weight of the Laurentide Ice Sheet, which once covered this entire region (Stewart and Lockhart 2004).

These key features combine to form critical habitat areas for many species of marine fauna including anadromous fish and large concentrations of migratory species including shorebirds, waterfowl, seabirds, and marine mammals. The following section provides an overview of the biological characteristics of each taxa (by key species) potentially impacted by shipping activities in the RSA.

1.3.2.1 Fishes

Approximately 60 species of fish are known to inhabit estuarine waters of Hudson Bay and James Bay (CARC 1991). Fewer species are present in the northern limits of the RSA, where arctic species predominate. Arctic char, Arctic cod, and other species contribute directly to the domestic fishery, and indirectly to the food chain of marine and terrestrial mammals and birds. Fish species considered important to the local commercial, recreational, and subsistence fisheries are identified in Table B-1. An overview on the biology of these species is provided below.

Table B-1: Overview of Marine Fish Species Found within the Local and Regional Study Areas

Common Name	Species	Inuktitut Name	Habitat	*SARA* Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Arctic char	*Salvelinus alpinus*	ᐃᖃᓗᖅ ᐱᖅ / ᑕᓕᐅᖅ ᒥᐅᑕᖅ	Anadromous (Riede 2004). In the marine environment, they are found in coastal areas in waters 30 to 70 m deep (Billard 1997).	No status	Not assessed	Yes	✔	✔
Greenland cod	*Gadus ogac*	ᐃᐅᒃ	Demersal[c]. Coastal waters up to 400 m deep (Coad and Reist 2004; Cohen et al. 1990).	No status	Not assessed	Yes	✔	✔
Polar cod	*Arctogadus glacialis*	ᐃᐅᒃ	Cryopelagic[d] or epontic[e] (Coad and Reist 2004). Marine waters down to 1,000 m; Mainly found in the shallower areas of the water column (Scott and Scott 1988).	No status	Not assessed	Yes	✔	✔
Arctic cod	*Boreogadus saida*	ᐃᐅᒃ	Cryopelagic or epontic. Marine waters down to approximately 1400 m. Favour coastal areas during the summer and winter months (Coad and Reist 2004). Spawning occurs under the Arctic ice (DFO 2011b).	No status	Not assessed	Yes	✔	✔
Fourhorn sculpin (marine form)	*Myoxocephalus quadricornis*	ᑲᓇᕐᒃ	Benthic. Shallow coastal estuarine environments (Morrow 1980). In spring, they move to deeper waters for the summer and are generally found in waters 45 m to 100 m deep (Muus 1999).	No status	Not at Risk	Yes	✔	✔
Arctic staghorn sculpin	*Gymnocanthus tricuspis*	ᑲᓇᕐᒃ	Benthic. Prefers sandy bottoms (Fedorov 1986; Coad and Reist 2004). Coastal areas, close to shore (ArcOD 2011).	No status	Not assessed	Yes	✔	✔
Arctic sculpin	*Myoxocephalus scorpioides*	ᑲᓇᕐᒃ	Benthic. Shallow marine environments up to 275 m (Coad and Reist 2004).	No status	Not assessed	Yes	✔	✔
Slender eel blenny	*Lumpenus fabricii*	ᒪᓕ ᖃᓄᐃᑉ ᑐᑦ	Sandy to rocky habitats. Seem to prefer seagrass and algae, where they spawn (Mecklenburg and Sheiko 2004).	No status	Not assessed	No	✔	✔
Greenland halibut	*Reinhardtius hippoglossoides*	ᖃᓕᕆᓪᓗᒃ	Epibenthic. Surface to deep waters down to 2000 m (Coad and Reist 2004).	No status	Not assessed	Yes	✔	✔

[a] SARA.The *Act* is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity (extracted from *SARA* 2012).

[b] COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. It is up to Government to legally protect wildlife species designated by COSEWIC. The potential impacts of legal listing are for Government to analyse, and the SARA applies only to wildlife species on the SARA legal list (extracted from COSEWIC 2012).

[c] live on or near the seafloor.

[d] cold, deep marine environments.

[e] associated with the lower interface of the sea ice.

Arctic char (*Salvelinus alpinus*)

Arctic char exhibit anadromous and land-locked life history types (DFO 2006c). The anadromous forms of this species spend a large portion of its life cycle in the coastal marine environment (Riede 2004; Billard 1997). Spawning occurs in freshwater rivers, with annual migrations to marine waters occurring in the spring after the first 2-6 years of life (DFO 2006c). During autumn, adults migrate back to freshwater habitats to overwinter (Richardson et al. 2001). Arctic char feed on crustacean and other fish including capelin (Mallotus villosus), sand lance (Ammodytes spp.), Arctic cod, and juvenile Greenland cod (Richardson et al. 2001; Coad and Reist 2004).

In the RSA, Arctic char can be found along the western and northern coast of Hudson Bay and coastal areas of Hudson Strait (Coad and Reist 2004), with high abundances identified near Arviat, Chesterfield Inlet, Cape Dorset, and Kimmirut (NPC 2008) (Figure B-7). Arctic char are harvested commercially, recreationally, and for subsistence use (Canadian Circumpolar Institute 1992; Heather and usher 2004). Kangiqliniq Hunter and Trappers Association consider Arctic char an important food fish species for the residents of Rankin Inlet (Nunami Stantec Ltd. 2012).

Greenland cod (*Gadus ogac*)

Greenland cod are a demersal[2] fish found most commonly in coastal waters up to 400 m deep (Coad and Reist 2004; Cohen et al. 1990). They feed on crustaceans, molluscs, sea stars, worms, and other fish including capelin, polar cod juvenile Greenland cod and Greenland halibut (Coad and Reist 2004). Greenland cod spawn at the mouths of freshwater rivers during spring (DFO 2006a). Their habitat range overlaps with the RSA, primarily occupying inlets and estuaries along both coasts of Hudson Bay extending south to Arviat along the west coast and to the Eastmain River estuary in James Bay along the east coast (Coad and Reist 2004; Ochman and Dodson 1982; Hunter et al. 1984).

Polar cod (*Arctogadus glacialis*)

The habitat range of polar cod includes offshore continental shelf waters of the RSA in Hudson Bay and Hudson Strait (Cohen et al. 1990; NPC 2008). They exhibit cryopelagic[3] or epontic[4] life history types (Coad and Reist 2004), although they frequent primarily the upper surface waters in Hudson Bay (Scott and Scott 1988). Polar cod are closely associated with sea-ice and spawn underneath the ice during winter (Bradstreet et al. 1986; Craig et al. 1982). Prey species include other fish and crustaceans; predators include seabirds, seals, whales, and other fish (Bradstreet 1982).

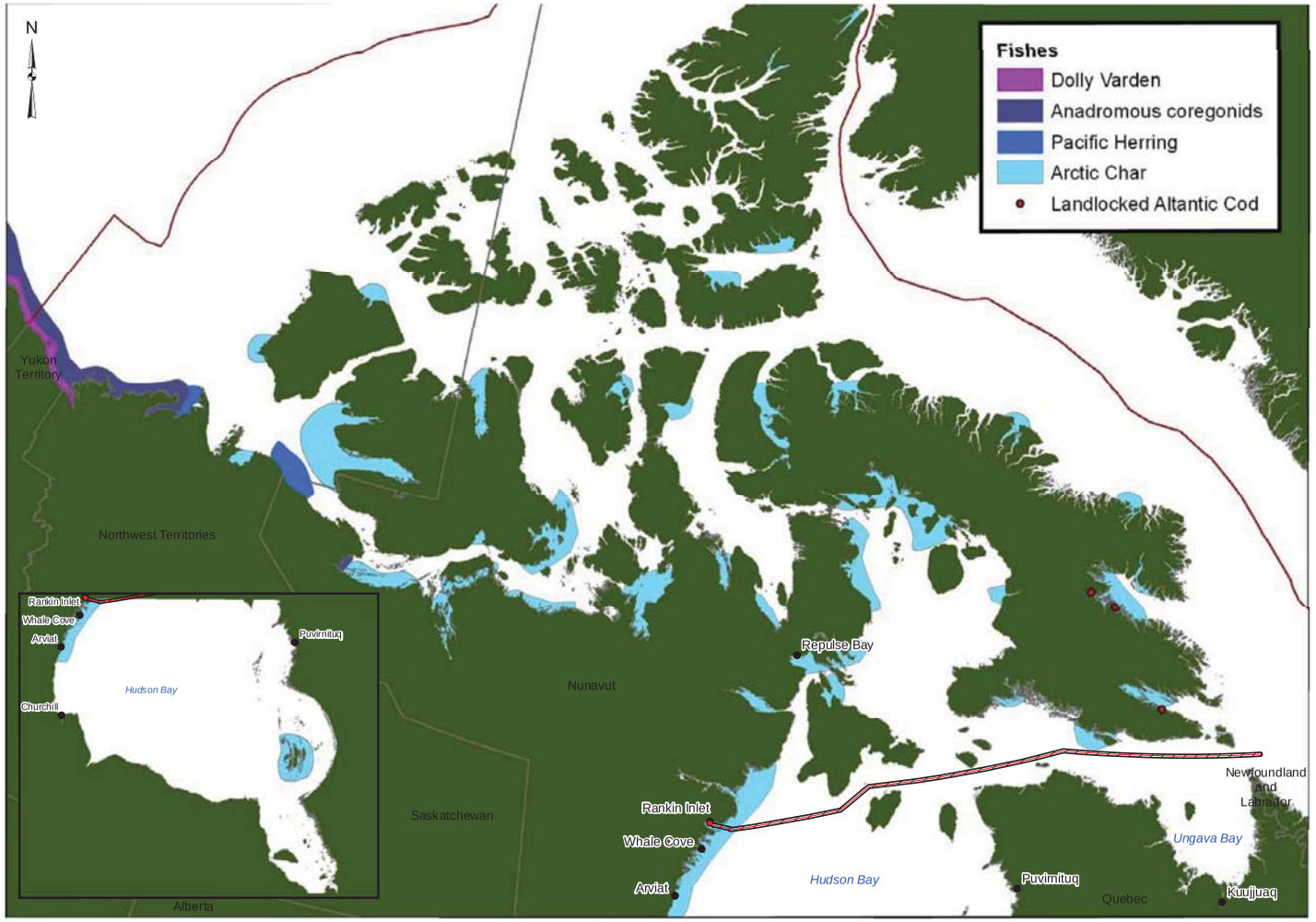
Arctic cod (*Boreogadus saida*)

Arctic cod are a key species in the arctic marine ecosystem (DFO 2011b). Like polar cod, Arctic cod exhibit cryopelagic or epontic life history types and have a short life span (Coad and Reist 2004). They live in marine waters down to 1,400 m (Coad and Reist 2004) and inhabit coastal areas during the summer and winter months (Cohen et al. 1990). Arctic cod feed on epibenthic mysids, amphipods, copepods, and other fish (Coad and Reist 2004). Spawning is thought to occur in late autumn and winter under the sea-ice. Arctic cod are a main food source for marine mammal and seabirds, particularly narwhals and murres (DFO 2011b).

[2] live on or near the seafloor

[3] associated with cold, deep marine environments

[4] associated with the lower interface of the sea ice



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

POVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF ARCTIC CHAR (*Salvelinus alpines*) AND OTHER SELECTED FISH SPECIES IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	20 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-7**	
REVIEW	DW	18 Jan. 2013		

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1535029_WL_Tech_Sup\02_PRODUCTION\5000\MXD\Report\1535029_Figure_B-7_Distribution_of_Arctic_Char.mxd

There is no commercial harvest of Arctic cod in the Canadian Arctic (DFO 2011b). Subsistence fishery records indicate that Arctic cod have been traditionally harvested in Arviat, Whale Cove, Coral Harbour, Cape Dorset, Kimmirut (Canadian Circumpolar Institute 1992; Heather and Usher 2004). Their habitat range overlaps with that of the RSA and extends into the Hudson Bay and Hudson Strait (Coad and Reist 2004).

Fourhorn sculpin (*Myoxocephalus quadricornis*)

Fourhorn sculpins are a benthic species (Coad and Reist 2004) and are generally found in shallow coastal estuarine waters (Morrow 1980). In the spring, this species migrates to deeper waters for the summer months where they are typically found in waters 45 to 100 m in depth (Muus 1999). They feed on crustaceans, molluscs, and fish (Coad and Reist 2004). Spawning occurs in shallow waters where pairing and egg laying occur in gravel substrate (Muus 1999). This species is distributed throughout Hudson Bay and Hudson Strait (Coad and Reist 2004). Fourhorn sculpins have been traditionally harvested in Arviat, Whale Cove, Coal Harbour, Cape Dorset, and Kimmirut (Canadian Circumpolar Institute 1992; Heather and Usher 2004).

Arctic staghorn sculpin (*Gymnocanthus tricuspis*)

The Arctic staghorn sculpin are a benthic species preferring sandy bottom types but also frequenting mud, gravel, and rocky habitats (Fedorov 1986; Coad and Reist 2004). This species tends to inhabit near-shore areas (ArcOD 2011). Spawning occurs in late autumn and winter (ArcOD 2011). Artic staghorn sculpin feed primarily on benthic amphipods and worms (Fedorov 1986). They are not a commercially harvested species and do not represent a major target species of the subsistence fishery.

Arctic sculpin (*Myoxocephalus scorpioides*)

Arctic sculpin are known to occur in the RSA, with a regional distribution extending from James Bay and the Straits of Belle Isle to Greenland (Fishbase 2012). They are a benthic species found primarily in shallow marine environments up to 275 m in depth (Coad and Reist 2004). Spawning occurs during autumn (Coad and Reist 2004). Prey items include mainly crustaceans (Coad and Reist 2004). They are not a commercially harvested species and do not represent a major target species of the subsistence fishery.

Slender eelblenny (*Lumpenus fabricii*)

The slender eel blenny can be found in a variety of marine environments from sandy bottoms to rocky habitats but are rarely found in intertidal areas (Coad and Reist 2004; Mecklenburg and Sheiko 2004). They are closely associated with seagrass and macroalgae in the nearshore where they spawn during autumn (Mecklenburg and Sheiko 2004). This species feeds on crustaceans, worms, clams, and other fish eggs (Coad and Reist 2004). Its habitat range includes both Hudson Strait and Hudson Bay (Coad and Reist 2004). They are not a commercially harvested species and do not represent a major target species of the subsistence fishery.

Greenland halibut (*Reinhardtius hippoglossoides*)

The Greenland halibut is an epibenthic species and can be found at the surface to waters down to 2,000 m (Coad and Reist 2004). This species feeds on other fishes, crustaceans and squids (Coad and Reist 2004). Its habitat range includes the Hudson Strait (Coad and Reist 2004). The Greenland halibut has become increasingly important in developing commercial fisheries in the eastern Arctic (Coad and Reist 2004); however, they do not represent a major target species of the subsistence fishery.

Hearing Abilities of Marine Fish

It is well known that fish use sound for communication, detection of predators and prey, and learning about their environment (Popper and Fay 1999; Zelick et al. 1999; Fay and Popper 2000; Popper et al. 2003). All fish species can hear with varying degrees of sensitivity within the frequency range of sound produced by seismic sources and other industrial sound sources (Popper and Fay 1973; Fay 1988; Popper and Fay 1993; Fay 2000). The hearing range for most fish is believed to be in the frequency range of 100 to 1000 hertz (Hz) (Fay 1988). A smaller number of species can detect sounds to over 3,000 Hz, while a very few can detect sounds to well over 100 kHz. Because of wide differences in hearing capability and morphologies among fish species, behavioural responses and the susceptibility of fish to auditory trauma varies greatly. There is considerable anatomical and physiological variation amongst fish with respect to hearing structures, suggesting that various species may detect and process sound in different ways (Popper and Fay 1993). Fish can be divided into 2 broad categories: hearing generalists and hearing specialists (Popper et al. 2003; Ladich and Popper 2004). Hearing generalists are fish species without any auditory system specializations. They have poor auditory sensitivity characterized by a narrow bandwidth of hearing, typically detecting sounds from below 50 Hz up to 1 or 1.5 kHz (Popper et al. 2003). This includes most bottom-dwelling species such as Greenland halibut (Popper et al. 2003). The majority of fish species that fall into this category generally do not hear frequencies much above 1 kHz, with peak sensitivities around 300 to 500 Hz (Ladich and Popper 2004). The sound pressure detection threshold can be as high as 120 dB re 1 µPa at 1 m at the most sensitive frequency (Nedwell et al. 2004). Hearing specialists have specialized auditory structures connected to well-developed pressure sensitive organs (Popper and Fay 1993). These morphological adaptations allow hearing specialists to detect sound pressure with greater sensitivity (i.e., lowering their hearing threshold) and in a wider bandwidth than “generalists”, and makes hearing specialists more sensitive to high-amplitude sound introduced into the marine environment.

Hearing thresholds for many Arctic species of fish are largely unknown. Underwater noise generated by vessel engines and cavitation can affect fish behaviour. Behavioural changes may cause disruption to migration patterns or spawning events and movement away from valuable food sources and have the potential to cause population-level effects. Fish are particularly sensitive if these changes occur over a critical period when they have a short window of opportunity to complete an activity.

Over 60 species of marine fish may be found in the LSA and RSA including: Greenland cod (*Gadus ogac*), slender eelblenny (*Lumpenus fabricii*), fourhorn sculpin (*Triglopsis quadricornis*), Arctic staghorn sculpin (*Gymnocanthus tricuspis*) and Arctic sculpin (*Myoxocephalus scorpioides*), Arctic char (*Salvelinus alpinus*), Arctic cod (*Boreogadus saida*), and polar cod (*Arctogadus glacialis).* Polar cod and Arctic cod are both hearing specialist species and are likely to be present in the RSA. Cod fish can detect both sound acceleration and sound pressure over a substantial frequency range; 20 to 150 KHz. Sound pressure thresholds in cod fish in the frequency range 60 to 300 Hz lie in the range 80 to 90 dB re 1 µPa at 1 m. Although hearing thresholds for most of these fish species are largely unknown, hearing thresholds for closely related species such as the walleye pollock

(*Theragra chalcogramma*) and the Atlantic cod (*Gadus morhua L.)* are known and may be used as surrogates for Greenland cod. The hearing ability of walleye pollock, from three different age groups (corresponding to size-classes), was determined from auditory evoked potentials by Mann et al. 2009. Walleye pollock hearing was most sensitive between 100 and 200 Hz, with thresholds around 75 dB re: 1 µPa (Mann et.al 2009). Hearing sensitivity decreased as frequency increased up to 450 Hz. The three age groups of walleye pollock did not show a difference in hearing sensitivity, although there was a noticeable interaction between frequency and age

as well as a trend with older fish having a slightly lower mean threshold level. Water temperature appears to have an effect on the hearing thresholds at 350 Hz for walleye pollock. Each degree of temperature increase (from 8 to 12°C) resulted in an 8.3-dB decrease in hearing threshold, with hearing being largely changed by local temperature over their natural range of occurrence. However, walleye pollock are generally found in the marine environment at temperatures less than those used during the Mann et al. 2009 laboratory experiments. In the Bering Sea, walleye pollock are generally found in 3–6°C waters and avoid temperatures less than 0°C (Kotwicki et al. 2005). They may be found in temperatures as warm as 10–12°C (Bailey et al. 1999). Based on the above results, Mann et al. 2009 suggests that the hearing thresholds of walleye pollock are generally similar to those of other gadid fishes.

Hearing studies on Atlantic cod demonstrated that this species is sensitive to pure tones in the frequency range of 30 to 470 Hz. Greatest sensitivity was observed between 60 to 310 Hz and the hearing threshold ranged from 78 to 117 dB re: 1 µPa (Chapman and Hawkins 1973). Changes in levels of ambient sea noise caused variation in thresholds in most frequency bands. In calm sea conditions, unmasked thresholds can be obtained. Thresholds were largely independent of the sound source distance within 1.7 to 50 m, suggesting that cod are sensitive to acoustic pressure (Chapman and Hawkins 1973).

1.3.2.2 Marine Birds

The Hudson Bay marine ecosystem provides resources of critical importance to resident and migrant marine birds throughout the year. At least 43 species of seabirds, shorebirds, waterfowl, and marine-associated raptors frequent offshore, inshore, intertidal, or salt marsh habitats of the Hudson Bay marine ecosystem (Table B-2). Few of these species are year-round residents. Most pass through the area during summer for staging, moulting, nesting, and brooding purposes (Canadian Circumpolar Institute 1992) prior to transiting to their traditional wintering grounds in the south, many of which fall outside the NSA (e.g., Arctic terns, red-necked phalaropes). Thus, impacts to certain long-range migratory species have the potential for transboundary effects. Marine bird species present year-round in Hudson Bay / Hudson Strait are limited to common eider, king eiders, black guillemot, dovekie, and ivory gull. These species have adapted to accessing prey in polynyas, where current and tidal action keep waters ice-free throughout the winter. FigureB- 8 and Figure B-9 provide an overview of marine bird distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.

Table B-2: Overview of Seabird Species Potentially Present within the Local and Regional Study Areas

Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Black guillemot	*Cepphus grylle*	year-round	coastal / offshore	Harvested for subsistence. Nests in small colonies on steep shores on Southampton and Coats islands.	No status	Not assessed	Yes	✔	✔
Thick-billed murre	*Uria lomvia*	summer	coastal / offshore	Large breeding colony (520 000 pairs) on Akpatok Island in Hudson Strait. Traditional knowledge suggests that murres winter in large numbers in area of open water west of the Belcher Islands in southeast Hudson Bay. Moulting adult birds with their young complete swimming migration in August from a number of known bird colonies in Hudson Bay through the Hudson Strait to offshore areas of Newfoundland and Labrador (Mallory and Fontaine 2004).	No status	Not assessed	Yes	✔	✔
King eider	*Somateria spectabilis*	year-round	coastal	Widely distributed in James Bay and Hudson Bay.	No status	Not assessed	Yes	✔	✔
Common eider	*Somateria mollissima*	year-round	coastal / offshore	Hudson Bay subspecies overwinter in areas where open water and shallow depth coincide. Breeds along rocky coasts or tundra throughout Hudson Bay. Present along ice edge and at polynyas. Feed exclusively on blue mussel.	No status	Not assessed	Yes	✔	✔
Northern fulmar	*Fulmarus glacialis*	summer / fall	coastal / offshore	Rare visitor to James Bay in late fall. Observed at Coats Island.	No status	Not assessed	No	✔	✔
Black-legged kittiwake	*Rissa tridactyla*	summer	coastal / offshore	Occurs on the open waters of northern Hudson Bay in July and August, and occasionally at Churchill in early summer.	No status	Not assessed	No	✔	✔
Dovekie	*Alle alle*	year-round	coastal / offshore	Winter offshore in Hudson Bay, Hudson Strait and Gulf of St. Lawrence.	No status	Not assessed	No	✔	✔

Table B-2: Overview of Seabird Species Potentially Present within the Local and Regional Study Areas

Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Long-tailed duck	*Clangula hyemalis*	May-Oct	coastal	Occur in large numbers close to shore in Hudson and James Bay. Some individuals also overwinter on open water of James Bay.	No status	Not assessed	No	✔	✔
Canada goose	*Branta canadensis*	summer and fall	coastal	Spring and fall transient. Breeds in large numbers along the coasts (McConnell River Migratory Bird Sanctuary) and on the islands of Hudson Bay and James Bay (e.g., Southampton Island).	No status	Not assessed	Yes	✔	✔
Lesser snow goose	*Anser caerulescens*	May – Sept	coastal	Migratory species. Breeding colonies occur along the coasts (McConnell River Migratory Bird Sanctuary) and on the islands of Hudson Bay (e.g., Southampton Island). Hudson Bay supports over 50% of the eastern Arctic breeding population.	No status	Not assessed	Yes	✔	✔
Atlantic Brant	*Branta bernicla*	April to October	coastal	Migratory species. Breed on Southampton Island. During the fall migration, > 50% of the population frequents eelgrass habitat in James Bay.	No status	Not assessed	No	✔	✔
Glaucous gull	*Larus hyperboreus*	summer	coastal / offshore	Breed along the northern coasts of Hudson Bay, the Belchers, and widely throughout the Canadian Arctic.	No status	Not assessed	No	✔	✔
Herring gull	*Larus argentatus*	April-Nov	coastal / offshore	Migratory species. Breed along the coasts of Hudson Bay and James Bay in summer and in the Belchers.	No status	Not assessed	No	✔	✔
Ross's gull	*Rhodostethia rosea*	spring and autumn	coastal / offshore	Established nesting areas near Churchill, McConnell River Migratory Bird Sanctuary, and in the Canadian High Arctic (Devon Island). May overwinter in polynyas.	TH (Schedule 1)	TH	No	✔	✔
Ivory gull	*Pagophila eburnean*	year-round	coastal / offshore	Occur in Hudson Bay during both summer and winter, but breed in the	EN (Schedule 1)	EN	No	✔	✔

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Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
				Canadian High Arctic.					
Sabine's gull	*Xema sabini*	summer	coastal / offshore	Migratory species. Breeds on colonies along the northern coasts of Hudson Bay. Pelagic outside breeding season.	No status	Not assessed	No	✔	✔
Thayer's gull	*Larus thayeri*	summer	coastal / offshore	Migratory species. Breeds along the coasts of northern Hudson Bay during summer including Coats and Southampton islands.	No status	Not assessed	No	✔	✔
Arctic tern	*Sterna paradisaea*	summer	coastal / offshore	Migratory species that breeds throughout the Hudson Bay and Hudson Strait.	No status	Not assessed	No	✔	✔
Pacific loon	*Gavia pacifica*	summer	coastal	Migratory species. Arctic breeding species common and numerous along the mainland and island coasts of the Hudson Bay coast.	No status	Not assessed	No	✔	✔
Red-throated loon	*Gavia stellata*	summer	coastal	Migratory species. Arctic breeding species common and numerous along the mainland and island coasts of the Hudson Bay coast.	No status	Not assessed	No	✔	✔
Common loon	*Gavia immer*	summer	coastal	Migratory species. Common in southeastern Hudson Bay and James Bay.	No status	Not at risk	No	✔	✔
Black scoter	*Melanitta americana*	summer	coastal	Migratory species. Common on the Belchers and along the coast from southeastern Hudson Bay west to Churchill. May overwinter in small numbers in James Bay.	No status	Not assessed	No	✔	✔
Red-breasted merganser	*Mergus serrator*	summer	coastal	Migratory species. Common along the coasts of James Bay and southwestern Hudson Bay. Males and non-breeding birds frequent coastal marine waters.	No status	Not assessed	No	✔	✔
Red-necked phalarope	*Phalaropus lobatus*	summer	coastal / offshore	Migratory species. Breeds widely across the Arctic and throughout Nunavut.	No status	Not assessed	No	✔	✔

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Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Red phalarope	*Phalaropus fulcarius*	summer	coastal / offshore	Migratory species. Breeds along the west coast of the Hudson Bay, on the Ungava Penninsula and on the southern end of Baffin Island in Nunavut.	No status	Not assessed	No	✔	✔
Parasitic jaeger	*Stercorarius parasiticus*	summer	coastal / offshore	Migratory species. Breed along the coast and islands of Hudson Bay.	No status	Not assessed	No	✔	✔
Long-tailed jaeger	*Stercorarius longicaudus*	summer	coastal / offshore	Migratory species. Breeds along the Quebec coast of Hudson Bay, on Southampton Island, and along the Kivalliq coast.	No status	Not assessed	No	✔	✔
Pomarine jaeger	*Stercorarius pomarinus*	summer	coastal / offshore	Migratory species. Breeds along the Quebec coast of Hudson Bay and on Southampton Island.	No status	Not assessed	No	✔	✔
Sandhill crane	*Grus canadensis*	summer	coastal	Migratory species. Summer visitors to the southern and western coasts of James Bay and Hudson Bay, from Boatswain west and north. Also reported on the Belchers and Southampton islands.	No status	Not at risk	No	✔	
Dunlin	*Calidris alpina*	summer	coastal	Migratory species. Breeds along the west coast of the Hudson Bay, on Southampton and Coats Island and on the southern end of Baffin Island in Nunavut.	No status	Not assessed	No	✔	
Semi-palmated sandpiper	*Calidris pusilla*	summer	coastal	Migratory species. Breeds in in the Hudson Bay including Southampton Island, Coats Island and the southern end of Baffin Island.	No status	Not assessed	No	✔	

