BAFFIN ISLAND

DYNO

Dyno Nobel

Baffin Island

EMERGENCY RESPONSE ASSISTANCE PLAN

DYNO NOBEL Baffin Island INC.
EMERGENCY RESPONSE ASSISTANCE PLAN
Emergency Response Notification

1. In the event of an emergency Mary river Site Security/MRT will be notified first at:

Radio:

- Radio Channel: EMERGENCY and or SS TAC (Site Services/Security)
- Call "Code 1, Code 1, Code 1"
- State Name
- Emergency Details
- Location
- **Phone:**
- Security 647-253-0596 Ext 6047

2. Dyno Nobel Baffin island on site plant will be contacted at:
   (647) 253 0596. Ext 6067
3. Off-Site notification:

	NAME	HOME	CELL
1.	NFLD Hardrok (24hr emergency)	(709) 754-4900	
2.	Jim Kasemets	(709) 632-4007	(709) 632-4007
3.	Roland Walsh	(709) 699-8987	(709) 765-6031
4.	Mark Gillis	(709) 634-2993	(709) 640-7969
5.	Kevin McDonald	(902) 341-2181	(902) 848-6849

Revision and Distribution

An updated copy of this ERAP must be kept in the following locations. Revisions to this ERAP must be reviewed and signed-off on by all who possess a copy:

Emulsion Plant Office	Mary River Site Security
DNBI Pick-ups – LTP040 & LTP043	Mary River MRT
DNBI Loader – LDR020	NHR Office – Corner Brook, NL
Emulsion Trucks – RC913 & RC914	NHR Office – St. John's, NL

Contents

EMERGENCY ACTION

Fire

Fire not involving explosives or ammonium nitrate (AN)

In the event of a fire not involving explosives or ammonium nitrate, Mary River Site Security will be notified of a "CODE ONE" on either the "Emergency" or "SS TAC" channel, or by phone at (647) 253-0596 ext. 6047**.** Fires which do not involve explosives or ammonium nitrate will be extinguished using normal fire-fighting procedures.

Fire involving explosives or AN

No attempt will be made to fight fires involving explosives or equipment containing explosive residue (AN included). The plant will be shut down and evacuated to the muster station (shown in Appendix C). After a verified head count all individuals will evacuate and blockade the main gate as shown on map to ensure no one enters. When all employees are out of harm's way, personnel will call a "CODE 1" on radio channel "Emergency" or "SS TAC" or call Security by phone at 647-253-0596 (extension number 6047).

The procedure for plant site evacuation is given in the Plant Evacuation Procedures section (page 6). In all cases, keep away from the gases and smoke released by the fire.

Detonation

In the event of a detonation at the plant, the emergency plan will go into effect immediately, starting with complete evacuation of the plant site. See page 6 of this ERAP.

Lightning

If lightning approaches the plant, remove all personnel to the main gate until all clear. See page 6 of this ERAP. If lightning approaches while the explosives truck is in pit, the truck should return to plant, time permitting, and follow the evacuation procedure. If there is no time to return to plant, leave the truck in the pit and notify the pit supervisor. Evacuate all pit personnel from the pit until the lightning passes.

Spills

Ammonium Nitrate

Ammonium nitrate for use at the Mary River Project is stored in containers in two locations; the KM 97 laydown and smaller quantities at the emulsion plant. The AN prill is stored in 1,000 kg tote bags, 20 of which are stored double-stacked in each of the 20' containers. No AN is stored outside at any time. AN is only withdrawn from the containers when required by plant production. It is loaded directly into the AN Handling Module of the plant to minimize any exposure of the product to the environment (See Appendix C)

Small spills will be swept up with plastic dust pan and broom and emptied in plastic cans marked AN only, to be either recycled in the plant or disposed of in blast holes. Large spills will be dealt with on an individual basis depending upon size of spill. Efforts will be made to contain spill and area will be secured before clean up begins.

Emulsion

Emulsion is stored in a single, 36,000 kg capacity tank within the emulsion loading garage (see the site plan in Appendix C). Smaller quantities may be stored in the two bulk emulsion trucks (10,000 kg capacity each) which are parked in the garages when not in use in the mine.

Small spills will be scooped up with non-sparking shovels and placed in bags, transported to magazine site at KM 105.5, to be stored until ready for disposal in blast holes. Large spills will be dealt with on an individual basis depending upon size of spill. Efforts will be made to contain spills and an area will be secured before clean-up begins. This may involve pumping of large spills into a tanker or scooping up product with shovels.

Oils, fuels, etc.

Methods of spill containment in all fuel/lubricant storage areas within the plant are is use to ensure spills are adequately contained before they occur. However, in the event of a spill outside of the designated storage areas, spills will be diked and absorbent pads used to collect the spill. Residual product not capable of being reused will be contained, collected with adequate amounts of soil absorbent to solidify the material and render it inert.