Table B-2: Overview of Seabird Species Potentially Present within the Local and Regional Study Areas

Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Least sandpiper	*Calidris minutilla*	summer	coastal	Migratory species. Common breeder on the mainland shores of Hudson Bay south of Chesterfield Inlet in the west and Inukjuak in the east	No status	Not assessed	No	✔	
White-rumped sandpiper	*Calidris fuscicollis*	summer	coastal	Migratory species that breeds on the southern tip of Baffin Island and on the northwestern side of the Hudson Bay.	No status	Not assessed	No	✔	
Baird's sandpiper	*Calidris bairdii*	summer	coastal	Migratory species that breeds on the northern end of Baffin Island and in the coastal areas of the northern Foxe Basin.	No status	Not assessed	No	✔	
Pectoral sandpiper	*Calidris melanotos*	summer	Coastal	Migratory species that breeds along the northwest coast of the Hudson Bay, on Southampton and Coats islands in Nunavut.	No status	Not assessed	No	✔	
American golden plover	*Pluvialis dominica*	summer	Coastal	Migratory species that breed along the shores of Hudson Bay and James Bay and Southampton Island.	No status	Not assessed	No	✔	
Semi-palmated plover	*Charadrius semipalmatus*	summer	Coastal	Migratory species that breed along the shores of Hudson Bay and James Bay.	No status	Not assessed	No	✔	
Black-bellied plover	*Pluvialis squatarola*	summer	Coastal	Migratory species that breeds on the shores of northern Hudson Bay and Southampton Island.	No status	Not assessed	No	✔	
Ruddy turnstone	*Arenaria interpres*	summer	Coastal	Migratory species that breeds on the southern end of Baffin Island, along the coastal areas of the northern Foxe Basin and on Southampton Island and Coats Island.	No status	Not assessed	No	✔	

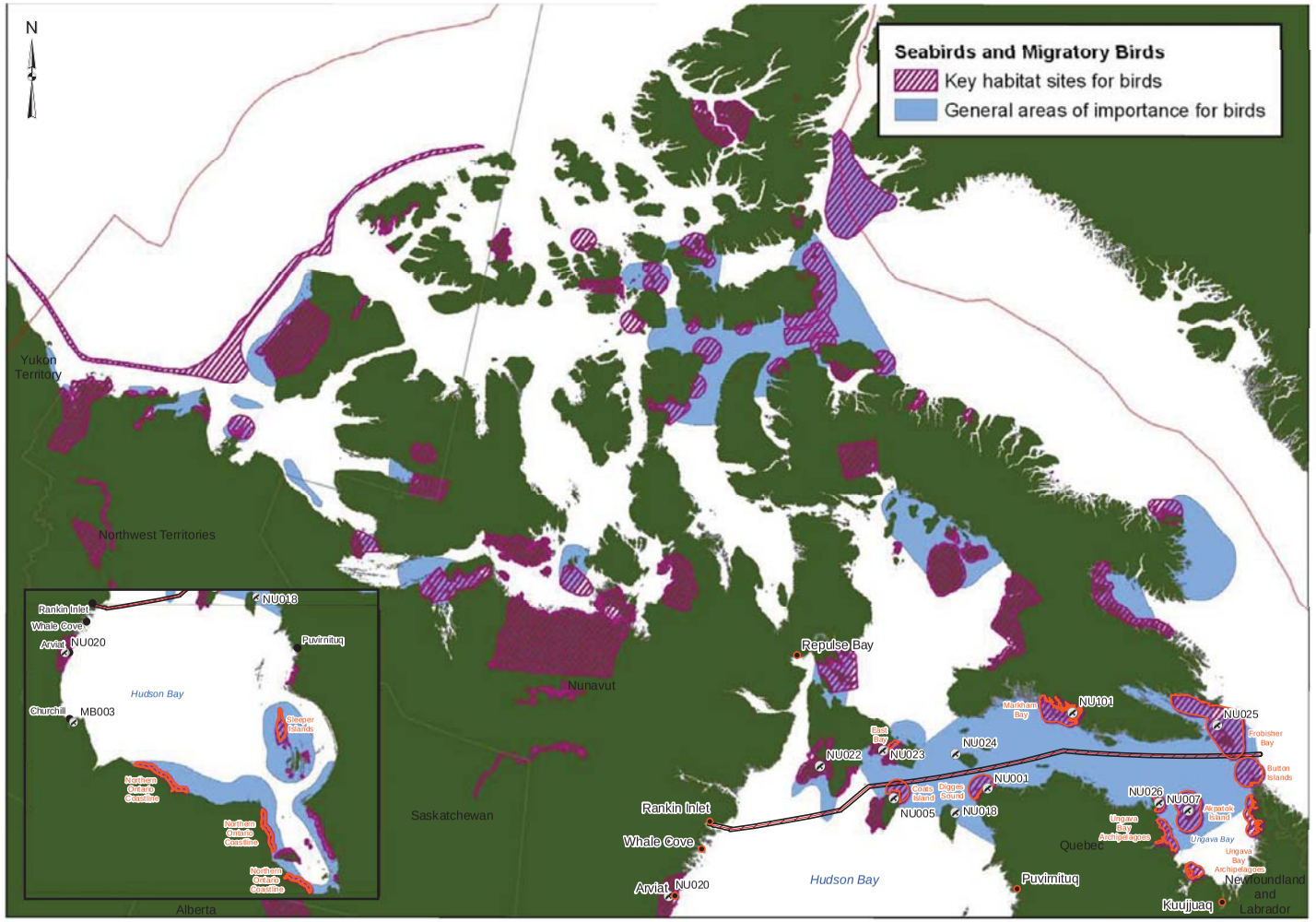
Table B-2: Overview of Seabird Species Potentially Present within the Local and Regional Study Areas

Common Name	Species	Seasonal Occurrence	Distribution	Other Relevant Information	SARA Status[a]	COSEWIC Status[b]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Sanderling	*Calidris alba*	spring / summer	Coastal	Migratory species. Common spring migrant along the coast near Churchill en-route to its breeding grounds in the Arctic.	No status	Not assessed	No	✔	
Red knot	*Calidris canutus*	summer	Coastal	Migratory species. Hudson Bay ecosystem provides critical resources for this species.	EN-*rufa ssp.* (schedule 1) SC-*islandica ssp.* (schedule 1)	EN-*rufa ssp.* SC-*islandica ssp.*	No	✔	
Peregrine falcon	*Falco peregrinus tundrius*	summer	coastal	Breed and hunt along the coasts of Hudson Bay and James Bay in summer. Breed in areas with high to moderate relief along the Hudson Bay coast of Manitoba, Nunavut, and northern Quebec and on Southampton, Coats and the Belcher and Nastapoka islands	SC (Schedule 1)	SC	No	✔	
Snowy owl	*Bubo scandiacus*	summer	coastal	Breed and forage along the coasts of Hudson Bay and James Bay	No status	Not at risk	No	✔	

[a] SARA (Species at Risk Act). The Act is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity (extracted from SARA 2012).

[b] COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. It is up to Government to legally protect wildlife species designated by COSEWIC. The potential impacts of legal listing are for Government to analyse, and the *Species at Risk Act* (SARA) applies only to wildlife species on the SARA legal list (extracted from COSEWIC 2012).

EN=Endangered, TH=Threatened, SC = Special Concern



LEGEND

- IMPORTANT BIRD AREAS
- COMMUNITY
- KEY MARINE HABITAT AREAS FOR MIGRATORY BIRD
- MARINE REGIONAL STUDY AREA (MARINE RSA)

ID#	Important Bird Areas
NU022	Harry Gibbons Migratory Bird Sanctuary (federal)
MB003	Wapusk National Park (federal)
NU005	Cape Pembroke
MB013	Seal River Estuary Heritage River (federal)
NU020	McConnell River Migratory Bird Sanctuary (federal) & Ramsar Site
NU023	East Bay Migratory Bird Sanctuary (federal)
NU024	Fraser Island
NU001	Digges Sound
NU101	Markham Bay Eider Colony
NU026	Eider Islands
NU007	Akpatok Island
NU018	Mansel Island
NU025	Hantzsch Island

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010, IBA 2012
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
KEY HABITAT AREAS FOR MARINE BIRDS

PROJECT NO.	1535029		FILE No.		
DESIGN	KZ	06 Feb. 2014	SCALE AS SHOWN	REV.	0
GIS	MH	06 Feb. 2014			
CHECK	KZ	16 Feb. 2014			
REVIEW	DRW	16 Feb. 2014			

Golder Associates

FIGURE B-8

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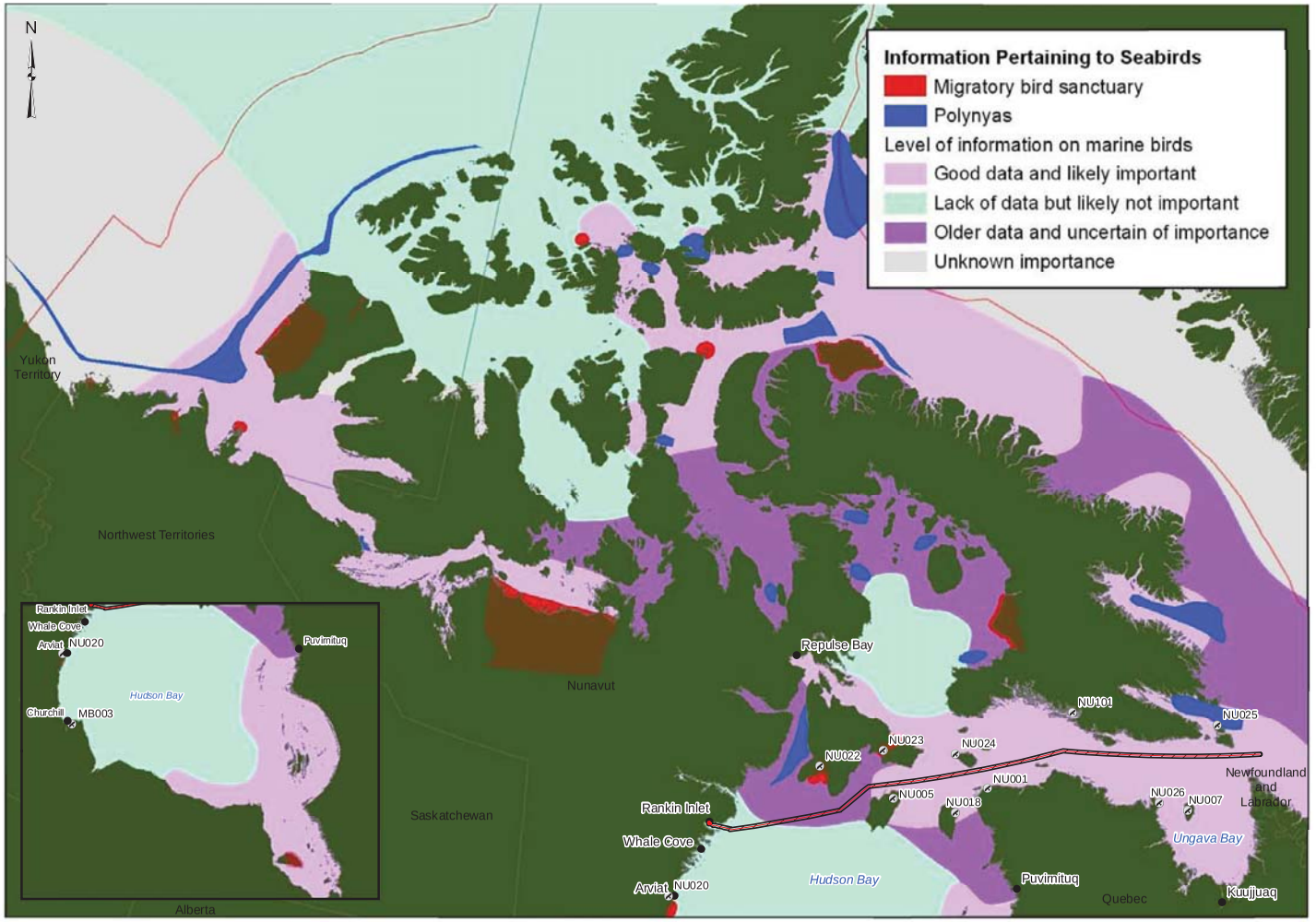


LEGEND

LOCAL STUDY AREA (LSA)

MARINE REGIONAL STUDY AREA (MARINE RSA)

ID#	Important Bird Areas
NU022	Harry Gibbons Migratory Bird Sanctuary (federal)
MB003	Wapusk National Park (federal)
NU005	Cape Pembroke
MB013	Seal River Estuary Heritage River (federal)
NU020	McConnell River Migratory Bird Sanctuary (federal) & Ramsar Site
NU023	East Bay Migratory Bird Sanctuary (federal)
NU024	Fraser Island
NU001	Digges Sound
NU101	Markham Bay Eider Colony
NU026	Eider Islands
NU007	Akpatok Island
NU018	Mansel Island
NU025	Hantzsch Island

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010, IBA 2012
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF MARINE BIRDS AND BIRD HABITAT IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	PR	18 Jan. 2013	FIGURE B-9	
REVIEW	DW	18 Jan. 2013		

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1535029_WL_Tech_Sup\02_PRODUCTION\5000\MXD\Report\1535029_Figure_B-9_Distribution_of_Birds.mxd

Hudson Bay / Hudson Strait provides key breeding habitat for numerous species, including many birds that are primarily Arctic breeders and others that are rarely seen in breeding condition outside the Arctic Islands. The only species listed under the SARA with the potential to occur in the RSA are the Ross's gull and the ivory gull (listed as Threatened and Endangered under Schedule 1 of SARA, respectively) (Table B-2). Those bird species identified as having special ecological or cultural importance, or holding special conservation status, with home ranges overlapping with the RSA are identified in Table B-2.

Three designated migratory bird sanctuaries occur along the shorelines of Hudson Bay / Hudson Strait: one south of Arviat in western Hudson Bay (McConnell River), and 2 on Southampton Island in northern Hudson Bay (Harry Gibbons and East Bay). Although these sites are generally a fair distance from the proposed shipping route, birds do forage offshore to considerable distances and may be vulnerable to impacts associated with shipping activities. For instance, hundreds of thousands of thick-billed murre fledglings migrate with molting adults from colonies in Hudson Strait (Hantzsch Island and Digges Sound) to Newfoundland by swimming, while those that nest on Akpatok Island overwinter west of the Belcher Islands.

Approximate densities of seabirds in the RSA during late summer / early fall have been identified by means of vessel-based seabird surveys undertaken in Hudson Bay and Hudson Strait in 2005 as part of the 2005 ArcticNet expedition (McKinnon et al. 2009). Mean seabird density indices were highest in Hudson strait (8.3 ± 1.9 birds/km^2) and lowest in southern Hudson Bay (0.36 ± 0.2 birds/km^2). Where mean density indices were high, sightings were dominated by northern fulmars or dovekies (or both). The results suggest that several seabird populations that migrate eastward through Hudson Strait converge at the eastern mouth of the Hudson Strait, thus representing a major staging area for migrant seabirds during September and October, particularly for northern fulmar, dovekie, and thick-billed murre.

In Hudson Strait, the mean density index of seabirds sighted within transects (both sitting on the sea and in flight) was 8.3 ± 1.9 birds/km^2. The species most commonly documented sitting on the sea were northern fulmar (65.8% of sightings) and dovekie (14.2%). The species most commonly documented in flight were Dovekie (48.3% of sightings) and northern fulmar (38.7%). Other species sighted (sitting on the sea and in flight) included, in order of abundance, thick-billed murre, black-legged kittiwake, glaucous gull, common eider and black guillemot (McKinnon et al. 2009).

In Hudson Bay, the mean density index of seabirds within transects (both sitting on the sea and flying) was 0.36 ± 0.2 birds/km^2. Species sighted sitting on the sea included thick-billed murre, herring gull, and glaucous gull. The species most commonly documented in flight were Canada goose (36.4% of sightings) and herring gull (23.6%). Other species sighted in flight included, in order of abundance, thick-billed murre, northern fulmar, black guillemot, black-legged kittiwake, glaucous gull, common eider, and long-tailed duck (McKinnon et al. 2009).

1.3.2.3 Marine Mammals

There are 11 species of marine mammals potentially present within the RSA for variable periods of time and at different times throughout the year (Table B-3). This includes 4 species of cetaceans (3 toothed whales and one baleen whale), 6 species of pinnipeds (seals and walrus), and the polar bear. Narwhal (*Monodon monoceros*), beluga (*Delphinapterus leucas*), and bowhead whales (*Balaena mysticetus*) are known to overwinter in Hudson Strait and in polynyas within Hudson Bay. Atlantic walrus (*Odobenus rosmarus rosmarus*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), and harbour seal (*Phoca vitulina concolor*) are year-round residents to at least portions of Hudson Bay. Polar bears are also common in the RSA, entering the pack-ice in early November following their denning season but retreat to coastal areas during the summer ice-free season. The remainder of marine mammals identified in Hudson Bay / Hudson Strait are migratory and seasonal visitors, limited largely by the presence of solid land-fast ice throughout the winter and spring. There is a pronounced geographic bias on the distribution of several species within Hudson Bay; for example, belugas are strongly associated with the western part of Hudson Bay with substantial attraction to estuaries such as the Churchill River. Table B-4 provides a summary of marine mammal species harvested throughout the year by Coastal Inuit communities in Nunavut. An overview on the biology of each marine mammal species potentially present in, or in the vicinity of, the RSA is provided below.

Table B-3: Overview of Marine Mammal Species Found within the LSA and RSA

Common Name	Species	Seasonal Occurrence	Habitat	SARA Status[(a)]	COSEWIC Status[(b)]	Of Cultural, Economic or Subsistence Importance	LSA	RSA
Ringed seal	*Pusa hispida*	Year-round	Shore-fast ice and pack-ice	No Status	Not at Risk	Yes	✔	✔
Harp seal	*Pagophilus groenlandica*	Open-water season (July-Sept)	Pack-ice	No Status	Not assessed	Yes	✔	✔
Bearded seal	*Erignathus barbatus*	Year-round	Pack-ice	No Status	DD	Yes	✔	✔
Harbour seal	*Phoca vitulina concolor*	Year-round	Coastal terrestrial areas and edge of shore-fast ice	No Status	Not assessed	Yes	✔	✔
Hooded seal	*Cystophora cristata*	Open-water season (July-Sept)	Pack-ice	No Status	Not assessed	Yes	✔	
Atlantic walrus	*Odobenus rosmarus*	Year-round	Pack-ice or coastal waters during summer; floe-edge / polynyas during winter	No Status	SC	Yes	✔	✔
Polar bear	*Ursus maritimus*	Year-round	Spring: shore-fast ice; Summer: coastal areas and inland; and Winter: shore fast-ice and coastal areas for denning	SC (Schedule 1)	SC	Yes	✔	✔
Beluga whale	*Delphinapterus leucas*	Winter (Nov-May) and Summer	Spring: ice-edges/leads; Summer: shallow coastal areas (around Southampton Island and western Hudson Bay); Fall: deep water (foraging); Winter: offshore pack-ice (Hudson Strait)	No Status	EN	Yes	✔	✔
Narwhal	*Monodon monoceros*	Year-round	Winter: deep water / edge of banks; Summer: fjords / coastal waters	No Status	SC	Yes	✔	✔
Bowhead whale	*Balaena mysticetus*	Winter (Feb-Jun)	Spring : along the ice-edge; Summer: open-water /pack-ice; Winter: heavy pack-ice	No Status	SC	Yes	✔	✔
Killer whale	*Orcinus orca*	Jun-Aug	Coastal / offshore	No Status	SC	No	✔	✔

(a) SARA (*Species at Risk Act*). The Act is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity (extracted from SARA 2012).

(b) COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. It is up to Government to legally protect wildlife species designated by COSEWIC. The potential impacts of legal listing are for Government to analyse, and the Species at Risk Act (SARA) applies only to wildlife species on the SARA legal list (extracted from COSEWIC 2012).

EN=Endangered, SC=Special Concern, DD=Data Deficient

Table B-4: Marine Mammal Species Harvested Throughout the Year by Coastal Inuit Communities in Nunavut

Target Species	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Ringed seal	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Bearded seal	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Harp seal	✔			✔		✔	✔	✔	✔	✔	✔	
Hooded seal							✔	✔	✔	✔	✔	✔
Harbour seal							✔	✔	✔	✔	✔	
Walrus	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Beluga	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Narwhal	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Bowhead								✔				
Polar bear	✔	✔	✔	✔	✔					✔	✔	✔

Source: Priest and Usher (2004)

Ringed seal (*Phoca hispida*)

The ringed seal has a circumpolar distribution that is closely associated with the distribution of land-fast ice. This species occurs at the southern limit of their range in Hudson Bay where it is present year-round (Mansfield 1967; Stewart and Lockhart 2005). Ringed seals are the most abundant and widespread seal in the Arctic; however, their numbers in western Hudson Bay declined between 1995 and 2010 based on annual aerial surveys conducted during spring/summer (Lunn et al. 2000; Vincent-Chambellant 2010; Ferguson and Young 2011). The results of two DFO aerial surveys in 2007 and 2008 indicate the relative density of ringed seals in western Hudson Bay falls in the range estimated in previous years and is consistent with estimates derived from surveys conducted in other Arctic areas (DFO 2009). In western Hudson Bay, density estimates for ringed seals varied greatly from year to year and there is inter-annual variation widely reported in the literature for the density of ringed seals hauled-out on the ice (DFO 2009). In 2007 and 2008, ringed seal relative densities in western Hudson Bay were estimated at 0.92 ±0.07 seal/km^2 and 0.44±0.05 seal/km^2 respectively with an abundance of 73170±5440 and 33701±3704 individuals respectively (DFO 2009)... Several factors, in addition to an actual change of seal abundance, could contribute to inter-annual variation including: ice type and conditions, water depth, temperature, wind speed and cloud cover, and time of the day and year could potentially affect ringed seal presence, haul-out activity and detectability (DFO 2009). DFO (2009) notes that many ringed seals may not have been available for detection in 2008 relative to 2007, and a declining population might not be an accurate interpretation of results.

The ability of ringed seals to maintain breathing holes in the land-fast ice enables them to occupy large areas that are inaccessible to other marine mammals except during the summer. During winter, their preferred habitat consists of ice leads and polynyas where breathing holes are easiest to maintain. In spring, breeding adults occur in highest densities in areas of stable land-fast ice with good snow cover where they maintain birth lairs for pup rearing (Hamill and Smith 1991), whereas non-breeders occur at the floe edge or in the moving pack-ice (Stewart and Lockhart 2005). Pups are born in early spring (March/April) and weaned prior to break-up of the sea-ice in late June (Evans and Raga 2001). Pups will remain in subnivean[5] dens during a 5 to 8 week lactation

[5] situated or occurring under the snow

period to avoid detection from predators such as polar bears (Evans and Raga 2001). During the open-water season (July-Sept), ringed seals are commonly observed hauled-out on the sea-ice in large numbers. Juveniles may move offshore at this time, but adults remain around islands and within the bays and fiords (McLaren 1958a; Dunbar and Moore 1980). As such, seals are unlikely to occur in large numbers in the proposed offshore shipping corridor during summer.

Figure B-10 provides an overview of ringed seal distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.

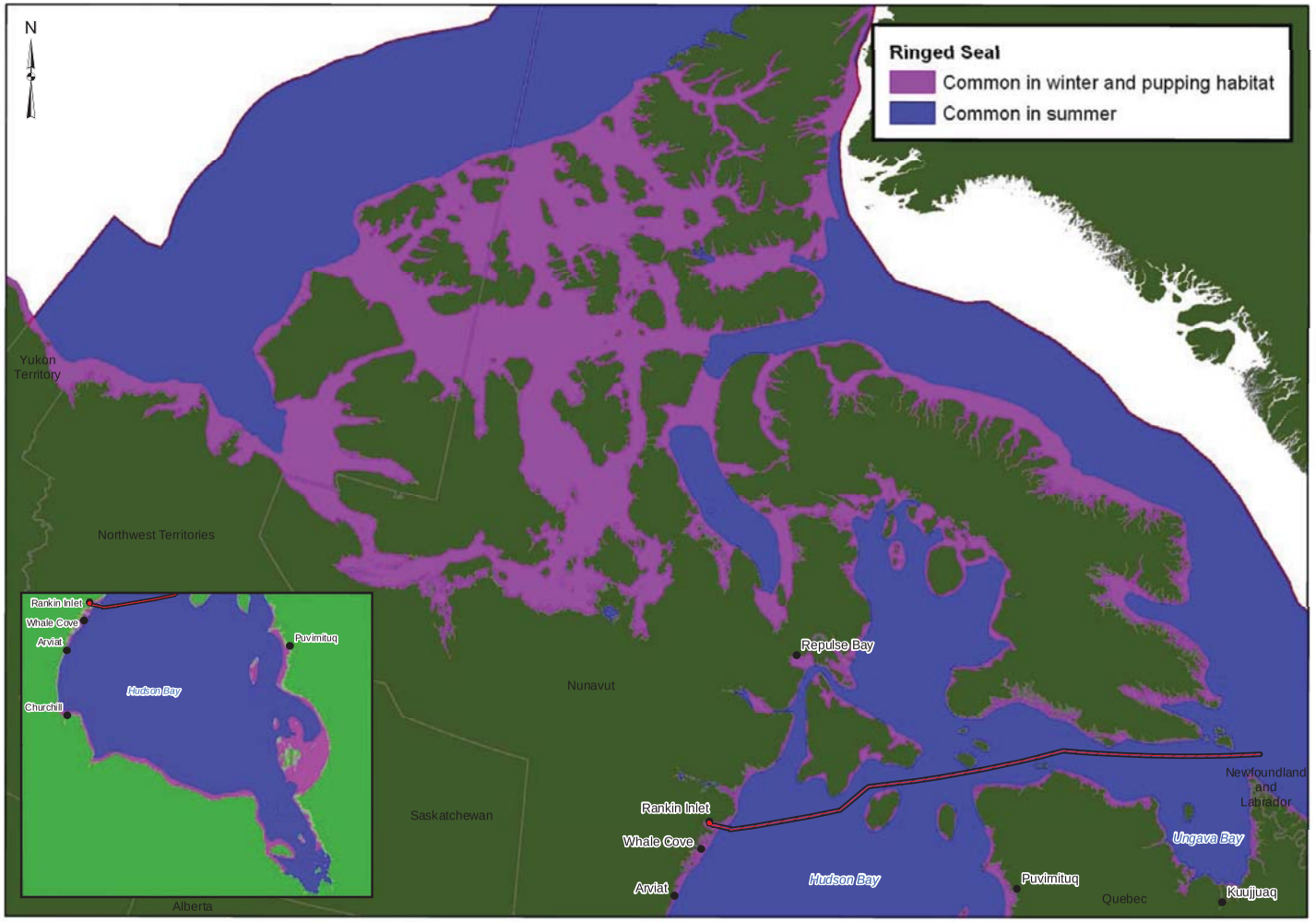
Ringed seals are considered a keystone species[6] (Ferguson et al. 2005), as both adults and pups are an important food source for polar bears (Smith et al. 1991). Other predators include Arctic fox, walrus, wolves, humans, and dogs (Hammill and Smith 1991). Juvenile ringed seals prey mainly on crustaceans under the ice, whereas adults prey on crustaceans and small fish (e.g., Arctic cod) (Richard 2001). This species serves as the main target of the Coastal Inuit subsistence hunt, with all communities in Nunavut (28 out of 28) actively harvesting this species (Priest and Usher 2004). The number of ringed seals harvested in Rankin Inlet is variable, ranging from 55 to 356 animals over a 5 year period (Priest and Usher 2004). The meat is considered a staple of the local diet, and seal hides are used for clothing and sold commercially. Concerns have been raised over possible declines in ringed seal abundance in western Hudson Bay, as indicated by Inuit traditional knowledge, due to reduced pregnancy rate (Stirling 2005), reduced pup survival and recruitment (Holst et al. 1999; Ferguson et al. 2005), later age of maturation and older age structure (Vincent-Chambellant 2010), and increased number of polar bears (Regehr et al. 2007).

Bearded seal (*Erignathus barbatus*)

Bearded seals are large, solitary seals, which have a circumpolar distribution in Arctic and sub-Arctic waters (Mansfield 1967). This species is sparsely distributed throughout their range, and are most abundant in areas where they have access to sea-ice upon which to haul-out, and in shallow water depths where they can access the seafloor (typically <200 m; Kingsley et al. 1985) to feed on crustaceans, molluscs, and fish (e.g., Arctic cod, polar cod, sculpin) (Burns and Frost 1979; Finley and Evans 1983). They are commonly found along continental shelf areas associated with high benthic productivity.

Since this species has only a limited capability to maintain breathing holes in solid ice, they are generally excluded from areas of land-fast ice during much of the year (e.g., High Arctic Archipelago) and are mostly found amongst the pack-ice where the surface is always accessible (Burns et al. 1981). As such, bearded seals move with the receding and forming ice, often travelling considerable distances to the north (seawards) in the summer and back south in the winter (Gilchrist and Robertson 2000). Studies of their general distribution have led to adopt the 250 m benthic contour interval as a measure to delineate the area in which bearded seals are commonly seen (Stephenson and Hartwig 2010). Figure B-11 provides an overview of bearded seal distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.

[6] a keystone species is a species that plays a critical role in maintaining the structure of an ecological community and whose impact on the community is greater than would be expected based on its relative abundance or total biomass



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

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KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF RINGED SEAL (*Phoca hispida*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	19 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-10**	
REVIEW	DW	18 Jan. 2013		

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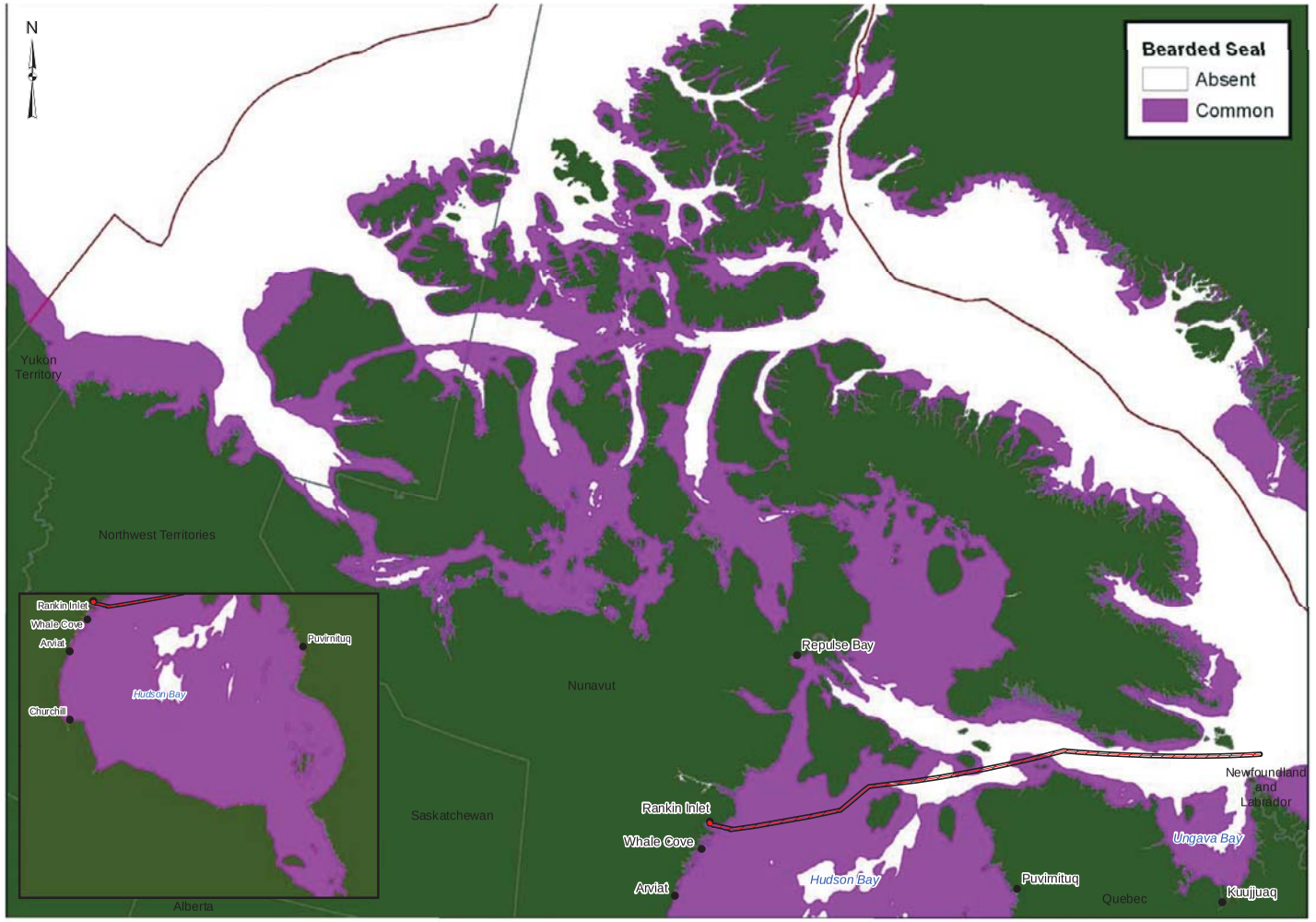

LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF BEARDED SEAL (*Erignathus barbatus*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.		1535029	FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-11**	
REVIEW	DW	18 Jan. 2013		

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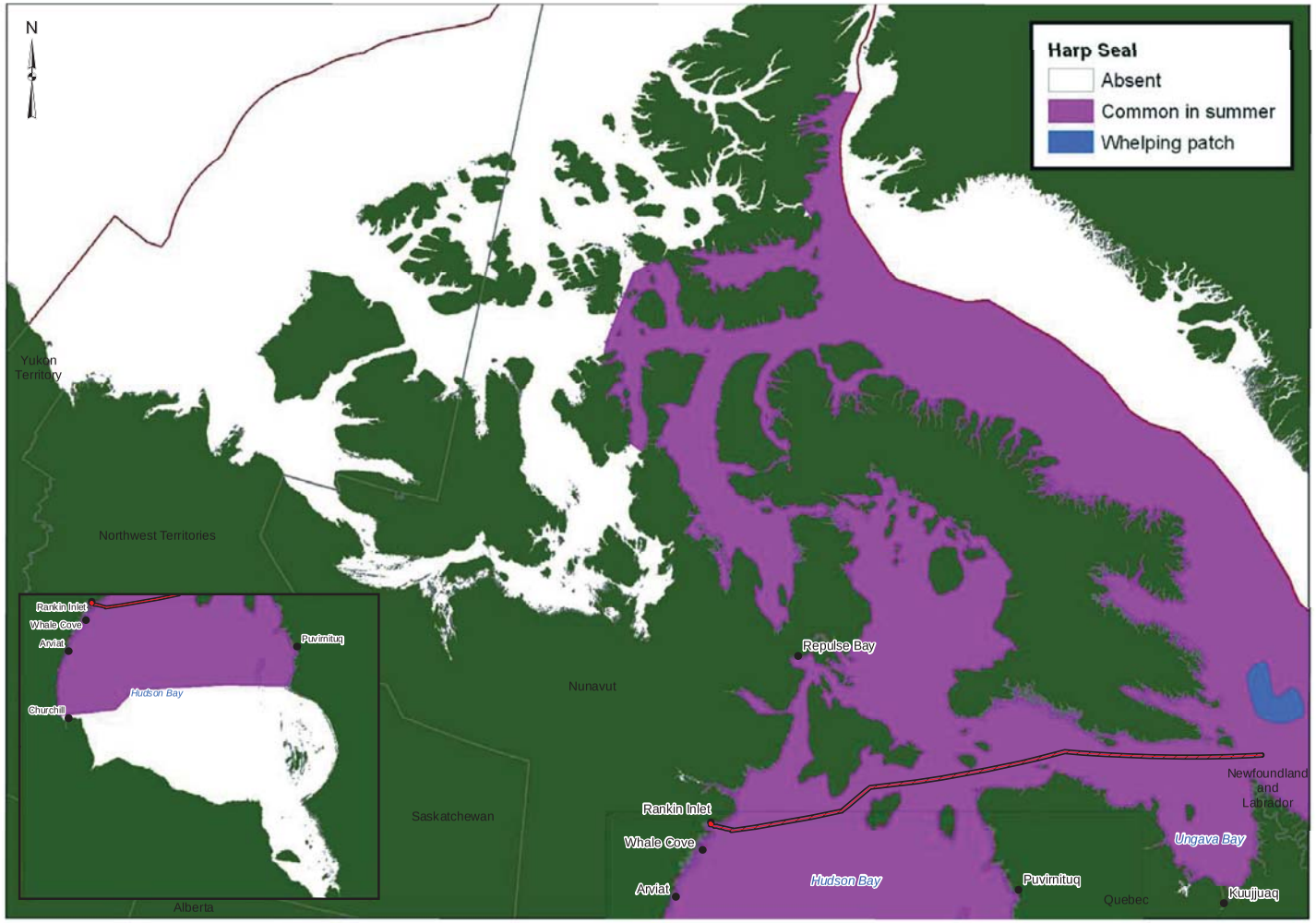
Bearded seal pups are born in late April on the ice, weaned approximately 12 to 18 days later, and then abandoned (Evans and Raga 2001). Mating occurs in the water shortly after weaning, and involves a 2-month delayed uterine implantation period. Both males and females mature around 6 years of age and reproduce biannually until 20 to 30 years of age (Evans and Raga 2001). Males actively vocalize underwater during the breeding season, with calling behaviour associated with territorial or mating displays (Richardson et al. 1995a). Bearded seals are estimated to number approximately 100 000 in the Canadian Arctic, and are especially abundant in Hudson Strait, Foxe Basin, and along the west coast of Hudson Bay (Mansfield 1967; Davis et al. 1980). The main predators of the bearded seal are polar bears and humans. This species is harvested throughout the year by virtually all coastal Inuit communities in Nunavut (27 of 28) (Furgal et al. 2002; Hovelsrud et al. 2008; Priest and Usher 2004), with hunting taking place from July to October. The meat is consumed and the tough flexible hide is used for harpoon lines, dog harnesses, whips, boot soles, and to cover boats called Umiak (Richard 2001). No Total Allowable Catch (TAC) limits exist for bearded seal in Nunavut. Population trends are listed as unknown by DFO (DFO 2015) and COSEWIC defines the status of bearded seals as 'Data Deficient' (DFO 2015)

Harp seal (*Pagophilus groenlandicus*)

The harp seal is a widespread species found in the northern Atlantic and Arctic oceans (Sergeant 1976). Their range includes northern Hudson Bay, Foxe Basin, Baffin Island, Davis Strait, Gulf of St Lawrence, Newfoundland, southern Greenland, Iceland, northern Norway, the White Sea, the Barents Sea, and the Kara Sea. Three distinct genetic populations are recognized: the Northwest Atlantic stock, the Greenland Sea stock, and the White Sea stock. Genetic evidence demonstrates that little gene flow occurs between the 3 stocks (Perry et al. 2000). Harp seals in Hudson Bay / Hudson Strait belong to the Northwest Atlantic stock and are only present in the RSA from ice break-up in early June until just before freeze-up (early October), at which point they migrate east outside the NSA and into the Gulf of St. Lawrence. Thus, impacts to harp seals due to the Project have the potential for transboundary effects. Harp seals are less common than ringed or bearded seals, but may have been more numerous and widespread in the past and may be re-occupying their former range (Stewart and Lockhart 2004). Figure B-12 provides an overview of harp seal distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.

During spring (late February to April), female harp seals aggregate on the pack-ice along the southeast coast of Labrador ('Front') and in the Gulf of St. Lawrence where they form dense and highly-synchronized "whelping herds" and give birth to a single pup. Pups are nursed for 12 days, after which they remain fasting on the pack-ice for approximately 2 weeks before entering the water to feed (Lavigne and Kovacs 1988; Lydersen and Kovacs 1996). Adult females attain sexual maturity at 4 to 6 years of age (Frie et al. 2003). Reproductive maturity occurs in males at about 8 years of age. Towards the end of lactation, females come into estrus and mate (Lavigne and Kovacs 1988). Gestation lasts about one year, including a 3 to 4 month period of delayed implantation (Stewart et al. 1989). The life span of harp seals is approximately 20 to 30 years. Both males and females are sexually active until the ends of their lives, showing no evidence of reproductive senescence (Ronald and Healey 1981).



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF HARP SEAL (*Pagophilus groenlandica*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.		1535029	FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Jul. 2012		
CHECK	PR	18 Jan. 2013	FIGURE B-12	
REVIEW	DW	18 Jan. 2013		

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1535029_WL_Tech_Sup\02_PRODUCTION\5000\MXD\Report\1535029_Figure_B-12_Distribution_of_Harp_Seal.mxd

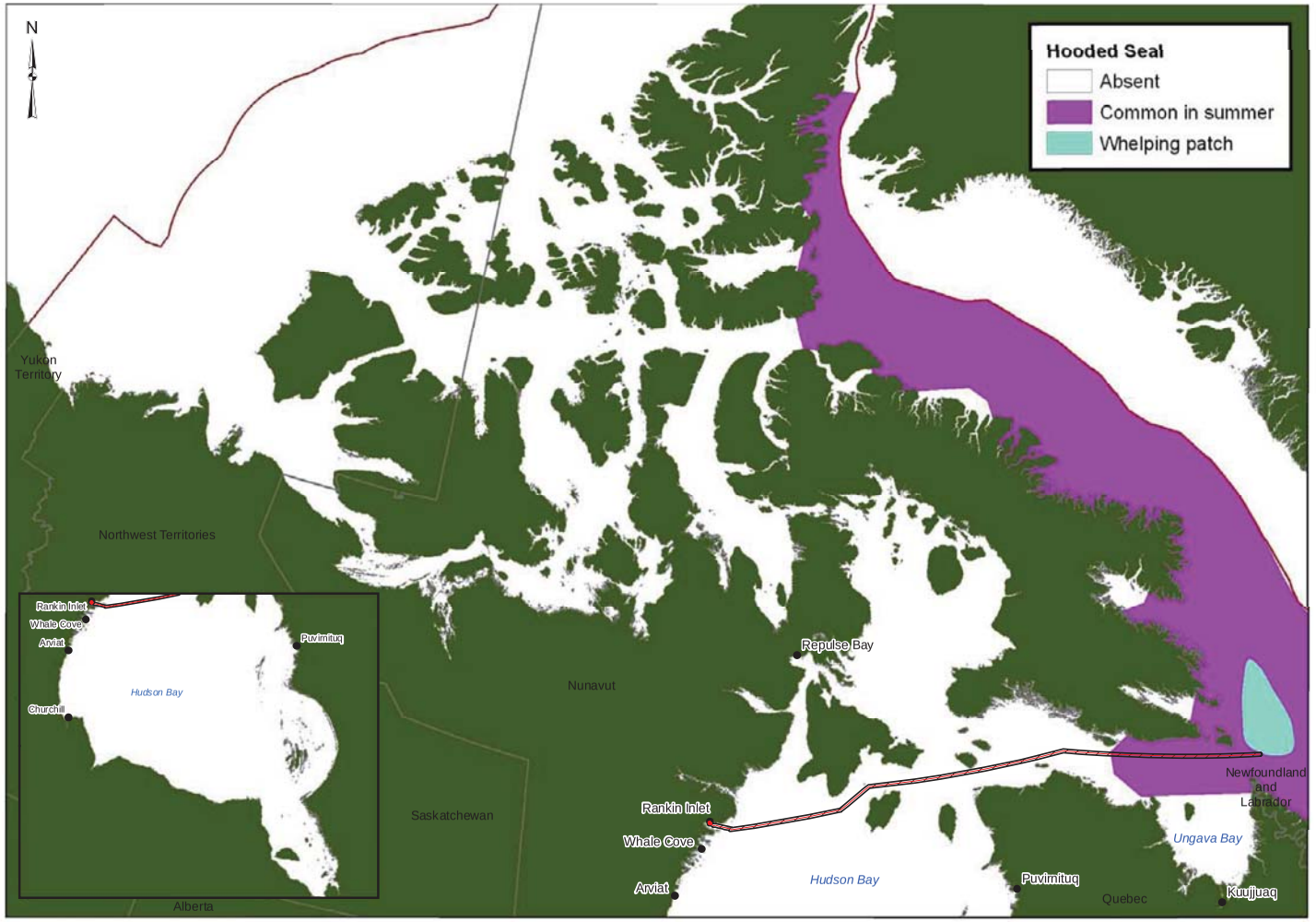
Harp seals undergo a moult in the post-breeding months, from early April to early May (Lavigne and Kovacs 1988). They are a highly social species that travel and forage in groups. The Northwest Atlantic population is highly migratory; after breeding, individuals follow the pack-ice up the coast of Labrador and spend the summer feeding in Baffin Bay, with small numbers entering Hudson Bay and Hudson Strait around Baffin Island before returning south to the Gulf of St. Lawrence during autumn, resulting in an annual migration of over 5000 km (Lavigne and Kovacs 1988). Natural predators of harp seals include polar bears, killer whales, Greenland shark, and humans (Lavigne and Kovacs 1988). Harp seals consume a wide range of fish and invertebrate prey that varies along their migration route (Lavigne 2002). Fish prey includes capelin, Arctic cod, Atlantic cod (Gadus morhua), Atlantic herring (Clupea herringus), and redfish (Sebastes sp.) (Lawson et al.1995). Pups and juveniles prey primarily on crustaceans, particularly euphausiids and amphipods (Haug et al. 2000; Nilssen et al. 2001).

The harp seal global population is presently estimated at 8 million individuals, with pup production at 1.4 million pups per year (Stenson et al. 2003; Potelov et al. 2003; Haug et al. 2006). The Northwest Atlantic stock is estimated to number 5.9 million individuals (DFO 2005a). This is a marked recovery from an estimated low of around 1.8 million recorded in the early 1970s (Sergeant 1976) linked to a population crash from overharvesting. This led to the near cessation of hunting and the gradual recovery of this stock. Catch levels have increased repeatedly during the last decade, with the Canadian and Greenland hunt now presently the largest marine mammal harvest in the world (DFO 2007). As of 2011, the Northwest Atlantic harp seal population was at the highest levels observed since monitoring began almost 60 years ago. Pup production in 2008 was on the order of 1.63 million animals with a total population size of around 8.0 to 8.7 million animals increasing to 8.6 to 9.6 million animals in 2010 (Hammill and Stenson 2011).According to Hammill and Stenson (2011) the likelihood that the population is no longer growing exponentially needs to be considered further, particularly within the context of levels of carrying capacity (K) to understand the dynamics of the population. It is important to note however, there is some uncertainty associated with reproductive rates and how density dependence is expressed in the models used to predict these population trends (DFO 2012). The 2010 assessment assumed that reproductive rates would remain high, predicting a population between 8.61 to 9.55 million animal (95% CI 7.80 to 10.80 million; DFO 2012). However, since 2008 reproductive rates have declined resulting in a 2012 population estimate of 7,700,000 (95% CI=6,900,000-8,400,000). The current population of Northwest Atlantic harp seals is estimated to have declined slightly since 2008; nevertheless it is near its highest level since the mid-19th Century (DFO 2012).

This species is hunted throughout Nunavut primarily during the months of June through September (Priest and Usher 2004), with pups representing the majority of the harvest. Both meat and blubber are consumed, and the pelts are sold commercially. Subsistence harvests are currently not regulated, but the commercial harvest is regulated by the 2011 to 2015 Integrated Fisheries Management Plan for Atlantic Seals. Seals are also caught incidentally in fishing gear (DFO 2012). DFO sets TACs within a 3-year period for the Northwest Atlantic population. In addition to Canada's commercial harvest, some harp seals are still taken in subsistence hunts in Labrador, Newfoundland, northern Quebec, and in Nunavut. Aboriginal peoples and non-Aboriginal coastal residents who reside north of latitude 53 degrees can hunt seals for subsistence purposes without a permit (DFO 2006b). Between 1983 and 1995, Canadian catches of Northwest Atlantic harp seals averaged approximately 52,000 seals per year, with catches increasing significantly to a range of 226,000 to 366,000 between 1996 and 2006 (DFO 2012). Since 2007 Canadian catches have declined significantly with DFO (2012) reporting a catch of 40,370 in 2011. Catches in the Canadian Arctic remains low at under 1,000 Northwest Atlantic harp seals per year (DFO 2012).

Hooded seal (*Cystophora cristata*)

The hooded seal occurs throughout much of the North Atlantic and Arctic Oceans (King 1983) preferring deeper water and occurring farther offshore than harp seals (Sergeant 1976; Campbell 1987; Lavigne and Kovacs 1988; Hammill and Stenson 2006). They are a highly migratory species, and are considered a rare visitor to Hudson Bay / Hudson Strait (Stewart and Lockhart 2004). Thus, impacts to hooded seals due to the Project have the potential for transboundary effects. As primarily deep-water feeders, the 200 m bathymetric contour interval has been adopted to estimate the offshore distribution boundary of this species (Stephenson and Hartwig 2010). Figure B-13 provides an overview of hooded seal distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. They are generally associated with heavy pack ice, and their presence would extend until ice break-up (Sergeant 1974).



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF HOODED SEAL (*Cystophora cristata*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Jul. 2012		
CHECK	PR	18 Jan. 2013	FIGURE B-13	
REVIEW	DW	18 Jan. 2013		

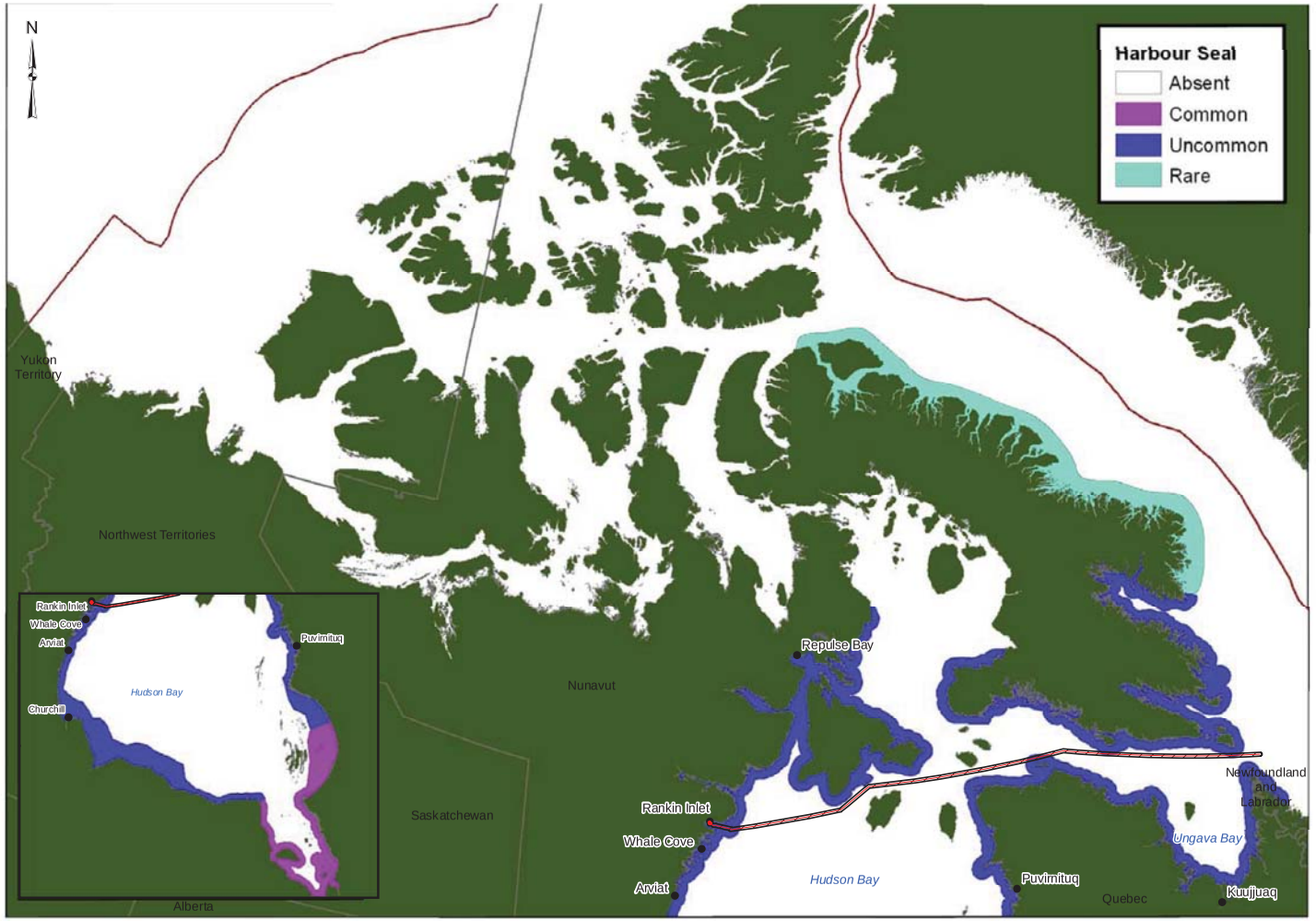
Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1535029_WL_Tech_Sup\02_PRODUCTION\5000\MXD\Report\1535029_Figure_B-13_Distribution_of_Hooded_Seal.mxd

Hooded seals of the Western North Atlantic stock breed synchronously during mid to late March in heavy pack-ice areas off the coast of eastern Canada and around Greenland. Breeding of this population is divided into 4 whelping areas. The “Front” herd (largest of the 4) breeds off the coast of Newfoundland and Labrador, the “Gulf” herd breeds in the Gulf of St. Lawrence, the “Davis Strait” herd breeds between Baffin Island and western Greenland, and the “West Ice” herd breeds in the Greenland Sea near the island of Jan Mayen (Sergeant 1974, 1976; Folkow et al. 1996). These breeding herds are considered to belong to 2 recognized populations (Hammill and Stenson 2006). Seals whelping near Jan Mayen are thought to constitute the Northeast Atlantic population, while hooded seals whelping and breeding in Davis Strait, the Gulf and at the Front are all thought to belong to the Northwest Atlantic population (Hammill and Stenson 2006). The breeding season for this polygamous species is brief lasting only 2 to 3 weeks, with mating taking place in the water (Boness et al. 1988; Kovacs 1990). This species has the shortest lactation period for any mammal, with most pups being weaned in 4 days (Bowen et al. 1987). Hooded seals moult in July, with each breeding stock congregating at separate traditional sites away from the whelping areas. Many seals are reported to migrate to the pack-ice east of Greenland in Denmark Strait at this time (Sergeant 1974, 1976; Folkow et al. 1996). Hooded seals form loose aggregations in specific areas during the breeding and moulting season and generally remain solitary outside this period. Hooded seal life span is approximately 25 to 30 years (Kovacs 2002).

The Northwest Atlantic population has been estimated at approximately 600 000 animals (593 500, +67 200 SE, Hammill and Stenson 2006), of which 90% are estimated to whelp at the Front (Stenson et al. 2006). The DFO 2011 to 2015 Integrated Fisheries Management Plan for Atlantic Seals still estimates the hooded seal herd in the northwest Atlantic to have increased from 478,000 in 1965, to approximately 600,000 animals currently (DFO 2011c). The Northeast Atlantic population is estimated at between 70 000 and 90 000 animals, although there is considerable uncertainty around these estimates due to scarcity of data and limited understanding of the relationships between whelping areas (ICES 2006). Hooded Seals are annually harvested by coastal Inuit of Greenland and Canada for subsistence purposes (Kovacs 2002) and have been commercially hunted at the Front since the late 1800s (Kovacs 2008b). Harvesting occurs primarily during the months of July through December (Table B-5). For the Canadian harvest, the TAC has been set at 10 000 seals per year since 1998 (ICES 2006). For the period 2000-2004, the total estimated catch of hooded seals was 48 188 (Kovacs 2008b). By-catch of hooded seals in coastal net fisheries has been reported from the United States, from trawl fisheries off Norway and Newfoundland, and salmon drift nets used off Greenland (Woodley and Lavigne 1991; Reeves et al. 1992; Waring et al. 2005).

Harbour seal (*Phoca vitulina concolor*)

The harbour seal is the most widely-distributed of all pinnipeds, inhabiting temperate, sub-Arctic and Arctic coastal areas on both sides of the North Atlantic and North Pacific Oceans. As this species does not maintain breathing holes in the ice, their distribution in the RSA is limited to locations where currents maintain open water year-round, typically in freshwater or estuarine rapids, in small coastal polynyas, or at the ice floe edge (Mansfield 1967). Harbour seals are not typically found in offshore waters exceeding 50 m depth (COSEWIC 2007). This depth limitation is supported by radio telemetry studies that have indicated that the 50 m benthic contour line may be used to demarcate their offshore limit of distribution (Stephenson and Hartwig 2010). Figure B-14 provides an overview of their distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. Adults tend to be solitary in the water but haul out in small sedentary groups on rocky shores, where pupping occurs. Harbour seals are harvested by coastal Inuit communities primarily during the period from July through October (Table B-4).



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF HARBOUR SEAL (*Phoca vitulina concolor*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-14**	
REVIEW	DW	18 Jan. 2013		

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Atlantic walrus (Odobenus rosmarus rosmarus)

The walrus (*Odobenus rosmarus*) has a circumpolar distribution and is the largest pinniped occurring in the Canadian Arctic. Individuals inhabiting coastal areas of the RSA belong to the Atlantic stock, 1 of 2 subspecies recognised. Walrus in the Canadian Arctic include two genetic populations, with seven different stocks (DFO 2013). The Baffin Bay (BB), west Jones Sound (WJS) and Penny Strait-Lancaster Sound (PS-LS) stocks comprise the high Arctic population. The central Arctic population is composed of the north and central Foxe Basin (N-FB and C-FB) and Hudson Bay-Davis Strait (HB-DS) stocks (DFO 2013). According to DFO (2013), the relationship between these six stocks and walrus distributed in south and east Hudson Bay (S&E-HB) is currently unknown. Recent aerial and satellite telemetry studies have been used to develop abundance estimates for six of the walrus stocks that make up the high Arctic and central Arctic populations in Canada. Based on those estimates, total allowable removals (TARs) were calculated for each stock using the Potential Biological Removal method (PBR) (DFO 2013). The aerial surveys of walrus haul outs conducted in 2007 to 2011 provided data to enable the calculation of abundance estimates for all stocks, with the exception of the S&E-HB stock (DFO 2013). However, it is likely that individual stock abundance estimates were underestimated due to incomplete survey coverage, inter-annual variability in distribution, and unfavourable weather and ice conditions (DFO 2013).

According to DFO (2013) stock estimates and associated TARs for walrus belonging to the high Arctic population are as follows:

- Baffin Bay stock was estimated at approximately 1,250 walrus in 2009 (based on a count of 571) resulting in an annual TAR of 10 to11 walruses;
- West Jones Sound stock was estimated at 503 (coefficient of variation (CV) = 0.07) walruses in 2008, (based on a count of 404) resulting in an annual TAR of seven or eight walrus; and
- Penny Strait-Lancaster Sound stock was estimated at between 661 (CV = 2.08) and 727 (CV = 0.07) walrus in 2009 (based on a count of 557) resulting in an annual TAR of 10to12 walrus.

However, dividing the harvest of the three stocks that make up the high Arctic population was not possible (DFO 2013). The average annual Canadian reported harvest (reported over 25 years) was approximately 14, less than the combined annual TAR of 27 to 31 walrus (DFO 2013).

The combined population estimates for the north and central Foxe Basin stocks in 2011 ranged from 8,153 (CV = 0.07) to 13,452 (CV = 0.43) animals and was based on counts of 6,043 and 4,484, respectively, using different survey dates and different adjustment factors (DFO 2013). The annual TARs is currently 106 to166 walruses and with a yearly harvest level of approximately 185 animals (DFO 2013). Further investigation into walrus movements within Foxe Basin and exchange with the larger Hudson Bay-Davis Strait stock is required to better understand how and if these stocks interact (DFO 2013).

Walruses from the Hudson Bay-Davis Strait stock summer in the Hoare Bay area on southeast Baffin Island. Population estimates were between 1,420 (CV = 0.07) and 2,533 individuals (CV = 0.17) in 2007 (based on a count of 1,056 animals; DFO 2013). The calculated annual TARs for the Hudson Bay-Davis Strait stock is currently 18 to 38 with local annual harvests of approximately 36 walruses (DFO 2013).

According to DFO (2013), the central Arctic population lacks sufficient data for a meaningful population estimate. Changes in the abundance of the Atlantic walrus population during the past 45 years remain unclear (COSEWIC 2006). Modelling indicates that populations in the Eastern Canadian Arctic have been in steady decline (Witting and Born 2005). The current total abundance of the Atlantic walrus is poorly known, the most recent information suggests a population size of 18,000 to 20,000 individuals (COSEWIC 2006). The population status of Atlantic walrus was recently upgraded to “Special Concern” (COSEWIC 2006). Walruses are harvested year-round by coastal Inuit communities in the Nunavut region (Table B-4; Priest and Usher 2004). Between 1996 and 2001, hunters reported an average annual walrus catch (landed) of 2/year from Arviat, 3/year from Chesterfield Inlet, 5/year from Rankin Inlet and none for the communities of Baker Lake or Whale Cove during that same period (NWMB 2004). Walrus hunting is subject to the terms of the Nunavut Land Claims Agreement and is legislated under the Marine Mammal Regulations of the *Fisheries Act*.

Walrus require large areas of shallow water (<80 m) with substrate that supports a productive bivalve community, the reliable presence of open water over these feeding areas, and suitable ice or land nearby upon which to haul out (Evans and Raga 2001). Atlantic walrus are highly gregarious and are associated with moving pack-ice for most of the year. In Hudson Bay, the paucity of sea-ice during summer forces walrus to haul-out in predictable locations on land. The main concentration of walruses in southern Hudson Bay is in the Belcher Islands (Sanikiluaq) (Figure B-15; DFO 2002). The main concentration of walruses in northern Hudson Bay resides on the northeast side of Coats Island and in Coral Harbour on the southeast side of Southampton Island (Figure B-15; DFO 2002). Walrus in both areas are present year-round with an estimated summer population of 2000 animals. The main concentration of walruses in Hudson Strait resides at Cape Dorset on the Foxe Peninsula (Figure B-15; DFO 2002). Walruses may occasionally haul out at the East Bay Bird Sanctuary on Southampton Island and the Bowman Bay Wildlife Sanctuary on Baffin Island (COSEWIC 2006).The general distribution of walrus and their preference for shallow near shore areas substantially reduces the potential for interaction of walrus with Project vessels in the shipping corridor (RSA). Figure B-16 provides a summary of distribution of haul-outs and areas of known important habitat for Atlantic Walrus in the Marine RSA and Adjacent Arctic Waters.

Walrus are characterized by a highly polygamous mating system, with breeding herds forming in January - April. They are long-lived animals (approximately 40 years) with a low reproductive rate. Females attain reproductive maturity at approximately 5 to 7 years of age, with a typical calving interval of 3 years (Garlich-Miller and Stewart 1999). Males reach sexual maturity at 6 to 10 years of age, although likely cannot successfully compete for females until they are older. Mating takes place in the water, usually from January to April, and pregnancy lasts 15 to 16 months. Females, therefore, can only give birth a maximum of once every 2 years, though it is more commonly 3 years between calves. This results in a pregnancy rate that is much lower than that of other pinnipeds. Walrus calves are born on land or on the pack-ice between late April and early June. The nursing period typically lasts for 2 years, with weaning occurring gradually over this time.

Behavioral responses of walrus to man-made noise are shown to be variable (DFO2002). Aircraft noise has been correlated with evidence of stampedes, with attendant mortality, as well as partial habituation to the noise (Born et al. 1995). Some individuals at haul outs may allow ships to approach quite close while others will react to ships 2 km away (Born et al. 1995). Displacement from haul outs for up to 9 hours has been noted as a result of in-air noise, with females and calves being the most susceptible to this type of disturbance (Salter 1979, Miller 1982). Suitable walrus habitat has been shown to be decreasing as human activities in the north expand

(COSEWIC 2006). Noise disturbance caused by motorized transportation and hunting have caused herds to abandon haul out near communities in favour of less accessible islands and shores (Born et al. 1995).

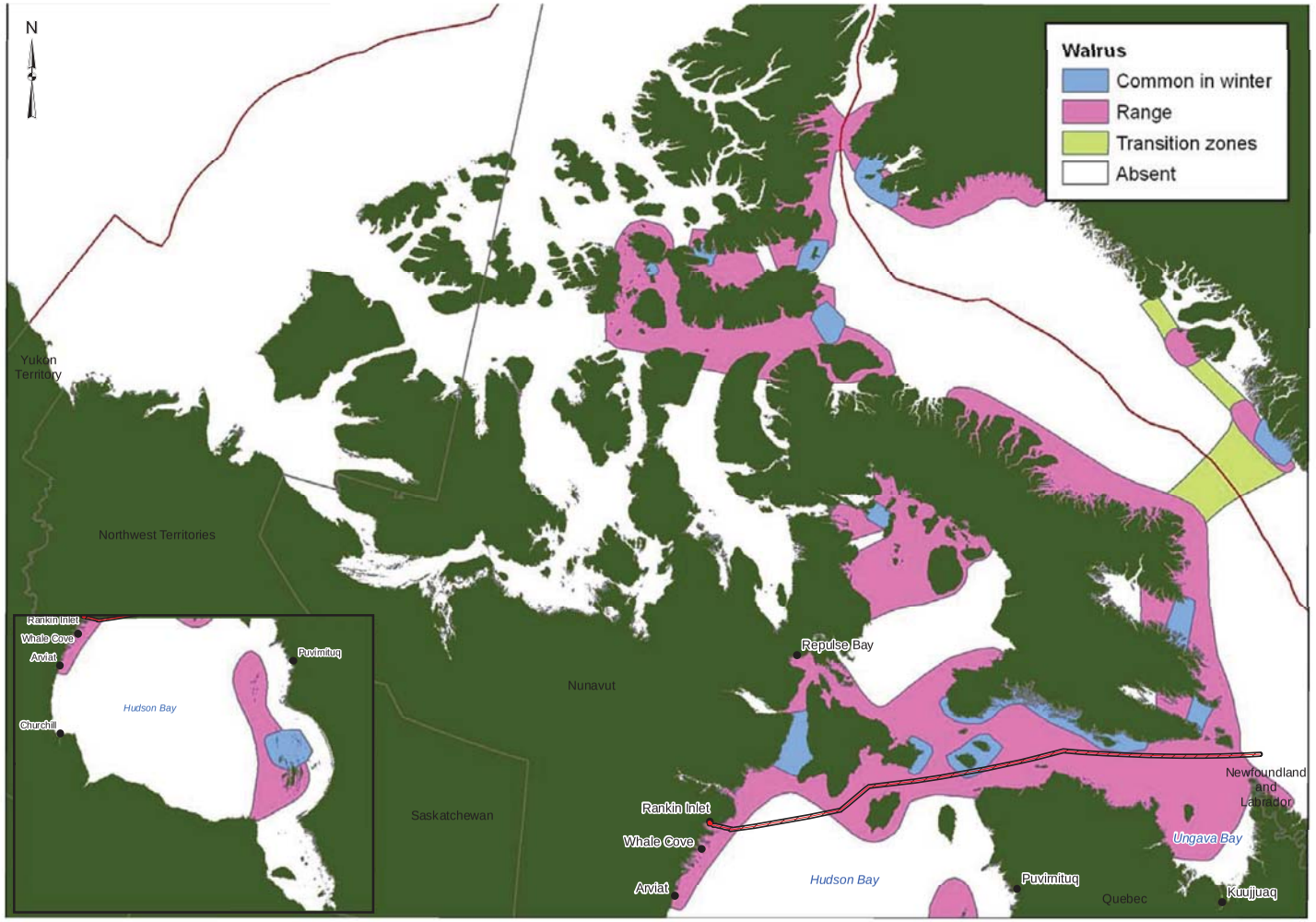
Interviews were conducted with Inuit hunters from Coral Harbour and Cape Dorset to document their knowledge regarding the seasonal distribution and abundance of walruses in northern Hudson Bay and western Hudson Strait (Orr and Rebizant 1987). Harvesters for Coral Harbour noted that during the winter, walruses were found along the floe edge from Leyson Point to Hut Point, with sightings of usually less than 100 walruses (Orr and Rebizant 1987). At the floe edge of Ruin Point, as many as 1,000 walruses have been noted, although usually sightings were around 500 individuals. Reports of sightings of 500 walrus at South Bay were also shared (Orr and Rebizant 1987). In the spring walrus were primarily noted in the area of South Bay, between Native Point and Ruin Point, with most sightings consisting of groups less than 100 individuals. The highest concentrations of walrus, up to 500, appeared to be at the floe edge near Renny Point. As ice breaks up in late spring, greater numbers of walrus (>500) are found near Leyson Point (Orr and Rebizant 1987). During the summer greater numbers of walrus were reported, with sightings common from Sea Horse Point, west along Bell Peninsula, to Ruin Point. Walrus Island, Bencas Island, the north and eastside of Coats Island and Evans Strait are all areas reported to have high concentrations (>1000) of walrus by hunters (Orr and Rebizant 1987). Harvesters noted that there appears to be a localized migration in the early fall, from the Coats Island and Walrus Island area, across to Evans Strait (Orr and Rebizant 1987). Harvesters reported more than 1,000 walrus hauled out or swimming in the area of Cape Pembroke (Orr and Rebizant 1987).

Cape Dorset hunters noted that during the winter months, walrus are sporadically distributed along the coast of Foxe Peninsula from Cape Dorchester to Chamberlain Island, with the largest number of walruses around Cape Dorchester (Orr and Rebizant 1987). Salisbury Island and Nottingham Island reported as many as 500 walruses in the area between the two islands. Most sightings documented were in groups from 20 to 50 individuals during the winter months (Orr and Rebizant 1987). Cape Enavolik, Shuke Island and Sakkiak Island were all noted to support as many as 1,000 walruses, with most individuals observed either swimming or hauled out on floating pack ice near the floe edge. During the spring, walruses can be found from Cape Dorchester to Dorset Island, commonly in groups of ~1,000 animals along the coast, while the groups from around the tip of Salisbury Island and the southeast side of Nottingham Island were similar to the winter numbers of approximately 500 individuals. In the spring, walrus were most commonly observed hauled out on floating pack ice (Orr and Rebizant 1987). In the summer months, walrus numbers decline in the vicinity of Cape Dorset; hunters suggested that walrus prefer the area along the west coast of Foxe Peninsula, from Lloyd Point to the group of islands north of Cape Dorchester during this time (Orr and Rebizant 1987). Walruses are known to travel around the islands of Mills, Salisbury and Nottingham in late summer, but hunting usually occurs along the west coast of Foxe Peninsula. Large groups of walrus of 500 to1000 individuals have been noted in the summer along the south, west and north coast of Salisbury Island and along the southeast coast of Nottingham Island (Orr and Rebizant 1987). In July and August, concentrations of over 1,000 walruses were reported around Cape Dorchester. During the fall, reports by hunters are similar to those made during the summer, with a slight decrease in the numbers along the northwest coast of Foxe Peninsula. This may be due to a seasonal migration of these animals to islands in Hudson Strait with noted increases in the number of animals observed around Nottingham and Salisbury Islands during this time (Orr and Rebizant 1987).

The main changes in seasonal distribution of the Northern Hudson Bay-Davis Strait walrus population occurred in the early to mid-1900 (COSEWIC 2006). This included the abandonment of haul outs along the west coast of Hudson Bay north to Chesterfield Inlet, Digges Island, Cumberland Sound, and on the Gyrfalcon Islands (Born et

al. 1995). During this time, walruses were rare in western Hudson Bay, but were moving northward where the coastline offered more suitable haul out (COSEWIC 2006). Walruses were numerous at islands near the community of Whale Cove from 1942 to 1945, but are uncommon in this area now (Fleming and Newton 2003). Small groups are sometimes seen at the floe edge south of Whale Cove (Gamble 1988; Fleming and Newton 2003). Inuit report that walruses were more numerous in the Chesterfield Inlet area in the early 1990s than in times previous (Fleming and Newton 2003). Some haul out in western Hudson Bay have been abandoned, but walrus have been noted to be hauled out (Figure B-16) in small numbers in summer at:

- Bibby Island (61°53'N, 93°05'W);
- Term Point (62°08'N, 92°28'W);
- “Little Walrus Island” in Mistake Bay;
- Sentry Island (61°10'N, 93°51'W);
- Wag Island (63°23'N, 90°38'W);
- Marble Island (62°41'N, 91°08'W); and
- Fairway Island (63°15'N, 90°33'W;Low 1906; Degerbøl and Freuchen 1935; Loughrey 1959; Reeves 1978; Born et al. 1995; DFO 2000; Fleming and Newton 2003).



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF ATLANTIC WALRUS (*Odobenus rosmarus rosmarus*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029		FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-15**	
REVIEW	DW	18 Jan. 2013		

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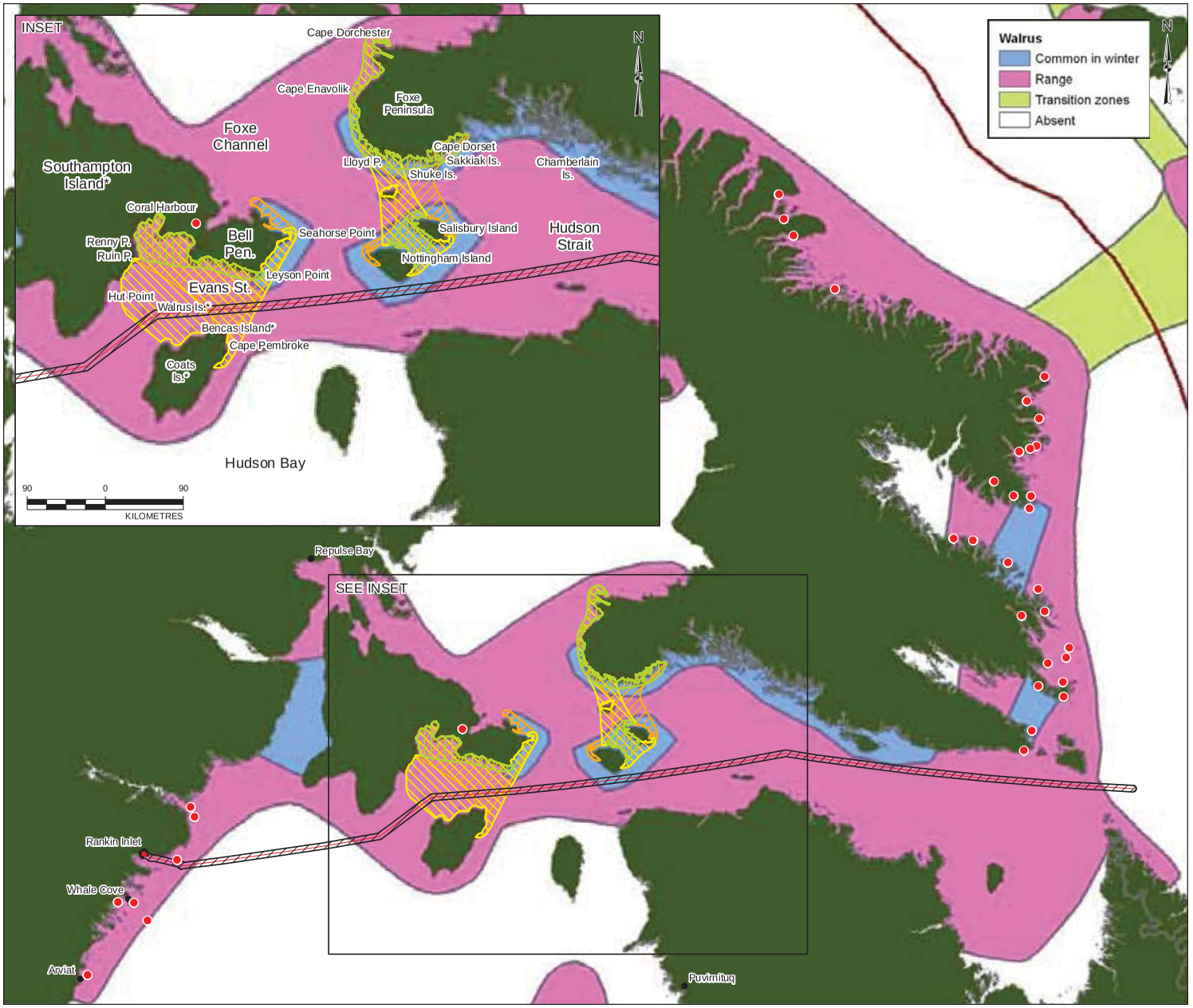

LEGEND

- KNOWN WALRUS HAUL OUT
- WALRUS DISTRIBUTION (SPRING)
- WALRUS DISTRIBUTION (SUMMER)
- WALRUS DISTRIBUTION (FALL)
- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

* HAUL OUTS AND MAIN CONCENTRATION AREAS

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
KNOWN WALRUS HAUL OUT LOCATIONS FROM STEWART ET AL. 2014; LOW 1906; DEGERBØL AND FREUCHEN 1935; LOUGHREY 1959; REEVES 1978; BORN ET AL. 1995; DFO 2000; FLEMING AND NEWTON 2003.
SPRING/SUMMER/FALL WALRUS DISTRIBUTION FROM ORR AND REBIZANT, 1987.
*HAUL OUTS AND MAIN CONCENTRATION AREAS FROM DFO, 2002.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010.
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

120 0 120
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF HAUL OUTS AND IMPORTANT HABITAT ATLANTIC WALRUS IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.		1535029	FILE No.	
DESIGN	EL	12 Jan. 2016	SCALE AS SHOWN	REV. 0
GIS	CDB	12 Jan. 2016		
CHECK	KZ	15 Jan. 2016		
REVIEW	PR	15 Jan. 2016		

FIGURE B-16

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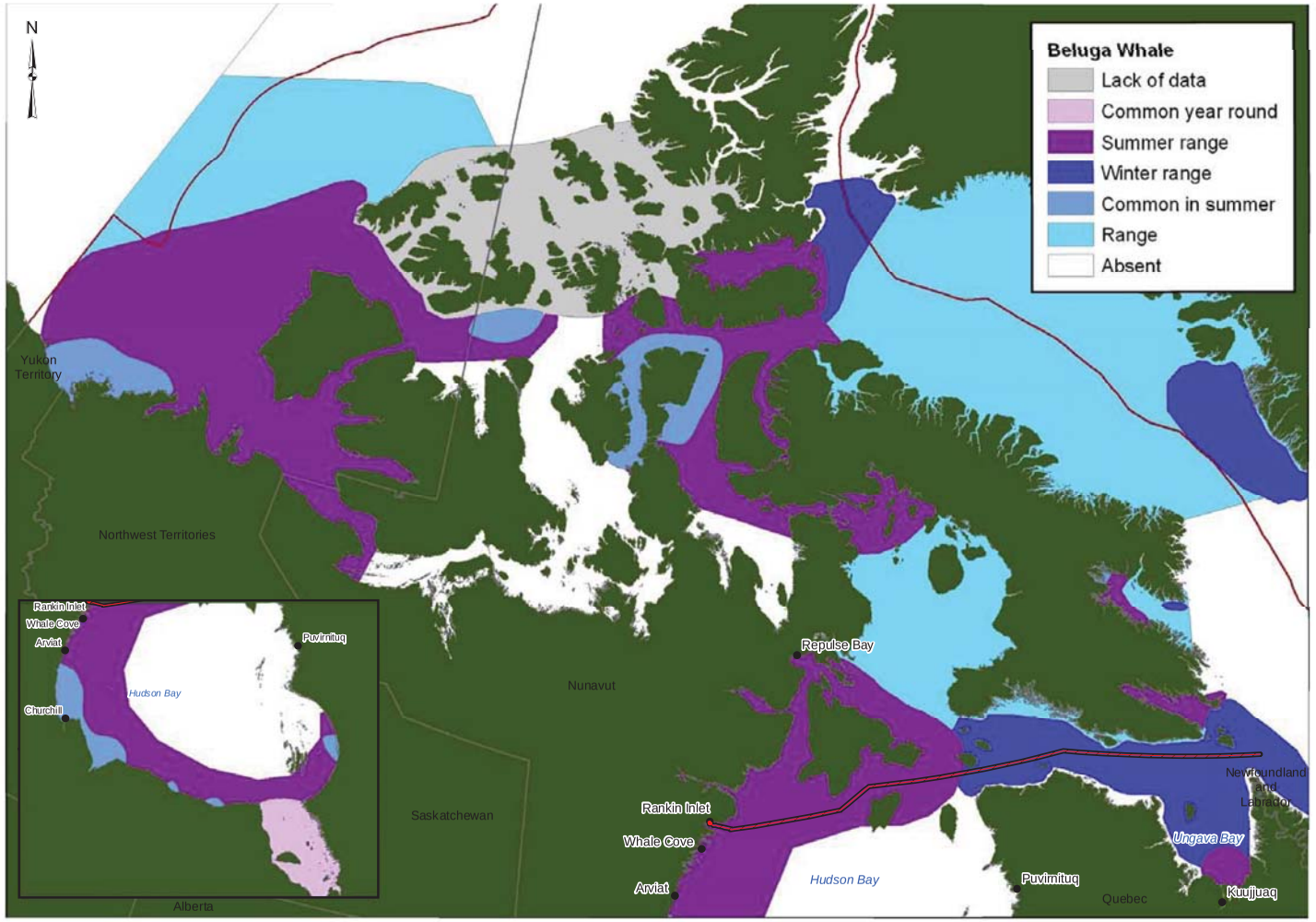
Beluga whale (Delphinapterus leucas)

Beluga whales are circumpolar in distribution, typically occurring in warm shallow estuaries during summer and migrating south during autumn to over-winter in the pack-ice, at established polynyas, or along prominent ice leads where open water conditions prevail (Doidge and Finley 1993; NAMMCO 2005). Beluga whales in the Canadian Arctic are sub-divided into 7 populations based on summer distribution and genetic differences (COSEWIC 2004a). The highest concentrations of belugas in the Canadian Arctic occur in the Hudson Bay region (Stephenson and Hartwig 2010), where animals during summer are observed in concentrated groups along both eastern and western coasts, as well as in James Bay and in nearby Ungava Bay (Gosselin et al. 2013). Each spring and fall, Hudson Strait is considered an important migration route for over 60,000 beluga whales from the Eastern and Western Hudson Bay populations (Gosselin et al., 2013; Richard 2005, 2010). Estuaries serve as important feeding and calving grounds for beluga whales, with their first arrival in these areas timed with the initial ice breakup in late June and their abundance increasing into the summer. Molecular genetic studies indicate at least two populations in Hudson Bay: a western Hudson Bay (WHB) stock and an eastern Hudson Bay (EHB) stock (Brennin et al. 1997; Brown Gladden et al. 1997; De March and Postma 2003). The WHB stock numbers about 57 000 individuals (Richard 2005). Genetic studies (Turgeon et al. 2012) and satellite telemetry (Bailleul et al. 2012) have shown that the two stocks overwinter together, where interbreeding likely occurs. Beluga whales in James Bay appear to constitute a distinct breeding population (Postma et al. 2012).

Most beluga whales present during summer in the Hudson Bay region belong to the WHB stock and occur in shallow coastal waters along western Hudson Bay (Martin et al. 2001), concentrating in the Churchill, Nelson, and Seal River estuaries (Stephenson and Hartwig 2010). The most recent population estimate for the WHB population was estimated at approximately 57,300 animals (95% C.I.: 37,700 to 87,100) (Richard 2005), making this stock of beluga the most abundant cetacean species in the region. Individuals from the EHB stock occur during summer along the shores of eastern Hudson Bay, including the Nastapoka River and the Little Whale River estuaries in northeastern Nunavik (Quebec's Arctic region) (Stephenson and Hartwig 2010). The EHB stock, currently listed as endangered by COSEWIC, was depleted by intensive commercial hunting between the 1860s and the early 1900s and has decreased from an estimated pristine population size of 12,500 to about 3,000 individuals in 2009 (Hammill et al. 2009). Aerial line transect surveys conducted in 2011 provided revised abundance estimates of the EHB stock at 3,351 animals (CV 48.9%; 95% CI: 1552 to 7855), which included correction factors for submerged animals and an additional 354 individuals counted during dedicated surveys in Little Whale River estuary (Gosselin et al. 2013). An uncorrected density estimate of 0.02 individuals / km^2 (CV 47.1%) was reported for EHB beluga whales in the eastern Hudson Bay survey area (Gosselin et al. 2013). The 2011 EHB abundance estimate is higher than that of 2008 (2,646 individuals; Gosselin et al. 2009), lower than that of 2004 (4,274 individuals; Gosselin 2005), and in line with model predictions of the stock abundance for 2011 (Doniol-Valcroze et al. 2011).

Belugas have been observed in many areas of Hudson Strait during the summer months (July and August), and even throughout the fall from September to November (Lewis et al. 2009). Migration is believed to begin northward along the coast of Hudson Bay during late August / early September (COSEWIC 2004a). In early August, satellite tagging studies and aerial surveys indicate a behavioural shift with beluga starting to migrate from southwestern Hudson Bay estuaries (e.g., Seal, Churchill and Nelson rivers; Sergent 1973; Smith 2007). Most beluga have left Hudson Bay by early September, with some following the west coast of Hudson Bay northward into Rankin inlet, while others mover eastward along the southern coast of Hudson Bay then northward along the Nunavik coastline or crossing Hudson Bay via offshore waters (Smith 2007). In late

September, beluga whales tagged in eastern Hudson Bay begin migrating northward along the coast and move through Hudson strait in the months of October and November (Lewis et al., 2009). Although some beluga whales have been reported to overwinter in polynyas in northwest Hudson Bay and in James Bay, in general, beluga whales over-winter in highly productive areas in Hudson Strait, Davis Strait, and Baffin Bay (Gosselin et al. 2009; Hammill and Lesage 2009; Hammill et al. 2009; DFO 2010a; Stephenson and Hartwig 2010). Smith (2000) suggests that it appears that the Western Hudson Bay, Eastern Hudson Bay, Ungava Bay and possibly James Bay stocks join together to winter in Hudson Strait. Figure B-17 provides an overview of beluga whale distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. The presence of beluga whales along the shipping corridor is thought to be low, given their general distribution pattern and preference for shallow nearshore waters.



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF BELUGA WHALES (*Delphinapterus leucas*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.		1535029	FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-17**	
REVIEW	DRW	18 Jan. 2013		

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Beluga whales are harvested year-round by most coastal Inuit communities (20 out of 28) (Table B-4) (Priest and Usher 2004). During summer, they are mostly hunted along the western coast of Hudson Bay up to 35 km offshore (Canadian Circumpolar Institute 1992) from Arviat to Cape Fullerton. They are hunted primarily for their tusks and their meat. The meat is eaten or fed to dogs.with (Born *et al.* 1995).

Over the 5-year period from 1996 to 2001, the total annual mean number of beluga whales taken through hunting was approximately 1,339 for all of Nunavut, whereas annual rates of belugas harvested from the community of Rankin Inlet ranged from 22 in 1998 to 1999 to 116 in 1999 to 2000 (Priest and Usher 2004). Subsistence harvest of beluga whales by Nunavik Inuit communities is directed towards a mixture of the WHB and EHB stocks, with the reported 2010 harvest consisting of 45 beluga whales taken near Sanikiluaq (Belcher Islands), 16 in the eastern Hudson Bay area, 15 in Ungava Bay, 146 in Hudson Strait in the spring and 58 in the fall (Doniol-Valcroze et al. 2011).

Narwhal (*Monodon monoceros*)

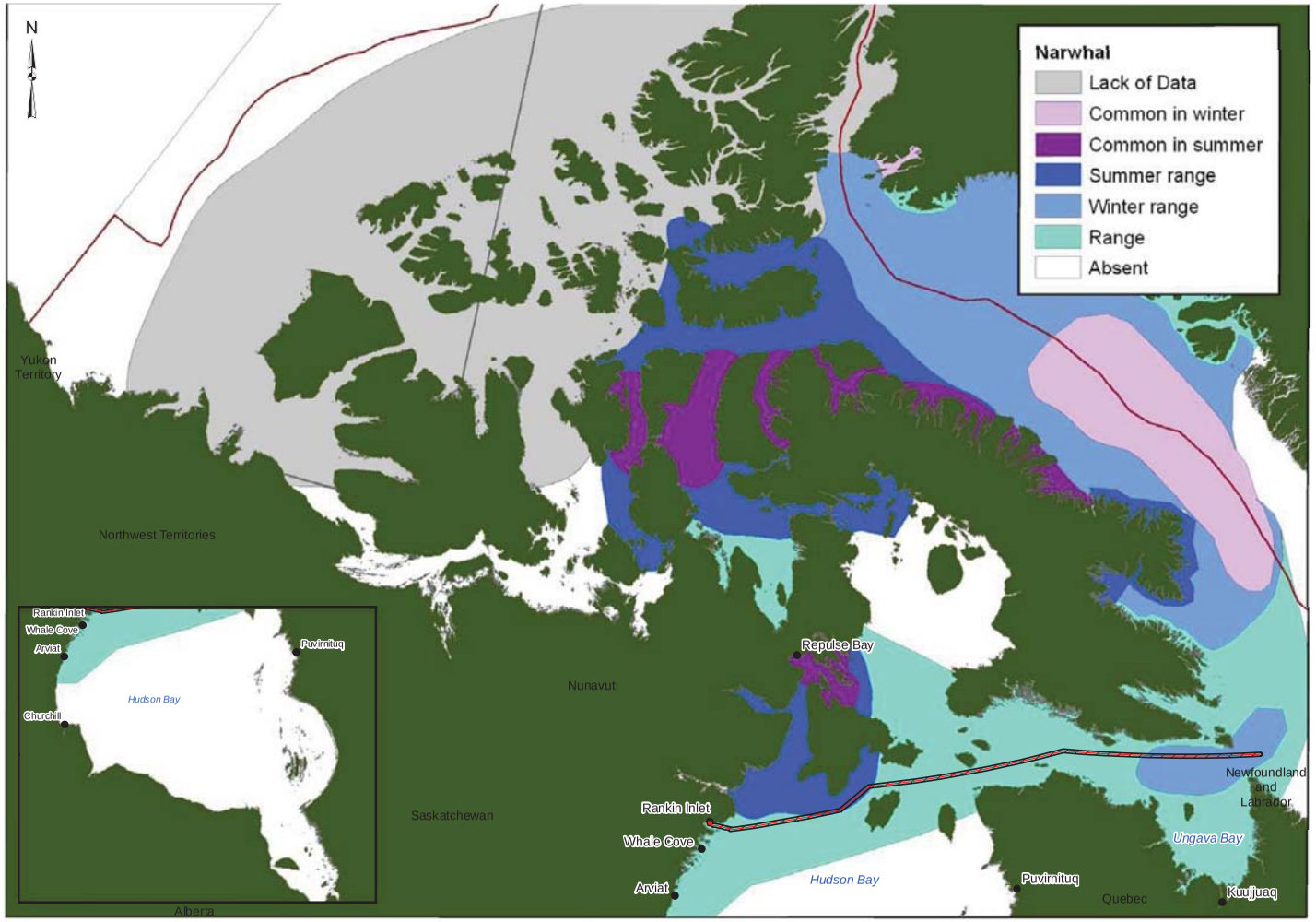
Two of 3 recognized populations of narwhals occur in the Canadian Arctic (Baffin Bay and Hudson Bay), with the third stock residing in East Greenland (COSEWIC 2004b). The populations are distinguished by means of their summer distribution, although the degree of genetic interchange between the 3 stocks is poorly known. The summer range of northern Hudson Bay narwhals includes the waters surrounding Southampton Island, with the larger aggregations in Repulse Bay, Frozen Strait, Western Foxe Channel, and Lyon Inlet (Figure B-18). Most narwhal are assumed to winter in eastern Hudson Strait and range over an area of roughly 250 000 km² (COSEWIC 2004b), while some occur in open leads and polynyas in northern Hudson Bay and western Hudson Strait. The core summering areas potentially overlap with the proposed open-water shipping route between Rankin Inlet and eastern Hudson Strait (Figure B-18).

Little information is known on narwhal habitat requirements. Throughout the year, they appear to be closely associated with the Arctic pack-ice, following the distribution of the ice and moving towards coastal areas when these are ice free. In summer, they appear to prefer coastal areas and ice-free shallow bays. During freeze-up, the coastal areas are abandoned, and the narwhals move offshore (Heide-Jørgensen 2002). During their fall migrations, and later while wintering in the pack ice, narwhals tend to prefer deep fjords and the continental slope, where depths range from -1000 to -1500 m and upwelling zones may increase biological productivity. The quality of sea-ice habitat, particularly the presence of leads in fast-ice and the density of broken pack-ice, appears to highly influence habitat selection (COSEWIC 2004b). Given that narwhal are an ice-associated species, it is likely that potential effects of climate change will result in changes to their habitats, prey availability, and increased natural mortality and may lead to changes in abundance, distribution and stock structure (Laidre and Heide Jorgensen 2005, Laidre et al. 2008). Narwhals generally travel in small groups in summer (<10 individuals), but gather in concentrations of many hundreds of animals during migrations in the spring and fall.

In Nunavut, local residents and scientists have observed killer whales feeding and hunting on marine mammals including narwhals (Steltner et al. 1984; Campbell et al. 1988; Stewart et al. 1995; Laidre et al. 2002; Higdon and Ferguson, 2009). Killer whales may be an important predator of narwhals, as indicated by their evasive behavioural responses when killer whales are nearby (Campbell et al. 1988; Laidre et al. 2002). This evasive behaviour may lead to more narwhals being available to hunters as narwhals tend to seek protection near shorelines, in bays or in inlets when killer whales are present. DFO is working with Nunavut HTOs to gather information on killer whale abundance and distribution in Nunavut, to evaluate their impact on their prey (Ferguson et al. 2012, 2011, Higdon et al. 2011).

Mating in narwhals occurs between March and May, and calving occurs in July and August. Since the lactation period exceeds 12 months, the interval between successive conceptions is usually 3 years, but about 20% of females conceive at the first breeding season following birth of their calves (Heide-Jorgensesn 2002). The basic life history features of the narwhal are similar to those of other medium-sized toothed whales (Hay 1985), with long life spans and sexual maturity estimated to be 6 to 7 years for females and 9 years for males (Garde et al. 2007). Narwhals feed heavily during migrations, but very little during the open water season (Hay and Mansfield 1989). Fish, squid, and shrimp make up the narwhal diet, particularly Arctic cod and polar cod (Heide-Jorgensen 2002). Their main predators are killer whales, polar bears, and humans, and possibly occasionally Greenland sharks and walruses (Hay and Mansfield 1989). Narwhal are harvested by coastal Inuit communities in Nunavut throughout the year under a quota system. The blubber is highly prized by the Inuit for food and is consumed locally or traded to other Inuit communities. The meat is also consumed as food. Narwhal tusks are a valuable economic commodity. Coral Harbour, Chesterfield Inlet, Rankin Inlet, Cape Dorset, Whale Cove, Kimmirut, Arviat, Baker Lake, and Hall Beach.

In 2008, DFO conducted a survey of the summer aggregation area for the Northern Hudson Bay narwhal population. Given apparent defects in the 2008 survey and uncertainty in the results, including the estimation of sustainable catches, a new survey was recommended (DFO 2012a,b). In August 2011, DFO conducted additional aerial surveys of the Northern Hudson Bay summer aggregation area. The 2011 surveys of the summering aggregations of Northern Hudson Bay narwhals produced a population estimate of 12,485 (95% CI: 7,515 to 20,743) (DFO 2012a). On the basis of this survey, an annual Total Allowable Landed Catch (TALC) of 157 narwhals for the Northern Hudson Bay population was allocated (DFO 2012a). In northern Hudson Bay, the harvest quota is to be shared among hunters in Repulse Bay, Coral Harbour, Chesterfield Inlet, Rankin Inlet, Cape Dorset, Whale Cove, Kimmirut, Arviat, Baker Lake, and Hall Beach (DFO 2012b). COSEWIC (2004b) currently recognizes narwhal in the Canadian Eastern Arctic as a species of “Special Concern”.



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF NARWHAL (*Monodon monoceros*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029		FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-18**	
REVIEW	DW	18 Jan. 2013		

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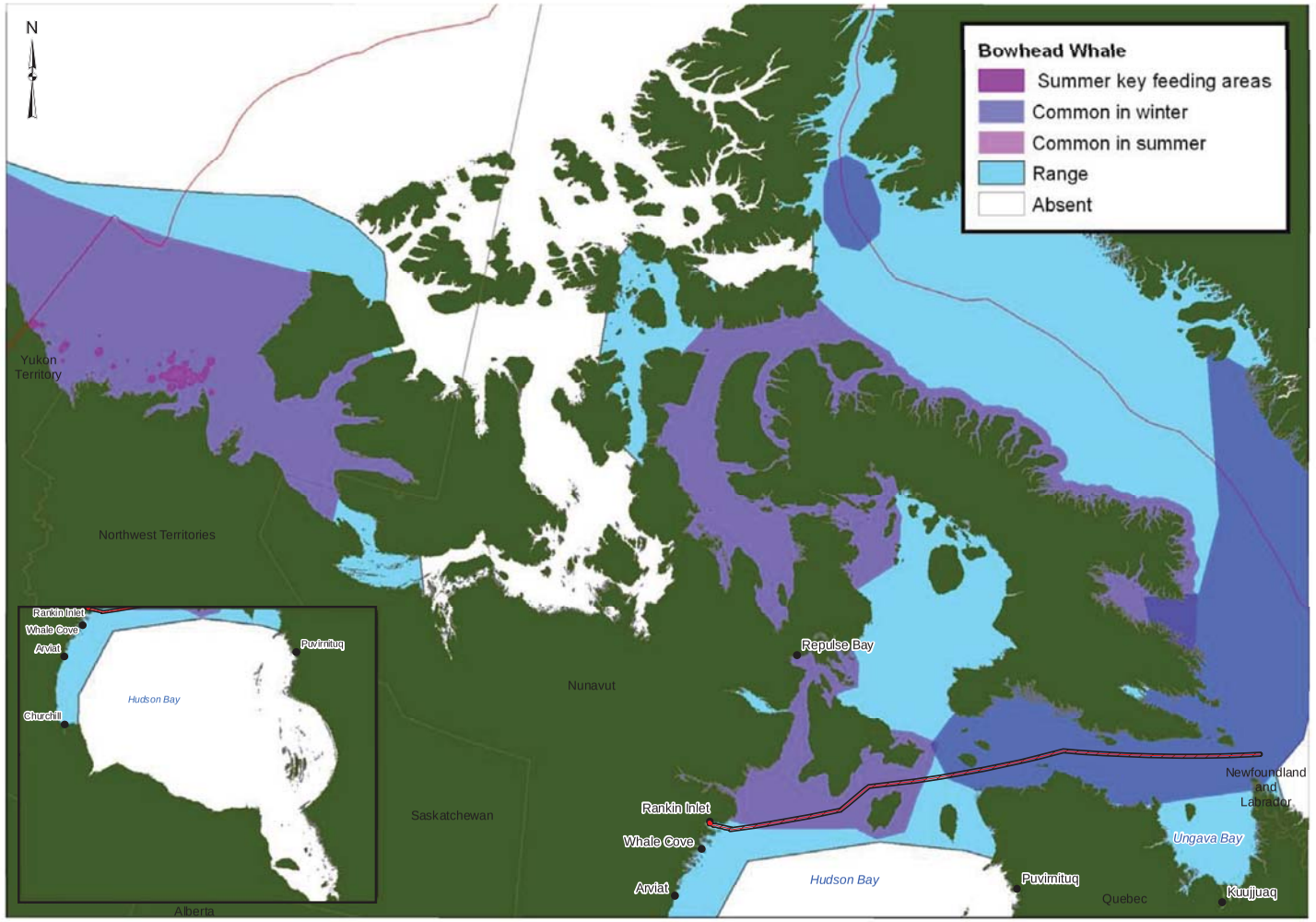
Bowhead whales (*Balaena mysticetus*)

The bowhead whale is the only baleen whale that occurs in circumpolar Arctic waters year-round. This species is especially well adapted to life in seasonally ice-covered seas by having no dorsal fin, a thick blubber layer, a low surface area to volume body ratio, and an enlarged head that they use to break through thick sea-ice (Montague 1993). Males tend to be smaller than females and reach sexual maturity at 12 to 13 m body length (Koski et al. 1993). Females reach sexual maturity at 12 to 14 m (Koski et al. 1993), which corresponds to >25 years in age (Rosa et al. 2004). There is evidence that the lifespan of bowhead whales can exceed 150 years (DFO 1999). Mating is believed to occur in February or March, with calves born from April to early June. Calves remain with their mothers for nearly a year (Koski et al. 1993).

Bowhead whales that occur in Hudson Bay/Hudson Strait belong to the Eastern Canadian Arctic-West Greenland (EC-WG) population, 1 of 4 populations present in Arctic waters. This population has a home range of approximately one million square kilometres, with summering grounds occurring in western Baffin Bay, the Canadian High Arctic, northern Foxe Basin, and northwestern Hudson Bay (COSEWIC 2009). Thus, impacts to the EC-WG bowhead whale population due to the Project have the potential for transboundary effects. Studies indicate that EC-WG bowhead whales travel large distances (Dueck et al. 2006; Ferguson et al. 2010a), may be spread over thousands of kilometres, and may segregate by size, sex, or reproductive status (Finley 2001). In the Hudson Bay region there are important areas of aggregation including the spring nursery area in northern Foxe Basin, northwest Hudson Bay for summering locations and Hudson Strait for wintering habitat in (Higdon and Ferguson 2010). Historic bowhead concentration areas, including possible nursery areas, include Roes Welcome Sound and around Rankin inlet (Reeves and Cosens 2003). The fall migration occurs over 2 to 3 months starting in late August/September. Wintering grounds are located in areas of unconsolidated pack-ice, such as northern Hudson Bay, Hudson Strait, central Davis Strait, southern Baffin Bay, and off West Greenland. These areas provide shelter and protection from their main predator killer whales. During spring, whales from southeastern Baffin Island travel to summering areas in Prince Regent Inlet and Gulf of Boothia by either a southern route via Hudson Strait and Fury and Hecla Strait, or a northern route via Lancaster Sound. In April and May, some bowheads move west transiting through Hudson Strait to their summer aggregation areas in northwest Hudson Bay (Reeves and Mitchell 1990) and also to northern Foxe Basin (NWMB 2000). Bowhead cow-calf pairs have been observed using the flow edge as a nursery area in northern Foxe Basin (Cosens and Blouw 2003). Figure B-19 provides an overview of bowhead whale distribution in the RSA based on historical sightings, current scientific knowledge, and IQ. Seasonal migration and general distribution patterns of EC-WG bowhead whales are thought to be largely dictated by ice conditions (Ferguson et al. 2010a), water depth and temperature (Thomson et al. 1986; Finley 2001; Harwood et al. 2010), predators (NWMB 2000; Finley 2001; Laidre et al. 2008; Ferguson et al. 2010b), and abundance and distribution of their main prey species including euphausiids, copepods, and epibenthic organisms (mysids and gammariid amphipods) (Thomson et al. 1986; LGL 1987; Finley 2001; Harwood and Smith 2002; COSEWIC 2009).



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF EASTERN CANADIAN ARCTIC / WEST GREENLAND BOWHEAD WHALES (*Balaena mysticetus*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029		FILE No.	
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-19**	
REVIEW	DW	18 Jan. 2013		

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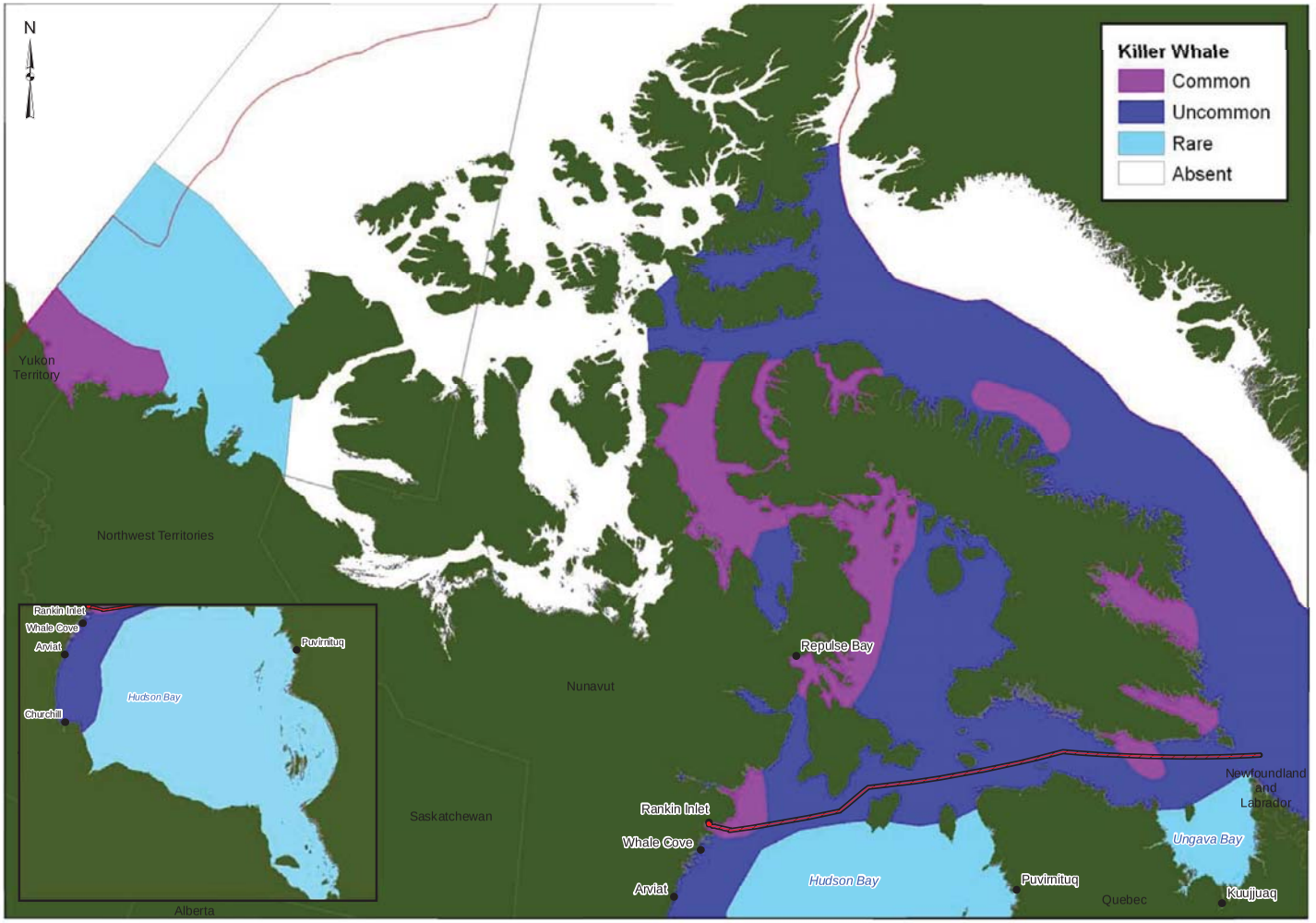
The population of EC-WG bowhead whales is currently estimated at 6,344 animals (95% CI 3119 to 12 906; COSEWIC 2009). EC-WG bowhead whales are currently designated as 'special concern' (COSEWIC 2009) and are being considered for listing under the federal SARA. EC-WG bowhead whales currently support a limited subsistence harvest by Inuit in Nunavut, which is co-managed by the Nunavut Wildlife Management Board (NWMB) and DFO. The population crosses international boundaries and in 2007, the International Whaling Commission granted Greenland a quota of two animals per year from this population pending annual review of the hunt sustainability.

Killer whale (Orcinus orca)

Killer whales are widely distributed throughout the Canadian Arctic, where they likely prey on a large variety of marine mammal species, including those harvested by coastal Inuit communities. They are known to migrate into Hudson Bay, Foxe Basin, and the central High Arctic each summer when open-water conditions allow (Dunbar and Moore 1980; Higdon 2007; COSEWIC 2008a), likely seeking out prey, such as seals (Leatherwood et al. 1976) and juvenile bowhead whales (Finley 2001). Declining summer sea ice may be allowing killer whales to expand their range in the Arctic, as they have been observed with increasing frequency in the Hudson Bay region (Higdon 2007). There is little available information on abundance or density of killer whales in Nunavut, and it is unknown if increases in sightings are representative of a growing population (Higdon 2007). The Inuit Traditional Ecological Knowledge of Killer Whales (Westdal 2009) summarised information on killer whales provided by workshop participants from Rankin Inlet, Arviat, Repulse Bay, Igloolik, and Hall Beach. Participants from Rankin Inlet indicated that killer whales have been around for a long time. In the past, there were not many killer whales seen near Rankin Inlet. About half the participants said that sightings have increased in recent years, and two participants mentioned that killer whales have been sighted by people in the community every summer since 2000 (Volume 9, Section 9.3.1.3.3.3). Figure B-20 provides an overview of killer whale distribution in the RSA based on historical sightings, current scientific knowledge (satellite telemetry studies and prey distribution), and IQ. Killer whales are not actively hunted by coastal Inuit communities in the Canadian Arctic.



LEGEND

- LOCAL STUDY AREA (LSA)
- MARINE REGIONAL STUDY AREA (MARINE RSA)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF KILLER WHALE (*Orcinus orca*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	PR	18 Jan. 2013	**FIGURE B-20**	
REVIEW	DW	18 Jan. 2013		

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Polar bear (Ursus maritimus)

Polar bears in the Canadian Arctic are segregated into 13 sub-populations, with those occurring in the RSA belonging to the Western Hudson Bay (WHB), Foxe Basin (FB), and Davis Strait (DS) sub-populations (Thieman et al. 2008). Delineation of the geographic separation of these three sub-populations is shown on Figure B-21. Polar bears generally occur at low densities throughout their range and are most abundant in shallow water areas near shore or where currents or upwellings increase biological productivity near ice edges associated with open water, polynyas, or lead systems (Schliebe et al. 2008). The productivity of polar bear habitat is closely linked to the physical attributes of sea ice and the density and distribution of ice-dependent seals, especially ringed and harp seals (COSEWIC 2008b; Peacock et al. 2013). From early winter until spring, polar bears are dispersed predominantly over sea-ice along the coast where they may range >200 km offshore. The annual ice melt generally forces polar bears in Hudson Bay and James Bay ashore from mid-July through late August, when they are at their maximum yearly weight from feeding on fat, newly-weaned seals. IQ on aspects of climate change from residents of Baker Lake and Arviat suggests that ice is melting earlier in recent years (as early as June) and may be forcing bears to retreat ashore sooner than in previous years (GN 2005). Polar bears tend to show long-term site fidelity with respect to preferred terrestrial summering grounds and spend several months of the open-water season in coastal areas, with some individuals also found inland (COSEWIC 2008b). During the summer, the WHB sub-population tends to congregate on coastal capes and headlands between Cape Churchill and Arviat (Figure B-22; Stapleton et al. 2014; Stirling et al. 1999). Arviat residents have reported that polar bears are becoming more common in areas in which they have not been observed previously, particularly during the summer months (GN 2005). The FB polar bear sub-population concentrates along the coastline during late summer and is observed in highest densities on Southampton Island, on several islands near Lyon Inlet, and on coastal islands throughout the Foxe Basin area (Figure B-23; Garshelis et al. 2012). In the Project area, the DS sub-population congregates along coastal areas of Frobisher Bay, on Akpatok Island, and along the northern tip of Ungava Bay (Labrador / Quebec border) at the entrance to Hudson Strait (Figure B-23; Peacock et al. 2013). During the open-water season, polar bears also have been observed offshore swimming in ice-free waters of Hudson Bay as reported during aerial surveys and other field investigations being conducted in the region (S. Atkinson 2013, pers. comm.). The majority of these sightings occurred less than 5 km from shore and in waters adjacent to larger islands (S. Atkinson 2013, pers. comm.; M. Dyck 2014, pers. comm.). No open-water surveys targeting polar bears have been conducted during the summer, and, therefore, no at-sea density estimates are available for this species during this period. However, the number of polar bears occurring offshore during the open-water summer season is thought to be minimal (S. Atkinson 2013, pers. comm; M. Dyck 2014, pers. comm.).

During fall, there is a gradual northward movement of the WHB subpopulation along the south coast of Hudson Bay, as bears gather to await the formation of new sea ice in November (Amstrup et al. 2007). Some polar bears tagged in the Churchill region moved northward along the Kivalliq Coast as far as Chesterfield Inlet (Stirling et al. 1999). Polar bears may overlap with the RSA and LSA in Melvin Bay during the winter time. During winter and spring, polar bears belonging to the Davis Strait sub-population use the sea ice along Davis Strait, Labrador Sea, and west to Ungava Bay and eastern Hudson Strait (Peacock et al. 2013). During winter, the FB sub-population generally is restricted within the mouth of Hudson Strait (COSEWIC 2008b). Figure B-23 provides an overview of polar bear distribution in the RSA based on historical sightings, current scientific knowledge, and IQ.

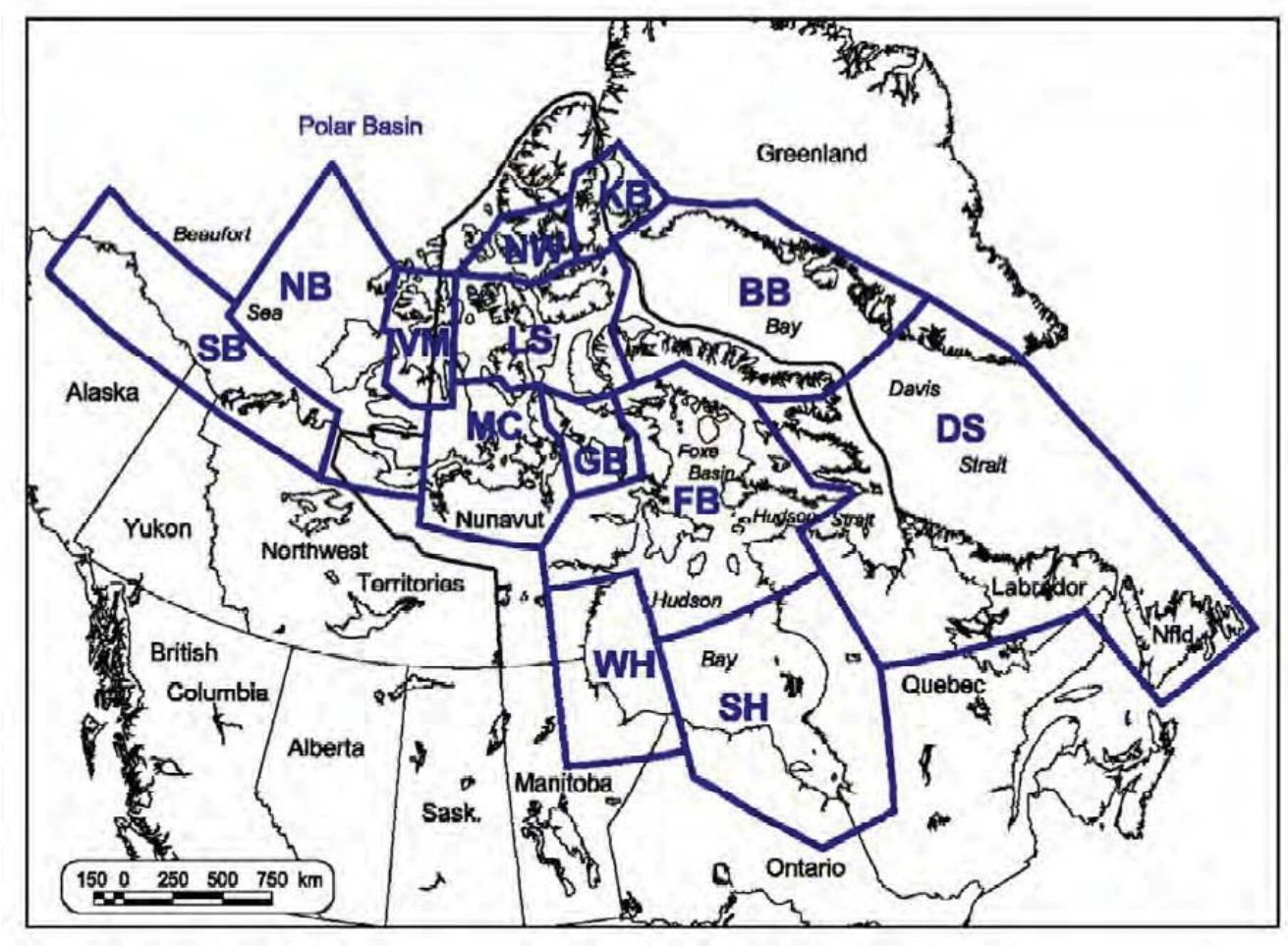


Figure B-21: Canadian Sub-populations of Polar Bears. Abbreviations of Delineated Sub-populations include Viscount Melville Sound (VM), Norwegian Bay (NW), Kane Basin (KB), Lancaster Sound (LS), Baffin Bay (BB), Davis Strait (DS) Southern Hudson Bay (SH), Western Hudson Bay (WH), Foxe Basin (FB), Gulf of Boothia (GB), M'Clintock Channel (MC), Southern Beaufort Sea (SB), and Northern Beaufort Sea (NB) (adapted from COSEWIC 2008b)

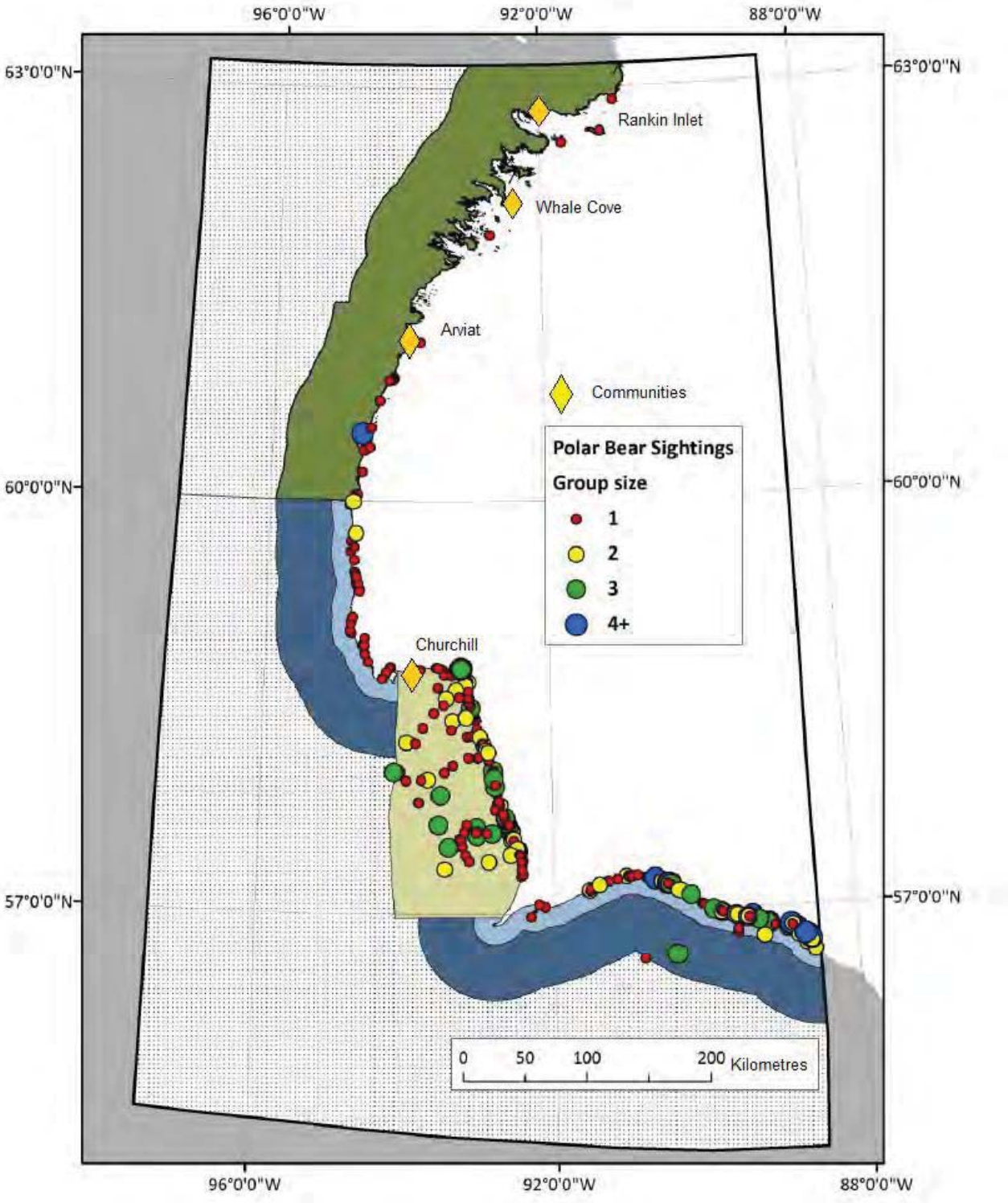
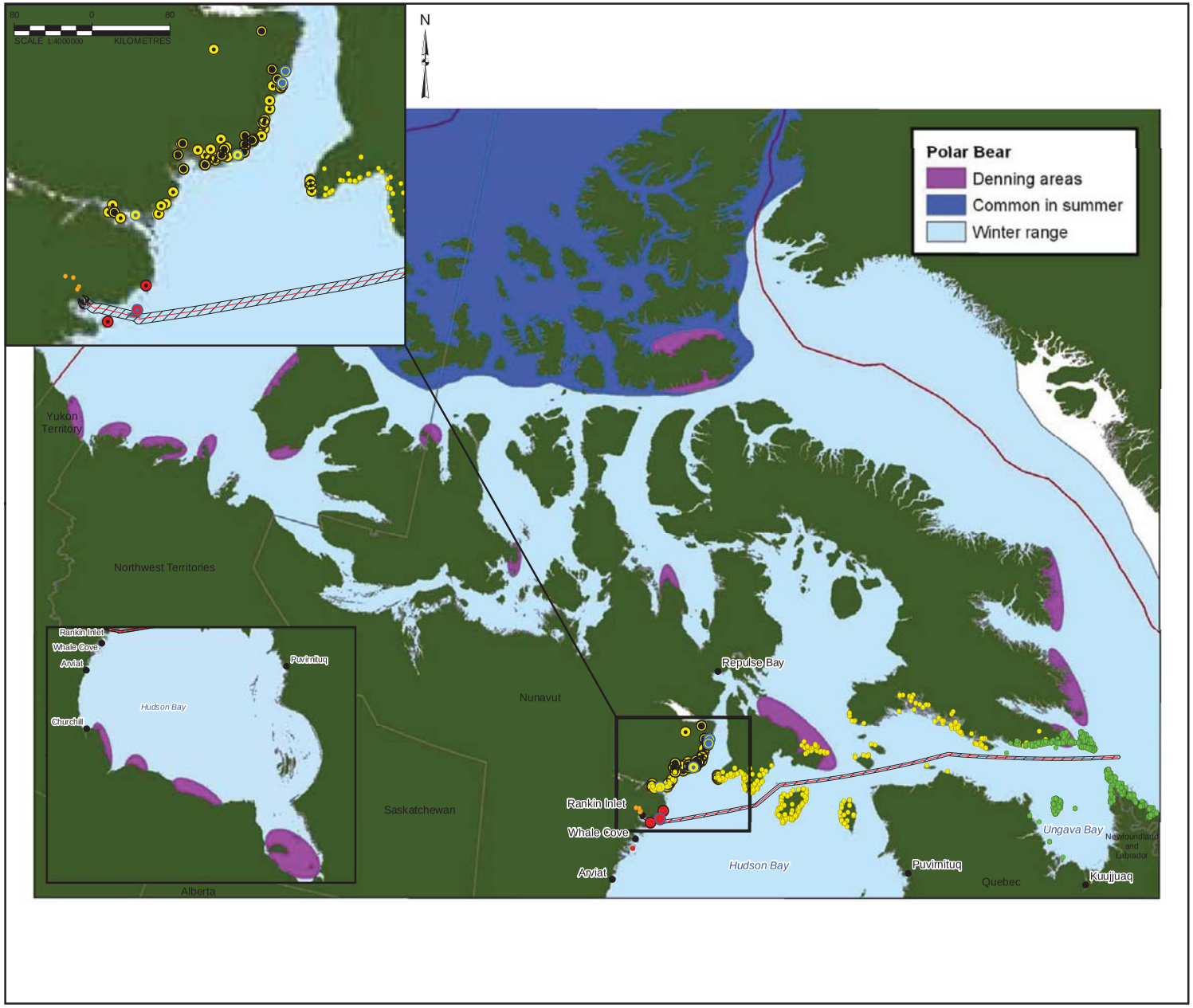


Figure B-22: Polar Bear of the Sightings Recorded During Aerial Surveys in the Western Hudson Bay in August of 2011 (extracted from Stapleton et al. 2014)



LEGEND

POLAR BEAR SIGHTINGS

- 2009/2010 AERIAL SURVEY SIGHTINGS DURING LATE SUMMER (GN UNPUBLISHED DATA)
- 2005-2007 MARK CAPTURE-RECAPTURE SURVEY (GN UNPUBLISHED DATA)
- WEST HUDSON BAY - AUGUST 2011 AERIAL SURVEY (GN UNPUBLISHED DATA)
- SUMMER POLAR BEAR SIGHTINGS COLLECTED DURING FIELD WORK
- 1 SPOTTING
- >1 SPOTTING
- SPOTTED IN WATER
- SHIPPING ROUTE (APPROXIMATE)

REFERENCE

PROVINCIAL DATA OBTAINED FROM E.S.R.I.
BASE IMAGE OBTAINED FROM STEPHENSON AND HARTWIG, 2010
GOVERNMENT OF NUNAVUT (GN) UNPUBLISHED DATA PROVIDED BY M.DYCK AND S.STAPLETON
DATUM: NAD 83 PROJECTION: CANADA ALBERS EQUAL AREA CONIC

240 0 240
KILOMETRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
DISTRIBUTION OF POLAR BEAR (*Ursus maritimus*) IN THE MARINE RSA AND ADJACENT ARCTIC WATERS (ADAPTED FROM STEPHENSON AND HARTWIG 2010, GN UNPUBLISHED DATA)

Golder Associates

PROJECT NO.	1535029	FILE No.		
DESIGN	AK	19 Jul. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	24 Jul. 2012		
CHECK	KZ	16 Feb. 2014	**FIGURE B-23**	
REVIEW	DRW	16 Feb. 2014		

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When the majority of individuals move back onto the ice in November during freeze–up, pregnant females remain on land near the coast to dig maternity dens in deep snowdrifts and frozen ground. Breeding occurs in March to May, implantation is delayed until fall, and birth is generally thought to occur from late November to mid-January. Although some cubs are born in earth dens, most births occur in snow dens that may be occupied for 5 to 6 months during the maternal event (Schliebe et al. 2008). Only pregnant female polar bears den for this extended period of time, during which time they rely on fat stores for energy and sustenance. The average litter size is less than 2. Cubs are dependent upon mothers until after the start of their third year of life. Age of first reproduction is normally 5 to 6 years for females. These factors contribute to the low reproductive potential for the species (Schliebe et al. 2008).

The WHB subpopulation was shown to have declined by 22% between 1987 and 2004, from approximately 1294 indiviudals in 1,987 to 935 individuals in 2004 (Regehr et al. 2007). However, recent aerial surveys conducted during summer of 2011 estimate abundance of the WHB sub-population at just over 1000 animals (Stapleton et al. 2014). The highest concentrations of bears occurred along the coasts and surrounding islands, particularly in the area south of Arviat. This study is supported by IQ shared by Inuit Elders indicating that the number of polar bears and dens along the western coast of Hudson Bay are increasing (COSEWIC 2008b). Results from a compilation of interviews conducted with local Inuit by the Nunavut Tunngavik Incorporated (NTI) indicate that polar bear numbers in the Rankin Inlet region have been increasing since the 1980s (GN 2005).

The DS sub-population was recently estimated by Peacock et al. (2013) by compiling 35 years of mark-recapture studies. This sub-population was estimated to number 2,158 individuals (±180 SE) in 2007 - an increase from the last population assessment conducted in 1970. The population is thought to be influenced by low recruitment rates, average adult survival rates, high population density when compared to other sub-populations in the area, as well as high prey density but variable ice conditions. Peacock et al. (2013) suggest that the DS subpopulation appears to be stable and likely may be experiencing the effects of density dependence.

Mark-recapture surveys conducted from 1989 to 1994 estimated the FB sub-population at 2,197 individuals (+256 SE) (Taylor et al. 2006). In 2004, the estimated abundance of this sub-population had increased to 2,300 animals. Information from traditional knowledge studies suggested the population was increasing and the opinion of various scientists agreed that an increase may have occurred due to low historical harvests rates (COSEWIC 2008b). Recent aerial surveys conducted during the late summer of 2009 and 2010 generally agreed with these previous population assessments, and estimate polar bear abundance for the FB subpopulation at approximately 2580 individuals (95% CI about 2,100 to 3,200),; Garshelis et al. 2012). The FB sub-population, characterized by average litter sizes, robust annual growth rates, and good body conditions (Garshelis et al. 2012), appears to be near stable taking into account current harvest levels.

Polar bears are harvested by coastal Inuit communities in Nunavut throughout the year under a quota system. The polar bear quota increased from 8 to 21 bears from the 2010-2011 to the 2011-2012 annual quota for the Western Hudson Bay sub-population, which includes the area around the communities of Arviat, Baker Lake, Whale Cove, Rankin Inlet, and Chesterfield Inlet (GN 2011). The 2013-2014 recommended quota is 24 bears (GN 2013). The number of polar bears hunted in Rankin Inlet from 1996 to 2001 ranged from 1 to 13 bears (Priest and Usher 2004). The annual 2013-2014 hunting quota for the FB subpopulation is 106 bears and includes 7 communities in Nunavut and 4 in Quebec (GN 2013; COSEWIC 2008b). The annual quota for the DS

subpopulation was 61 bear for 2012-2013; the recommended 2013-2014 quota is 48 bears (GN 2013). COSEWIC (2008b) currently recognizes polar bears in the Canadian Arctic as a species of “Special Concern”.

Hearing Abilities of Marine Mammals

Marine mammals are acoustically diverse, with wide variations in ear anatomy, frequency range, and amplitude sensitivity (Ketten 1991). An animal’s sensitivity to sound varies with frequency. Response to underwater sound likely depends strongly on the presence of and level of sounds in the frequency bands or range of frequencies to which the animal is most sensitive (Richardson et al. 1995a). The general trend is that larger species, such as bowhead whales, tend to have better hearing sensitivities at lower frequency ranges than smaller species, such as beluga whales and narwhal. Hearing abilities are generally only well understood in certain captive species where audiograms (plots of hearing threshold at different sound frequencies) have been developed based on behavioural response studies (reactions to sound) and electrophysiological experiments (measuring auditory evoked potentials) (Erbe 2002).

Toothed Whales (Beluga, Narwhal, Killer Whale)

The hearing abilities of beluga whales and narwhals at high frequencies are exceptionally well developed. This likely is related to their use of high frequency sounds for echolocation. Audible frequencies for toothed whales range from 80 Hz to 150 kHz, but they are most sensitive to sounds in the frequency range of 8 to 90 kHz (Richardson et al. 1995a).

Beluga whales are considered ‘mid-frequency cetaceans’ (Southall et al. 2007), meaning their most sensitive hearing range occurs in the mid-frequency range. Using sound for foraging, navigation, and social purposes, they are a highly vocal species with call types consisting of echolocation clicks, pulsed tones, whistles, and noisy vocals. Echolocation clicks are produced in the 40 to 60 kHz and 100 to 120 kHz range, with source levels reported at 206 to 225 dB re 1 µPa at 1 m (Au 1993). Non-echolocation calls (e.g., whistles) are centered on frequencies below 6 kHz, but may sometimes attain frequencies up to 14 kHz (Schevill and Lawrence 1949; Sjare and Smith 1986), with dominant frequencies ranging between 400 Hz and 8.3 kHz. Belugas can detect frequencies as low as 40 to 75 Hz; however, their sensitivity at this range is poor (Awbrey et al. 1988). Beluga whales have been documented to communicate with one another at distances of over 300 to 500 m (Bel’kovich and Shchekotov 1992).

No behavioural or electrophysiological audiograms are available for narwhals. Their vocalizations include echolocation clicks, pulsed tonal calls, and whistles. Narwhal echolocation sounds have been recorded at 40 kHz, with source levels reported at 218 dB re 1 µPa at 1 m (Mohl et al. 1990). Pulsed tones are produced in the 500 Hz to 5 kHz range, and whistles have been reported in the 300 Hz to18 kHz range, with dominant frequencies occurring at 300 Hz to10 kHz (Ford and Fisher 1978).

Baleen Whales (Bowhead Whales)

On a comparative basis, the baleen whale auditory system does not appear as specialized as that of toothed whales (Ketten 1997). Audiograms are not available for baleen whales due to the lack of these animals in captive settings, which is required (based on current technology) to conduct behavioural and electrophysiological hearing studies. Hearing thresholds and frequency sensitivities in baleen whales are thus inferred from anatomical ear structure, vocalizations, and behavioural studies in the wild (Richardson et al. 1995a). In general,

most baleen whale species have been shown to react to frequencies below 1 kHz (Richardson et al. 1995a). They have an estimated auditory bandwidth of 7 Hz to 22 kHz (Southall et al. 2007).

Hearing in bowhead whales can be inferred indirectly by the frequency at which they vocalize and the levels of sound at which behavioural reactions occur. Bowhead whales have been shown to react to sound with dominant frequencies between 50 and 500 Hz (Richardson et al. 1995a). Avoidance behaviour has been reported when bowhead whales were exposed to low broadband sounds of 90 dB re 1µPa (Richardson et al. 1995a). The majority of the sounds produced by bowhead whales are low frequency-modulated calls, with reported frequency ranges of approximately 25 to 900 Hz (Ljungblad et al.1982; Clark and Johnson 1984; Cummings and Holliday 1984). Bowhead vocalizations include pulsive and tonal sounds, the latter either descending, ascending, constant, or inflecting in frequency (Clark and Johnson 1984). The duration of bowhead vocalizations range from short 0.5 second signals to long and melodic 4 to 5 second tones (Clark and Johnson 1984). Most single-note tones carry little sound energy above 400 Hz (Wursig and Clark 1993). Source levels from tonal moans and pulsive sounds range from 128 to 185 dB re 1 µPa at 1 m, with some vocalizations recorded by hydrophones up to 20 km away from calling whales (Clark et al. 1986).

Singing behaviour is considered to be an advanced form of vocalization in baleen whales (Clark 1991). Songs are composed of units, phrases, and themes; units sung in a sequence form phrases, a repetition of a phrase is a theme, and several themes combined create a song that can last several minutes (Payne and McVay 1971). Songs have been documented to change within and between seasons (Clark and Johnson 1984; Würsig and Clark 1993; Tervo et al. 2007).

Pinnipeds (Seals and Walrus)

Underwater hearing sensitivity in seals and walrus falls in between that of baleen and toothed whales, with an estimated auditory bandwidth between 75 Hz and 75 kHz. Phocinid seals, such as the ringed seal and bearded seal, have underwater hearing thresholds between 60 and 85 dB re 1 µPa at 1 m, with flat audiograms between 1kHz and 30 to 50 kHz (Mohl 1968; Terhune and Ronald 1972, 1975; Terhune 1981). Some phocinids have been documented to be able to detect very high frequency sounds up to 180 kHz, although, their sensitivity to sounds above 60 kHz is poor and frequencies cannot be discriminated (Mohl 1968).

Ringed seal vocalizations include barks, clicks, and yelps, all of which occur in the 400 Hz to 16 kHz frequency range, with dominant frequencies concentrated above 5 kHz (Stirling 1973; Cummings et al. 1984). Source levels are between 95 and 130 dB re 1 µPa at 1 m, considerably lower in energy than other marine mammal vocalizations, and likely the reason why ringed seal vocalizations generally are detectable only within 1 km of the source (Cummings et al. 1984).

Bearded seals vocalize in the form of ‘songs’, which are presumed to be associated with territoriality and courtship (Ray et al. 1969; Budelsky 1993). Songs have been recorded at between 20 Hz and 6 kHz, with dominant frequencies occurring at 1 to 2 kHz, and source levels of 178 dB re 1µPa at 1 m (Ray et al 1969; Stirling et al 1983; Cummings et al. 1984). Unlike ringed seals, bearded seal vocalizations can be detected as far as 25 km from the source (Cleator et al. 1989).

Few studies have measured the audiogram of the walrus. In general, walrus have sensitive hearing to low frequency sounds (Kastelein et al. 2002). A study of an 18-year-old captive walrus reported an optimal hearing range between 1 kHz and 12 kHz, with maximum sensitivity (67 dB re 1 µPa at 1 m) occurring at 12 kHz

(Kastelein et al. 2002). Hearing sensitivity fell gradually below 1 kHz and dropped off sharply above 12 kHz (Kastelein et al. 2002). Walrus vocalizations include bell tones (male-specific), clicks, taps, knocks, rasps, and grunts. The dominant frequencies of most vocalizations occur between 400 and 1200 Hz (Ray and Watkins 1975). Clicks and taps are produced in the 100 Hz to 10 kHz range, with dominant frequencies concentrated below 2 kHz. Rasps are produced in the 200 to 600 Hz range, with dominant frequencies occurring between 400 and 600 Hz. The dominant frequencies of grunts occur below 1 kHz (Scheville et al. 1966; Ray and Watkins 1975; Stirling et al. 1983). Vocalizations in walrus are typically associated with herd organization and coordination behaviour (Richardson et al. 1995a).

Polar Bear

Little is known on underwater hearing abilities in polar bears. In-air hearing has been studied on captive subjects (using auditory evoked potentials to produce audiograms) demonstrating that polar bears can likely hear in-air at a slightly wider range of frequencies than humans (up to 25 kHz) and have absolute hearing thresholds below 27 to 30 dB re 20 µPa at 1 m (Nachtigall et al. 2007).

1.3.2.4 Species at Risk

COSEWIC and SARA-listed species potentially occurring within the RSA include 4 marine bird species and 6 marine mammal species, as outlined in Table B-5.

Table B-5: Species at Risk Potentially Occurring in the Shipping Corridor in Hudson Bay / Hudson Straight

Common Name	Species	SARA Status[a]	COSEWIC Status[b]
Marine Mammals			
Narwhal	*Monodon monoceros*	No status	SC
Beluga whale	*Delphinapterus leucas*	No status	EN – EHB stock SC – WHB stock
Bowhead whale	*Balaena mysticetus*	No status	SC
Polar bear	*Ursus maritimus*	SC – Schedule 1	SC
Walrus	*Odobenus rosmarus*	No status	SC
Killer Whale	*Orcinus orca*	No status	SC
Marine Birds			
Peregrine falcon	*Falco peregrinus tundrius*	SC-Schedule 1	SC
Ross's gull	*Rhodostethia rosea*	TH – Schedule 1	TH
Ivory gull	*Pagophila eburnea*	EN – Schedule 1	EN
Red knot	*Calidris canutus*	EN - *rufa ssp.* – Schedule 1 SC - *islandica ssp.* – Schedule 1	EN - *rufa ssp.* SC - *islandica ssp.*

[a] SARA (Species at Risk Act).The Act is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity (extracted from SARA 2012).

[b] COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. It is up to Government to legally protect wildlife species designated by COSEWIC. The potential impacts of legal listing are for Government to analyse, and the Species at Risk Act (SARA) applies only to wildlife species on the SARA legal list (extracted from COSEWIC 2012).

EN=Endangered, SC=Special Concern, TH=Threatened

Mitigation measures will be implemented to avoid or minimize any adverse effects from the Project on species at risk (SAR) in the marine environment regardless of the 'significance' of effects determined as part of the assessment. If marine-based SAR are encountered during the Project, including evidence of a SAR (e.g., dens, nests or eggs of a SAR), the primary mitigation measure implemented will be avoidance. A monitoring program will be undertaken to confirm that mitigation measures are successful. The results of monitoring will be provided to the relevant agency with management responsibility for the applicable SAR involved. Mitigation and monitoring strategies will be consistent with applicable status reports, recovery strategies, action plans and management plans that may become available during the Project.

Detailed mitigation measures proposed for the Project effects are discussed in detail in the sections below. In some instances, mitigation measures for one species are also relevant for other species. Follow-up and monitoring is discussed for all species in Section 8.3.11 of the FEIS.

1.3.2.5 Sensitive/Protected Areas

Measures have been taken by federal, provincial, and territorial governments, non-governmental organizations, as well as international organizations to identify, evaluate and protect areas of biological importance in Nunavut's marine and coastal environment. This section provides an overview of these protected areas in Hudson Bay / Hudson Strait in relation to the proposed shipping corridor (RSA).

Marble Island

Marble Island, located approximately 45 km southeast (offshore) of Rankin Inlet (Figure B-24) in proximity to the existing shipping corridor, was identified during the traditional knowledge study as an important congregation area for whales, seals, and birds (FEIS Volume 9, Section 9.3). This area has a long history of diverse use by Inuit who first came to the island as seasonal hunters, taking advantage of its wide variety of wildlife (Davis 1996). Marble Island is formally listed on the Canadian Register of Historic Places (Parks Canada 2012). Stewart et al. (1991) recommended the Rankin Inlet–Marble Island marine area to Parks Canada for consideration as a national marine park to conserve and protect the following key ecological and cultural features of this area:

- a dense, breeding population of threatened peregrine falcons near Rankin Inlet;
- a large breeding colony of common eider on Marble Island;
- anadromous stocks of Arctic char, which are locally harvested by Inuit communities;
- unique oceanographic conditions influenced by the influx of Chesterfield Inlet waters;
- maritime historical sites at Marble Island from the Knight Expedition and the whaling period including 2 shipwrecks; and
- evidence of historical coastal Inuit cultures (Stewart and Lockhart 2005).

Both the exceptional peregrine population and the maritime historical sites at Marble Island are facing increasing human disturbance and would benefit from the protection afforded by National Parks designation as they are

located near the growing community of Rankin Inlet and are a stop for tourists visiting by cruise ship. The area's rocky Canadian Shield shoreline provides a greater variety of marine habitats than the Churchill-Nelson area. Diana and Meliadine rivers provide small-scale estuarine habitats. This area would afford some protection to historical bowhead whale habitats, although more suitable bowhead whale habitat is present to the north in Roes Welcome Sound. All Project vessels along the shipping route will maintain a minimum distance of 2 km from Marble Island in order to avoid disrupting sensitive marine species located on or around the Island.

Ecologically and Biologically Significant Areas

DFO has identified a number of Arctic Ecologically and Biologically Significant Areas (EBSAs) in Hudson Bay and Hudson Strait using criteria from the Convention on Biological Diversity (Cobb 2011). These areas have been previously identified as important in ecosystem overviews, stock status reports, and traditional knowledge studies. Those EBSAs in the Hudson Bay Complex biogeographic region that overlap with the proposed shipping corridor are described below and illustrated in Figure B-24:

Southampton Island (including Coats Island) (EBSA 1.5)

- Largest island in Hudson Bay and situated near the confluence of Hudson Bay and Foxe Basin waters resulting in dynamic oceanographic mixing, and high marine productivity.
- Summer and winter use by the Northern Hudson Bay-Davis Strait population of Atlantic Walrus (Special Concern under COSEWIC).
- The waters surrounding Southampton Island are important spring and fall migration routes for beluga whales (Endangered under COSEWIC) and EC-WG bowhead whales (Special Concern under COSEWIC).
- Important nesting areas occur on Coats Island for seabirds (thick-billed murre, common eider, and black guillemot), which feed on aggregations of marine fish (e.g., capelin and Arctic cod) (Mallory and Fontaine 2004). The largest single colony of common eider in Nunavut occurs in East Bay.
- Southampton, Coats, and Mansel islands also are considered important denning and summer refuge habitat for the Foxe Basin polar bear population. Polar bears also frequent the land-fast ice adjacent to the islands in winter.
- Data confidence for this area is high due to intensive marine bird studies, tagging and survey data for marine mammals, and published IQ. The Southampton Island area scores high for several EBSA criteria.

Western Hudson Bay (Whale Cove to Arviat) (EBSA 1.6)

- Important area for beluga, killer whale, seabirds and Arctic char.
- Dense kelp beds occur along the coastline and provide important habitat for fish in the area.
- Area supports a wealth of LEK and TEK from the communities of Whale Cove, Rankin Inlet, and Arviat on the importance of marine mammals and fish (DFO 2011a).
- Important Arctic char stocks exist in this area and use the marine environment for feeding.

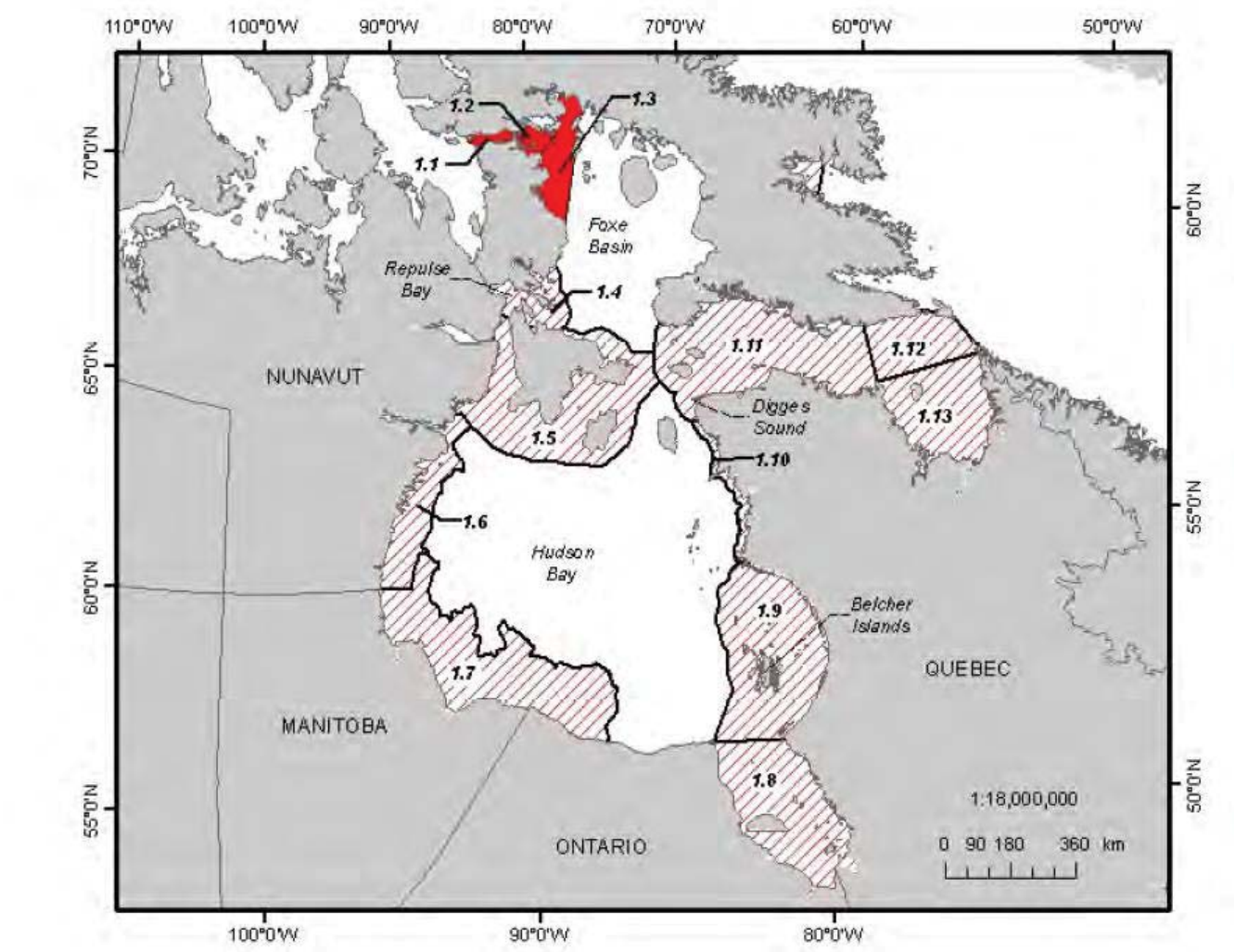

Figure B-24: Preliminary EBSA Identification Results for Foxe Basin (in solid red; 1.1 to 1.3) and for Hudson Bay / Hudson Strait (in red hatched lines; 1.4 to 1.12) as Determined Through a Series of Workshops Conducted in 2009 (DFO 2010b) (extracted from Cobb 2011)

Western Hudson Bay/Churchill/Nelson/Seal Estuaries (EBSA 1.7)

- The Nelson and Churchill estuaries provide an important habitat for a number of marine mammals and fish including the world's largest summer aggregation of beluga whales (Endangered under COSEWIC). Up to 3000 beluga whales congregate annually in the Nelson River estuary, with smaller numbers in the Churchill River estuary, to rear young and feed in these waters. Although the reason for these aggregations is not known, 2 commonly reported hypotheses are 1) thermal advantage from warm freshwater to initiate moulting; and 2) an evolutionary adaptation to take refuge from predation by killer whales in the shallow estuaries. Aggregations of approximately 70 000 beluga whales in this area are important for population fitness consequences.

- The Churchill region represents a key denning, feeding, and point of mobilization for Western Hudson Bay polar bear, which head north along the newly formed sea-ice to hunt ringed seal during fall/winter.
- A high degree of certainty exists for biophysical data available for this area due to Manitoba Hydro EIA Projects on the Nelson and Churchill rivers, as well as ongoing studies investigating the effects of climate change on marine mammals.
- The Seal River estuary was identified in 1999 as an Important Bird Area and is globally important for migrating black scoter.
- The Seal River is a Canadian Heritage River and remains a pristine, high-grade, remote wilderness river. It is the largest remaining undammed river in northern Manitoba. Harbour seals travel considerable distances up the Seal River estuary, representing an important adaptation to the freshwater environment by a marine mammal.
- The Province of Manitoba has designated a number of legally protected and managed lands, and identified Areas of Special Interest (candidate protected areas) along the Manitoba coastline for various ecological and biological reasons.
- Five internationally recognized Important Bird Areas have been identified along this part of Hudson Bay.
- Wapusk National Park and the provincially designated Churchill Wildlife Management Area, which extends to the Manitoba border and protects one of the world's largest known polar bear maternity denning areas. This national park also protects important caribou habitat. Similarly, the Kaskatamagan Wildlife Management Area (provincial designation) was established to protect the fragile coastal and tundra ecosystems and to protect important habitat for a number of bird species. The Churchill Special Conservation Area, designated to conserve and protect the Ross's gull, is also an integral part of the primary polar bear migration corridor in Manitoba.
- Hubbart Point, located north of the Seal River estuary, is an aggregation area for older male polar bears during the ice-free season. Beluga whales also congregate in waters off Hubbart Point, which is part of the North Hubbart Area of Special Interest.

West and Central Hudson Strait (EBSA 1.10):

- Serves as a key channel for Arctic waters via Foxe Basin, the outflow of Hudson Bay water, and also periodic intrusions of Atlantic water into northeastern Hudson Bay.
- Major seasonal migration route for all marine mammals that spend the summer in Hudson Bay and Foxe Basin and winter in either Hudson Strait or Davis Strait, including beluga whale, narwhal, and bowhead whale. The use of Hudson Strait by migrating marine mammals has been well documented through tagging studies and IQ.
- Walrus spend winters in west and central Hudson Strait on ice flows and on islands, such as Nottingham and Salisbury, where strong currents maintain open water. Walrus also overwinter on the northern shore of Hudson Strait near Kimmirut.
- Productivity is higher in West and Central Hudson Strait than Foxe Basin or Hudson Bay.

Support a number of important seabird nesting and feeding areas that occur on the northern and southern shores. Twenty percent of the North American population of thick-biller murres and a small colony of Atlantic Puffins are found near the Digges Sound and 10% of the Canadian population of common eiders breed and feed near Markham Bay (Mallory and Fontaine 2004).

- Physical oceanography in this EBSA has been well studied as part of long-term studies on Arctic flow-through.

Eastern Hudson Strait (EBSA 1.11):

- Heavily influenced by oceanographic conditions from Davis Strait resulting in high productivity.
- Important area for shrimp - Canadian Shrimp Fishing Area 3 occurs near Northern Ungava Bay eastward to Resolution Island.
- Supports western extent of Greenland halibut habitat.
- Provides significant overwintering refuge for Hudson Bay beluga whales and approximately 5000 to 8000 bowhead whales during winter.
- Support important occurrences of cold water corals in the deeper waters of the strait (Kenchington et al. 2011).

Ungava Bay (EBSA 1.12):

- Support Ungava Bay beluga whale stock, which has been reduced to as few as approximately 50 animals and may be extirpated (presently listed as Endangered under COSEWIC).
- Support important occurrences of corals in the deeper waters of the bay (Kenchington et al. 2011).
- Support 2 large colonies of thick-billed murre on Akpatok Island (Mallory and Fontaine 2004). Collectively, these colonies constitute the largest number of breeding thick-billed murre in Canada (>20% of the Canadian population). Black guillemots also nest along the Akpatok Island coast.
- A large portion of the breeding population of common eiders aggregate on the islands off the western shore of Ungava Bay. Key nesting sites occur at the Eider, Plover, Payne, and Gyrfalcon islands and the islands of northeastern Ungava Bay.
- Approximately 80 to 100 polar bear (~5% of the Davis Strait population) den and rear cubs along the southern shore of Akpatok Island during summer.

National Parks

To date, Parks Canada has established 2 National Parks in the Hudson Bay marine ecosystem: Wapusk and Ukkusiksalik (Stewart and Lockhart 2005). Wapusk National Park, established on 24 April 1996, is situated east of Churchill and protects an area of 11 475 km^2 that extends southward from Cape Churchill. Resources within the boundaries of the park are of national and international importance, including one of the world's largest known polar bear denning areas, and vital habitat for hundreds of thousands of waterfowl and shorebirds that nest along the coast of Hudson Bay or gather and feed there during the annual spring and fall migrations

(Stewart and Lockhart 2005). Park management is overseen by a board with representatives from the federal and provincial governments, the municipality of Churchill, and the First Nations of Fox Lake and York Factory. Ukkusiksalik National Park, established on 23 August 2003, extends westward from Roes Welcome Sound to include Wager Bay and the Brown and Piksimanik rivers, encompassing an area of 23 500 km^2 (Stewart and Lockhart 2005). Inuit residents from the Kivalliq communities, including Chesterfield Inlet, use this area for subsistence hunting and fishing.

Parks Canada also has identified several marine regions in arctic Canada within which it plans to recognize as Natural Areas of Canadian Significance. Two of the Natural Areas of Canadian Significance overlap with the proposed RSA, including Hudson Bay and Hudson Strait (Stewart and Lockhart 2005). The National Marine Parks Policy guides this process. Each area is intended to represent the natural, historical, and cultural diversity within a region. While National Marine Parks have yet to be established in northern Canada, Parks Canada has sought advice on which areas might make the best and most representative marine parks in the Hudson Bay and Hudson Strait marine regions. In Hudson Bay, Stewart et al. (1991) recommended 2 areas to Parks Canada for consideration as national marine parks – the Churchill-Nelson area and the Rankin Inlet-Marble Island area.

The Churchill-Nelson area was recommended for consideration as a National Marine Park prior to the establishment of Wapusk National Park, with the primary goal to protect the summer resident population of beluga whales in the Nelson, Churchill, and Seal rivers estuaries (known as the largest concentration of beluga whales in the world) (Stewart and Lockhart 2005). Other important physical, biological, and human use characteristics of this area include 1) extensive low-lying marshy coastal plains with wide tidal mud flats; 2) large estuarine habitats of the Churchill and Nelson rivers; 3) exceptional autumn concentrations of polar bears on the islands and headlands near Cape Churchill; 4) breeding shorebirds and waterfowl including the common eider; and 5) pre-historical coastal cultures, historical ports of entry instrumental in the exploration and development of central Canada, and the region's only deep water port for international shipping (Stewart and Lockhart 2005).

As noted earlier, the Rankin Inlet-Marble Island area was recommended as a National Marine Park to conserve and protect several key ecological and cultural features in this area (Stewart et al. 1991). The area of Hudson Strait immediately northeast of the Hudson Bay marine region was recommended as the most representative candidate for consideration as a future national marine park in the Hudson Strait marine region (DFO 2005b).

Migratory Bird Sanctuaries

Environment Canada's Canadian Wildlife Service (EC-CWS) has established 11 migratory bird sanctuaries in Nunavut to control and manage areas of key importance for the protection of migratory bird species and their habitat (Stewart and Lockhart 2005). Three of these sanctuaries occur within, or in the vicinity of, the proposed RSA: the McConnell River Migratory Bird Sanctuary south of Arviat, and the Harry Gibbons and East Bay Migratory Bird Sanctuaries on the southeast coast of Southampton Island. Both areas include terrestrial, wetland, and marine habitats, with the latter typically consisting of nearshore foraging areas for migratory birds. The Migratory Birds Convention Act prohibits activities in Migratory Bird Sanctuaries. Canadian Wildlife Service manages the activities that can be carried out within these areas. Prohibitive measures are placed on what activities can occur in these areas, as outlined in the Bird Sanctuary Regulations. Although important fish habitat could be protected through migratory bird sanctuaries, it is not an effective measure unless there is valuable bird habitat associated with the area that coincides with important or critical fish habitat.

The McConnell River Migratory Bird Sanctuary, established in 1960 to protect a small colony of lesser snow geese, encompasses 32 800 hectares (ha) along the west coast of Hudson Bay south of Arviat. This sanctuary is owned by the Coastal Inuit of Nunavut and subject to co-management agreements under the Nunavut Land Claims Agreement (Stewart and Lockhart 2005). Subsistence hunting and fishing activities presently occur within the sanctuary, mostly by community members of Arviat. In 1982, under the terms of the Ramsar Convention, the sanctuary was designated as a "Wetland of International Importance especially as Waterfowl Habitat" (Ramsar Site 248) because it provided major nesting habitat for multiple migratory bird species including Canada geese, lesser snow geese, and Ross's goose. Up to 200 000 birds colonize this sanctuary on an annual basis, with habitat degradation presently occurring due to a local increase in the snow goose population (Stewart and Lockhart 2005).

The Harry Gibbons Migratory Bird Sanctuary is located on Southampton Island in northern Hudson Bay, encompassing extensive tidal flat and wetland habitat areas along the Boas River delta and associated estuarine environment in the Bay of God's Mercy. This area supports large nesting colonies of lesser snow goose (population >500 000 birds in 1997), Atlantic brant, Canada goose, and tundra swan (Stewart and Lockhart 2005). Smaller breeding colonies of migratory birds are located outside the sanctuary at Ell Bay and Bear Cove (Stewart and Lockhart 2005).

The East Bay Migratory Bird Sanctuary is located on Southampton Island near the community of Coral Harbour. Established in 1959, this area encompasses 113 800 ha including marine, intertidal, and subtidal components. Notable bird species include Arctic tern, Atlantic brant, lesser snow goose, Canada goose, common and king eider, black guillemot, jaeger, herring and Sabine's gull, red knot, red phalarope, red-throated loon, ruddy turnstone, and several species of plover and sandpiper.

Important Bird Areas

Important Bird Areas (IBAs) are sites recognized as being globally important habitat for the conservation of bird populations, as designated by Bird Studies Canada, Nature Canada, and Birdlife International (Birdlife International 2012), an international bird protection organization. Collectively, these organizations support the international conservation of discrete sites that provide habitat for threatened birds, large groups of birds, and birds restricted by range or by habitat. Three Important Bird Areas occur within, or in the vicinity of the RSA; including Harry Gibbons and East Bay Migratory Bird Sanctuaries (sites #NU022 and #NU023 respectively) on Southampton Island, and McConnell River Migratory Bird Sanctuary south of Arviat.

International Biological Programme

In 1975, the International Biological Programme recognized a number of areas of biological, geological, and historical importance in northern Canada that were in urgent need of special protection (Nettleship and Smith 1975). Several of these areas, which have since been offered protection, and which occur within or in the vicinity of the RSA, include McConnell River (McConnell River Migratory Bird Sanctuary), and Boas River (Harry Gibbons Migratory Bird Sanctuary). Other areas near the RSA that have been identified as International Biological Programme sites but are not yet protected include Coats Island and Digges Islands. Coats Island is located northeast of Southampton Island. Digges Islands (West and East) are located in Digges Sound, at the northwest tip of the Ungava Peninsula in Western Hudson Strait. Both areas support key terrestrial habitats for migratory birds and seasonal habitats for several marine mammal species (Nettleship and Smith 1975).

Key Marine Habitat for Migratory Birds

EC-CWS has established 'key marine habitat' sites for migratory birds located near the proposed shipping route. Some of these sites overlap with existing protected/sensitive areas such as migratory bird sanctuaries designated by EC-CWS, IBAs, and/or International Biological Program sites. These areas were primarily established to protect terrestrial or coastal resources for marine birds. 'Key marine habitat' sites designated by EC-CWS aim specifically to identify important marine habitat areas for marine avifauna. Not all of these sites are protected under legislation; however, as local knowledge increases regarding habitat use and the overall importance of these sites to marine birds, legal protection status may follow. Generally, these areas are used by marine birds from late April through September. Additional details on the key marine habitat sites for migratory birds located near the proposed shipping route are summarized in Table B-6 and FigureB- 8 (adapted from Mallory and Fontaine 2004).

Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km^2)		Distance from shipping lane (km)
				Marine	Land	
Coats Island near Cape Pembroke	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area coming close to Coats and Walrus islands.	Important nesting areas occur on Coats Island for seabirds (thick-billed murre, common eider, and black guillemot), which feed on aggregations of marine fish (e.g., capelin and Arctic cod). Glaucous gull and peregrine falcon can be found along the cliffs at the colonies. Home to a large Iceland gull (*Larus glaucoides*) colony and the largest single colony of common eider in Nunavut occurs in East Bay.	International Biological Programme site (Region 9, Site No. 6-3) and an IBA (NU005).	1918	0	Overlaps
Digges Sound	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area. Colonies are considered to be some of the most disturbed by human activities in the Canadian Arctic.	20% of North American population of thick-billed murre and a small colony of Atlantic puffin (*Fratercula arctica*) and razorbill (*Alca torda*) occur near Digges Sound. 10% of the Canadian population of common eider breed and feed near Markham Bay. Other species that also breed here are black guillemot, glaucous gull, Iceland gull, herring gull, and Arctic tern.	International Biological Programme site (Region 9, Site No. 6-7) and an IBA in Canada (NU001).	2207	102	~3

Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km^2)		Distance from shipping lane (km)
				Marine	Land	
Frobisher Bay	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area and potential hydrocarbon exploration. The complex nature of currents in the region suggests that a potential oil spill in southern Davis Strait could not reach this marine area.	Colony of 3% of Canadian thick-billed murre population. Glaucous gull, black-legged kittiwake, and possibly Northern fulmar breed here. Nearby Loks Land is thought to support Nunavut's largest known colony of razorbill (not been visited since 1953). Dovekies congregate off the Hall Peninsula in August. An important nesting, feeding, and migration stop-over for common eider, Iceland gull, ivory gull, and harlequin duck (*Histrionicus histrionicus*). Canada goods and long-tiled ducks may also be found here.	Hantzsch Island is an International Biological Programme site (Region 9, Site No. 7-10) and a Canadian IBA (NU025).	12442	1336	Overlaps
Button Islands	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors. Concerns around increases in vessels in the area and potential hydrocarbon exploration. The complex nature of currents in the region suggests that oil spills in southern Davis Strait could enter this marine area. Oil spills associated with shipping could endanger a large number of marine birds and pollute their feeding areas.	Black-legged kittiwake and northern fulmar forage near the Button Islands. Ivory gulls and common eider have been observed. Thick-billed murre breed here.	International Biological Programme site (Region 9, Site No. 6-8).	3909	81	Overlaps

Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km^2)		Distance from shipping lane (km)
				Marine	Land	
Akpatok Island	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors - particularly for murres. Shoreline around Akpatok Island is considered to be "high hazardous risk of oil spills". Concerns around increases in vessels in the area and potential hydrocarbon exploration. The complex nature of currents in the region suggests that oil spills in southern Davis Strait could reach this marine area. Oil spills associated with shipping could endanger a large number of marine birds and pollute their feeding areas.	Large breeding colony of thick-billed murre. Black guillemots also nest along the Akpatok Island coast. Black guillemot nest along the island's coast. Peregrine falcon and glaucous gull also breed here.	Biological Programme site (Region 9, Site No. 6-6) and an IBA in Canada (NU007).	4943	859	82
Ungava Bay Archipelagoes	Sensitive to disturbance of important nesting sites along coast, important foraging grounds and staging / breeding areas in the marine environment, and key migratory corridors.	Support a large portion of breeding common eider. Eider occur in this area from April through October	The Plover and Payne, Gyrfalcon, and north eastern Ungava Bay islands are Canadian IBA (NU027, NU028, NU029).	5624	5	93
Sleeper Islands	Degradation of staging and foraging areas, particularly for eiders. Potential hydrocarbon exploration. Prevailing west and north west winds render the east coast of the Bay most susceptible to oil damage.	Common eiders nest here in the summer months. Over 30 species of birds have been observed in the Sleeper Islands.	IBA site (NU033).	1880	90	536

Table B-6: Environment Canada Key Marine Habitat Sites for Migratory Birds Located Near the Proposed Shipping Route

Site Name	Sensitivities	Biological Significance	Status	Size (km^2)		Distance from shipping lane (km)
				Marine	Land	
Belcher Islands	Degradation of staging and foraging areas, particularly for eiders. Excessive harvest of down from breeding colonies. Potential hydrocarbon exploration. Prevailing west and north west winds render the east coast of the Bay most susceptible to oil damage.	Common eider nest here in the summer. In the winter, polynyas and the floe edge support substantial numbers of common eider and long-tailed duck.	The North Belcher and South Flaherty islands are Canadian IBA (NU031, NU100).	5 to 15 recurrent, small polynyas		680
Northern Ontario Coastline	Degradation of staging and foraging areas, particularly for ducks. Potential hydrocarbon exploration.	Black scoter moult along this marine area feeding on blue mussels and other molluscs. Common eiders are year-round residents. Canada geese and lesser snow geese make use of coastal areas.	Waters in James Bay are part of the James Bay Preserve.	7860	41	607
Markham Bay	Disturbance and sensitivity to potential pollution of foraging, staging and migrating areas.	Support a large portion of breeding common eider. Support substantial numbers of Kumlien's gull (*Larus glaucoides kumlieni*) colonies and black guillemot. Eiders occur in this area from April through October.	No special designation.	4015	423	58
East Bay	Disturbance and sensitivity to potential pollution of foraging, staging and migrating areas.	Supports Arctic Canada's largest single colony of common eider. Supports colony of black guillemot and a large population of lesser snow goose. Substantial numbers of Atlantic brant and Sabine's gull also breed here. Supports some of the highest known breeding densities of shorebirds in the eastern Arctic. Red phalarope are the most common shorebirds.	Migratory Bird Sanctuary and a Canadian IBA (NU023).	274	1	84

Areas of High Biological Importance

Fisheries and Oceans Canada sponsored an Arctic Marine Workshop to bring together expert knowledge on marine fauna and habitat use in the Canadian Arctic (Stephenson and Hartwig 2010). The objective of the workshop was to identify overlapping areas of habitat use by different Arctic species, and, therefore, areas of High Biological Importance (HBI) to wildlife. In total, 19 HBI were identified; 3 of these occur within, or in the vicinity of, the proposed RSA including Southampton Island, Chesterfield Inlet, and Hudson Strait. The Southampton Island HBI extends from Cape Bylot to Ell Bay and includes the north and west coasts of Coats Island. This area provides important habitat for several species of seal, walrus (including an overwintering area), and numerous marine bird species. It also provides key denning habitat for polar bears and important foraging grounds for bowhead whales. The Chesterfield Inlet HBI consists of the Hudson Bay coast from Whale Cove to Arviat. This area provides key habitat for beluga whales, killer whales, several species of seal, Arctic char, and several seabird species along the coast. The Hudson Strait HBI, which includes Akpatok, Salisbury, and Nottingham Islands, has been identified as being amongst the most productive areas in the Arctic (Stephenson and Hartwig 2010), supporting several large seabird colonies along the coast, key shrimp habitat, and important overwintering areas for several marine mammals including narwhal, beluga whale, and walrus. This area is known to be more productive than Hudson Bay due to an increased level of surface mixing and a large tidal exchange. The ice edge, which extends the length of the Strait during winter, is also considered dynamic habitat for numerous Arctic marine species.

Bowhead Whale Critical Habitat Areas

Wheeler et al. (2012) investigated critical summer and fall habitat for bowhead whales in the eastern Canadian Arctic by performing a monthly ecological niche factor analysis for 3 bowhead whale spatial datasets in contrast to concurrent eco-geographical variable datasets (including sea surface temperature, chlorophyll, ice cover, water depth, slope, and distance to shore) to determine overall bowhead whale habitat suitability in this region. The study produced 11 habitat suitability models, and resulted in the development of a composite map of predicted high suitability habitat for the months of June to October. In total, 21 discrete areas were identified (with low confidence) within the Eastern Canadian Arctic as ‘critical habitat’ during the open-water season (Figure B-25). Of these, 9 (Areas 13, 14, 15, 16, 17, 18, 19, 20, and 21) were located within, or in the vicinity of, the proposed RSA or shipping corridor between Rankin Inlet and eastern Hudson Strait. Coastal Inuit knowledge (referred to as Inuit Qaujimajatuqangit or IQ – see Figure B-26) supported the identification of critical habitat in northwest Ungava Bay (Big Island; Area 15). Aerial surveys (Cosens and Innes 2000) and telemetry studies (Dueck et al. 2006) supported the identification of critical habitat near Southampton and Coats islands (Area 20). There was no corroborating IQ or scientific evidence to support other identified critical habitat in northern Hudson Bay, Hudson Strait, and Labrador (Areas 13 to 15, 18, and 19). This may be due to bowhead whales no longer frequenting these areas, or population surveys and IQ studies were not conducted in these areas.

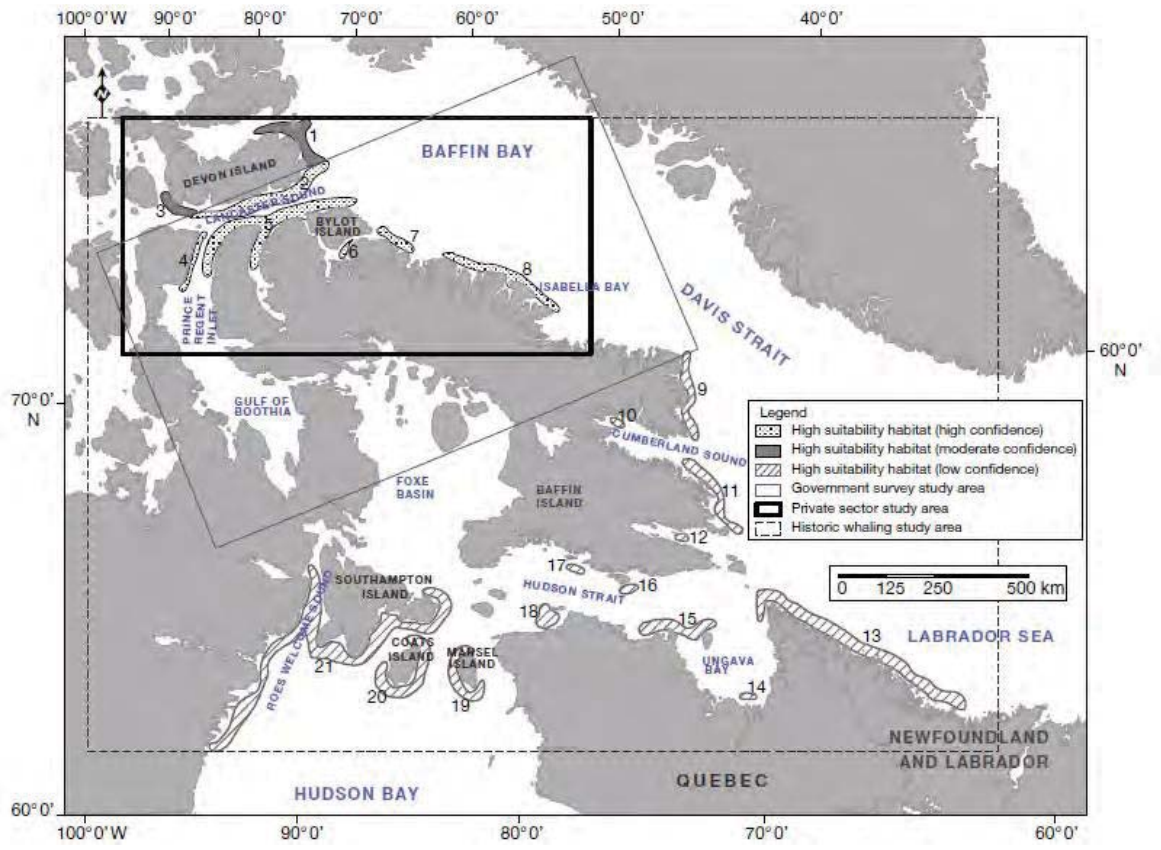

Figure B-25: Discrete Areas of Highly Suitable Bowhead Whale Habitat Identified for 3 or More Months from June to October in the Eastern Canadian Arctic (by analytical confidence) Produced by Ecological Niche Factor of 3 Bowhead Location Datasets and Associated Eco-Geographical Variables (extracted from Wheeler et al. 2012)

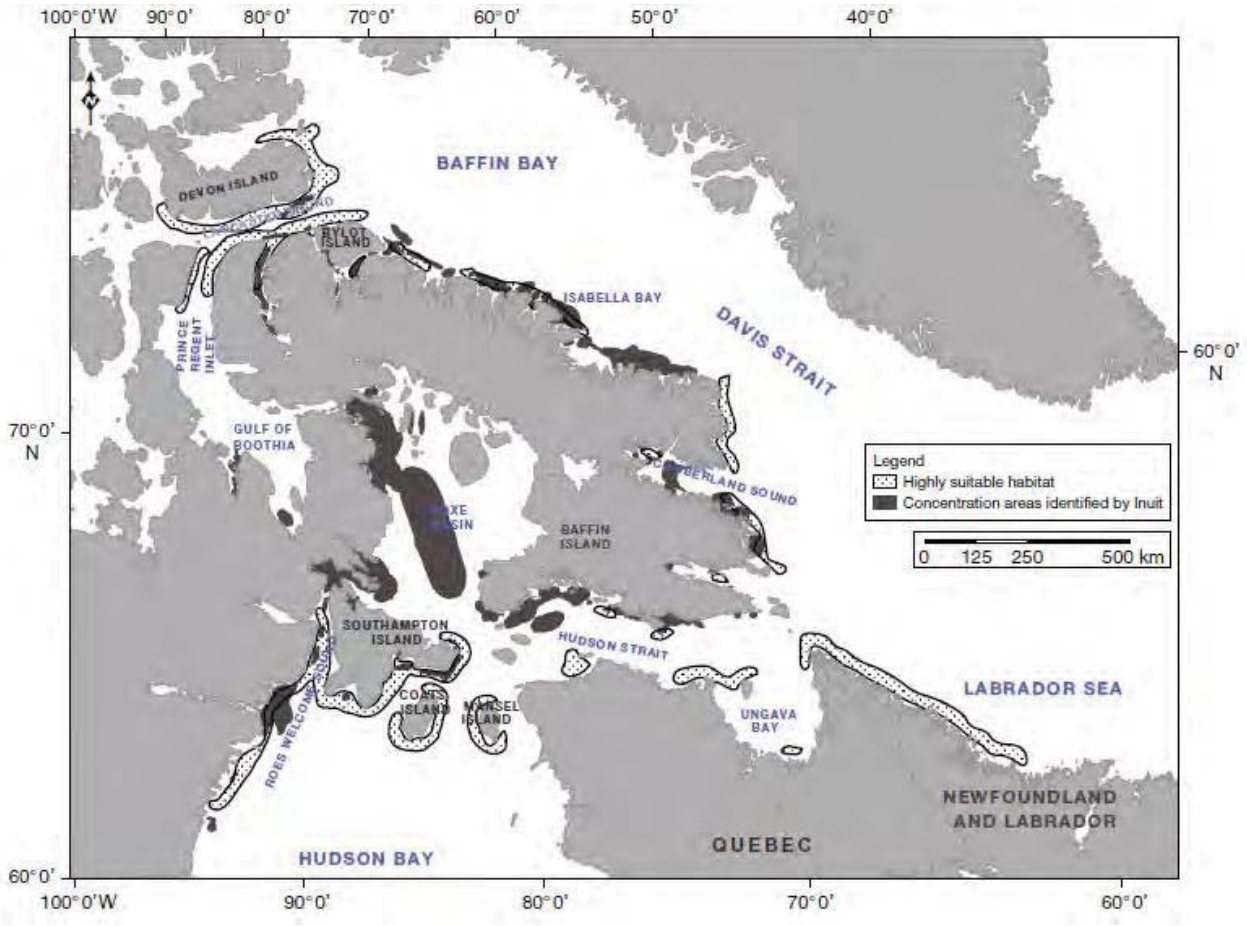

Figure B-26: Comparison of Highly Suitable Bowhead Whale Habitat Predicted by Ecological Niche Factor Analyses with Bowhead Concentration Areas Identified by Inuit in Nunavut, Canada, in Late Spring, Summer, and Early Fall (adapted from NWMB 2000 and Wheeler et al. 20

1.4 Traditional Knowledge

Sources of IQ for marine wildlife included the following:

- IQ studies conducted by Nanuk Enterprises in 1997 and 1998 in Rankin Inlet and Chesterfield Inlet. The results of these studies are summarized in FEIS Volume 9, Section 9.3;
- IQ studies conducted by Nanuk Enterprises in 2010-2011 in Rankin Inlet, Chesterfield Inlet, and Whale Cove. The full report is included as FEIS Volume 9, Appendix 9.3-A and summarized in FEIS Volume 9, Section 9.3;
- Interview conducted on 15 July 2011 by Nunami Stantec in Rankin Inlet with representatives from the Kangiqliniq Hunters and Trappers Organization. The full report is included as Appendix 8.2-A of the FEIS;
- IQ studies conducted by Nanuk Enterprises / Outcrop Ltd. during 2012, consisting of interviews with local hunters, fishers, tour operators, and experienced seamen representing the communities of Rankin Inlet,

Chesterfield Inlet, and Whale Cove. The 2012 interviews focused on marine resources along the proposed shipping route through Hudson Bay and the marine approaches to Rankin Inlet. The full report is included as FEIS Volume 9, Appendix 9.3-C and summarized in FEIS Volume 9, Section 9.3; and

- A literature review of the Nunavut Atlas (Canadian Circumpolar Institute 1992) and the Inuit Land and Occupancy Project (Freeman and Murty 1976) conducted by Golder in 2012 summarizing historical Traditional Resource Use (TRU) in the Rankin Inlet region and surrounding communities as described in FEIS Volume 9, Section 9.3.

Collectively, these studies identify the following main points of interest with respect to traditional resource use and traditional knowledge in the Project area:

- Itivia is commonly used by local community members for small boat operations including boat mooring and launching. The location of the proposed landing barge corresponds with the only navigable area at Itivia during a low tide;
- Arctic char represent an important food species for the local community and are mainly harvested during August in the Rankin Inlet region. Some residents also participate in the commercial Arctic char fishery, which occurs approximately 40 to 50 km (25 to 30 miles) outside Rankin Inlet, although it occurred closer historically. Other fish species locally harvested in the Project area (in marine waters) include sculpin, cod, capelin, whitefish, and trout;
- Hunting and fishing in Melvin Bay is thought to be less productive today than in the past (1960s and 1970s), a factor potentially linked to recent increases in local vessel traffic in the bay;
- Marine mammal species harvested in the Rankin Inlet region include the following:
- Beluga whales - hunted during the open-water season (primarily in August and September) – mainly near Marble Island. Most individuals summer near Churchill and migrate north along the west coast of Hudson Bay beginning in late August. Some individuals overwinter in polynya areas (when ice conditions allow) in northwestern Hudson Bay, Roes Welcome Sound, and Hudson Strait;
- Walruses – uncommon in Rankin Inlet in recent years, this species is hunted year-round in areas north of Marble Island. During summer and winter, large numbers of walruses haul-out on Bencus, Coats, Walrus, and Southampton islands;
- Polar bears – hunted primarily during winter on the sea-ice. Hunting is based on a quota system, which was lowered for the WHB sub-population during the 2010-2011 harvest to 8 individuals due to concerns for the population size, and then raised to 21 individuals for the 2011-2012 quota following increased reports by community members of problem bears near the communities (GN 2011). Some individuals have been observed on Marble Island and swimming offshore during the summer months between the surrounding islands. There is some concern by community members that increased shipping in the area may result in adverse impacts on polar bears, including behavioural disturbance (active avoidance or displacement effects) and/or physical injury / mortality from potential ship strikes;

- Four species of seal (ringed, bearded, harp, and harbour) – hunted throughout the year (on sea-ice and in open-water), with ringed seals being the most commonly hunted species. Recent increases in the number of harp seals near Rankin Inlet may represent influx of animals from adjacent Chesterfield Inlet that have been displaced by increased shipping / icebreaking activities in this area;
- Hunters have expressed concern over the proximity of the shipping route to Marble Island and potential effects of shipping on marine mammal distribution / migration, and hunting activities in this area. However, the implementation of a 2 km buffer (exclusion zone) around Marble Island for all Project vessels is deemed sufficient to mitigate these concerns;
- Narwhals and bowhead whales are not an important subsistence species for the Rankin Inlet community and are uncommon in the Rankin Inlet area. Narwhals summer north of Rankin Inlet in Daly Bay, Roes Welcome Sound, and Foxe Basin and winter in pack-ice regions of eastern Hudson Strait and Davis Strait. Bowhead whales are occasionally observed near Repulse Bay, Frozen Strait, Southampton Island, and Chesterfield Inlet;
- Hudson Strait is considered an important migratory corridor for marine mammals (beluga whales, narwhals, bowhead whales, and harp seals) transiting between Davis Strait / Labrador Sea and Hudson Bay / Foxe Basin. The critical migratory periods are early summer (June) and fall (late August to October). Proposed shipping activities for the Project coincide with the fall migratory period;
- Killer whales appear to be increasing locally in number particularly near Marble Island, although this species is not traditionally harvested. Concerns have been raised regarding the potential effects of the increasing killer whale population on other marine mammals due to predation, particularly with respect to bowhead whales;
- Several marine bird species are known to forage and/or nest in the Project area, including eider ducks (common eiders), black guillemots, Arctic terns, and several species of gull. Most nesting periods fall outside the shipping season (open-water). Egg harvesting occurs in spring for goose, eider duck, tern, guillemot, and gull. Shorebirds and raptors are not harvested by Inuit. The number of marine birds in Melvin Bay in recent years is thought to have decreased;
- Locally harvested shellfish species include blue mussels and clams. Historically, shellfish harvesting occurred along the north shore of Melvin Bay. Today, the harvest mainly occurs outside the harbour due to related health advisories from the Department of Health and Social Services. Scallops collected from the stomachs of hunted walruses are highly regarded by elders;
- Seaweeds (marine vegetation) are not locally harvested in the Project area in Melvin Bay;
- With respect to climate change, several major changes have been observed over the past 20 years in Rankin Inlet and include later freeze-ups, shorter sea-ice periods, decreases in land-fast ice, greater uncertainty in weather conditions, higher frequency of severe storm events, decreases in marine mammals observed in July, and changes in the timing of moulting of ringed seals (occurring as early as April); and
- Rankin Inlet community members recognize 2 shipping routes for access to Rankin Inlet (see Maps 1 and 2 in FEIS Volume 9, Appendix 9.3-C). In the deep-water sections of the shipping corridor, the exact shipping routes are not marked and likely vary by several kilometres. Recent increases in local shipping activity have been linked to several large Projects in the region including Meliadine, Meadowbank, Kiggavik, Baffinland, and Roche Bay.

2.0 CLOSURE

We trust that this report meets your immediate requirements. If you have any questions regarding the content of this report, please do not hesitate to contact this office.

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3.1 Personal Communication

Atkinson, S. Former Government of Nunavut Biologist. 2013. Personal Communication.

Dyck, M. Government of Nunavut Biologist. 2014. Personal Communication

APPENDIX C • RISK ANALYSIS OF MARINE TRANSPORTATION ROUTES

The approach used for the risk assessment draws on that of Areva for the Kiggavik Project[21].

A hazard is a condition with the potential to cause personal injury or death, property damage, environmental harm, or loss of service. Hazard severity along shipping and tug-barge routes can range from catastrophic resulting in fatalities and/or loss of the ship to minor where the incident does not significantly reduce ship safety and where mitigation measures are well within the crew's capabilities. A complete range of hazard severity is presented below in Table C-1.

Table C-1 Hazard Severity for Ship and Tug with Barge Routes

Hazard Severity and Rating Value	Definition
Catastrophic (Value 4)	Results in multiple fatalities and/or loss of the ship, tug or barge.
Hazardous (Value 3)	Reduces the capability of the ship or its operator's ability to cope with adverse conditions to the extent that there would be: • Large reduction in safety margin or functional capability; • Crew physical distress/excessive workload such that operators cannot be relied upon to perform required tasks accurately or completely; • Serious injuries to a small number of the crew; and • Possible fatality of one or more of the crew.
Major (Value 2)	Reduces the capability of the ship or its operators to cope with adverse operating conditions to the extent that there would be: • Significant reduction in safety margin or functional capability; • Significant increase in operator workload; • Conditions impairing operator efficiency or creating significant discomfort; • Physical distress to crew, including injuries; and • Major environmental damage, and/or major property damage.
Minor (Value 1)	Does not significantly reduce ship safety. Actions required by operators are well within their capabilities. Include: • Slight reduction in safety margin or functional capabilities; • Slight increase in workload such as routine ship navigation plan changes; • Some physical discomfort to the crew; and • Minor occupational illness and/or minor environmental damage, and/or minor property damage.

Likelihood ranges from probable where the incident is anticipated to occur one or more times in shipping and barge movements over the life of the Project, to extremely improbable where it is not anticipated to occur during the entire life-of-mine for the Project to any of the ships, tugs and barges contracted to AEM. Table C-2 provides a complete range of likelihoods.

[21] Areva. 2011. Kiggavik Project, Environmental Impact Statement, Marine Transportation, Tier 3 Technical Appendix 2J.

Table C-2 Likelihood of Mishap along Ship and Tug-Barge Routes

Likelihood and Rating Value	Definition
Probable (Value 4)	Qualitative: Anticipated to occur one or more times in ship or tug-barge operations over the life of the Project. Quantitative: Probability of occurrence per operational hour is greater than $1x10^{-5}$.
Remote (Value 3)	Qualitative: Unlikely to occur to each ship or tug-barge during its contract with the mine. May occur several times in the life of all ships and tankers for the life of the Project. Quantitative: Probability of occurrence per operational hour is less than $1x10^{-5}$ but greater than $1x10^{-7}$.
Extremely Remote (Value 2)	Qualitative: Not anticipated to occur to each ship or tug-barge while it is contracted by AEM during the life of the Project. May occur a few times in the life-of-mine to the ships and tankers contracted to AEM. Quantitative: Probability of occurrence per operational hour is less than $1x10^{-7}$ but greater than $1x10^{-9}$.
Extremely Improbable (Value 1)	Qualitative: So unlikely that it is not anticipated to occur during the entire life-of-mine for the Project to any of the ships and tankers contracted to AEM. Quantitative: Probability of occurrence per operational hour is less than $1x10^{-9}$.

The hazard severity value is multiplied by the likelihood value to determine the risk level. Table C-3 outlines the risk levels outcomes, which range from negligible to catastrophic.

Table C-3 Risk Levels

Severity and Value		Likelihood			
		Extremely Improbable	Extremely Remote	Remote	Probable
		1	2	3	4
Minor	1	1	2	3	4
Major	2	2	4	6	8
Hazardous	3	3	6	9	12
Catastrophic	4	4	8	12	16

Risk Levels 1-2 represent a negligible to low level of hazard to shipping. It does not significantly reduce the safety of the ship or tug-barge. Actions required by the ship's or tug's crew are well within their capabilities to avoid harm to the vessel, the crew and the environment.

Risk Levels 3-4 represent low to major risk. There is a significant reduction in the safety margin or functional capability of the ship or tug-barge. A great effort on the part of the crew will be required to avoid damage to the ship, major environmental effects and/or injuries to the crew.

Risk Levels 6-9 represent major to hazardous risk. The ship's or tug-barge's crew will have difficulty in coping with the adverse conditions to the extent the ship or tug barge will have a large reduction in its safety margin or functional capability, which could lead to serious injury to the crew and possible environmental harm.

Risk Levels 12-16 represent hazardous to catastrophic risk and is to be avoided. There could be fatalities, loss of the vessel, and/or major environmental harm.

Table C-4 Preliminary Risk Analysis of Tug-Barge and Ship Marine Routes

Preliminary Risk Analysis of Tug-Barge and Ship Marine Routes							
Hazard	Before Controls			Mitigation Measures	After Mitigation		
	Severity	Likelihood	Risk Level		Severity	Likelihood	Residual Risk
Tug-barge or ship runs aground	3	3	9	• Use electronic navigation aids; • Remain in shipping lanes; • Buoys within the near-shore islands; • Monitor adherence to standard operating procedures; and • One way traffic only in the access passage to Melvin Bay and Itivia harbour.	3	2	6
Loss of or damage to sea cans in heavy seas	2	3	6	• Lock sea cans to the deck; • Use appropriate stacking height for voyage; and • Slow tug tow speed in heavy seas.	2	2	4
Tug-barge or ship has mechanical failure	2	3	6	• Regular preventative maintenance schedule; • Maintain an inventory of critical parts on board; and • Have redundant critical systems.	2	2	4
Barge tow line breaks	2	3	6	• Have redundant tow line for safety purposes; and • Slow tow speed in heavy seas.	2	2	4
Collision or grounding of tugs between mooring location of large ships and Itivia harbour	3	4	12	• One way traffic only in the access passage to Melvin Bay and Itivia harbour; • Install Automatic Identification System on all tugs; and • Tugs proceed at a slower speed during low visibility periods.	3	2	6
Tug-barge or ship collides with a small boat from Rankin Inlet	2	3	9	• Education of public on use of shipping lanes; • Make public aware of incoming ships and tug-barge traffic in Melvin Bay; • Tugs-barge and ships proceed at a slow speed in periods of low visibility; and • Tug-barge and ships use horn in periods of heavy fog.	2	2	4
Tug-barge or ship sinks upon hitting ice	4	3	12	• Shipping is scheduled for open water; • Sail around ice; and • Slow vessel speed to avoid damage.	3	2	6