PLANT EVACUATION PROCEDURES

Evacuation

In the event that a fire involving explosives/AN, or a detonation occurring at the plant, the site must be immediately evacuated. Personnel must report to the muster point (noted on the site plan in Appendix C) where a head-count is to be conducted. When all personnel are accounted for, personnel must proceed to the main gate.

A "Code 1" alert must be broadcast on radio channel "Emergency" or "SS TAC" as soon as it is safe to do so. After repeating "code one, code one, code one", state your name, location and nature of the emergency. Indicate that there is a fire/detonation at the emulsion plant and no firefighting measures are to be taken. Security will re-broadcast this message to ensure all personnel on site are aware. Inbound or outboard air traffic must be halted or redirected.

As the landfill area is within the danger radius of a fire/detonation at the plant, plant personnel should sweep the landfill on their way out the emulsion plant road to ensure all personnel are clear of this area.

Guarding

The road to the emulsion plant must be guarded at the location given on the overall site plan in Appendix C. **NO ONE IS PERMITTED TO RE-ENTER THE AREA UNTIL AN "ALL-CLEAR" IS GIVEN.** If BIM employees are required to stand guard, Dyno Nobel Baffin Island (DNBI) employees will provide direction.

Response

It is the responsibility of Dyno Nobel Baffin Island management to direct the emergency response to a fire involving explosives/detonation at the plant. If no management personnel are on site, this will be coordinated through by the most senior DNBI employee on site. As previously stated, **the only response to a fire involving explosives/detonation**

at the plant is evacuation of the plant and guarding of all access points until the danger has passed.

RESOURCES

Milne Inlet - Port Site Complex			
For Outside caller - Main line # 647-253-0598 then Dial the Extension			
Name	**Position/Department**	**Phone Number**	**Internal Ext**
MRT	MRT	647-253-0598	4219
Health and Safety Coordinator	Health and Safety	647-253-0598	4122

Mary River			
For Outside caller - Dial 647-253-0596 +ext.			
Name	**Position/Department**	**Phone Number**	**Internal Ext**
Security Lead	Scarlet Security	(647) 253-0596	6047
MRT	MRT	(647) 2	6020
Environment Manager	Environment	(647) 253-0596	6016
Health and Safety Superintendent	Health and Safety	(647) 253-0596	6006

Outside resources include:

Emergency Services Dispatch	(867) 979-5662
R.C.M.P	1 (800) 979-1111
CANUTEC	(613) 996-6666
NRCAN Explosives Regulatory Division	(613) 948-5200
Environment Canada	1 (866) 283-2333

APPENDIX A: FIRE FIGHTING INFORMATION

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Ammonium Nitrate - 83% solution colourless	Use flooding amounts of water in early stages of fire. Keep upwind. This is an oxidizing agent which supports combustion and is an explosive hazard if heated under confinement that allows high pressure buildup. Evacuate to designated area if fire cannot be controlled.	Toxic oxides of nitrogen are given off during combustion. Fire-fighters require positive pressure self-contained breathing apparatus. Avoid contaminating with organic materials.
Ammonium Nitrate Prill - odourless white to light tan crystalline solid	Use flooding amounts of water in early stages of fire. Keep upwind. This is an oxidizing agent which supports combustion and is an explosive hazard if heated under confinement that allows high pressure buildup. Evacuate to designated area if fire cannot be controlled.	Toxic oxides of nitrogen are given off during combustion. Fire-fighters require positive pressure self-contained breathing apparatus. Avoid contaminating with organic materials. Many powdered metals such as Al, Sb, Si, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, Sn Zn and brass react violently and explosively with fused AN below 200 degrees C. Sensitivity to detonation increases when heated.
N-17	Flash Point: Not applicable Extinguishing Media: Not applicable	Wear self-contained breathing apparatus and protective clothing. No unusal fire explosion hazard.
L-2 Clear to pale yellow liquid. Very little if any odor.	Use water, CO_2, or Dry chemical	Fire fighters must be equipped to prevent breathing vapors or fumes of combustion. Highly toxic gases may result from exposure to fire or high temperatures.

APPENDIX A: FIRE FIGHTING INFORMATION

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Citric Acid Odourless, white or opaque crystals	Use water, Dry chemical, Alcohol or carbon dioxide	When heated to decomposition, citric acid emits acrid smoke. Fire fighters must wear self-contained breathing apparatus with full piece operated in positive pressure mode.
Fuel Oil (No. 2 diesel) dyed or pale yellow liquid with petroleum odour	Use water spray to cool fire exposed surfaces and to protect personnel. Shut off fuel from fire. Use foam, dry chemical or water spray to extinguish fire. Avoid spraying water directly into storage container due to danger of boilover.	Avoid strong oxidizing agents.
5168D Emulsifier dark viscous liquid with hydrocarbon odour Sodium Thiocyanate Colourless crystals with slight ammoniacal odour	Use carbon dioxide or dry chemicals on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires. Use dry chemical, water spray, water fog, carbon dioxide, foam or sand/earth to extinguish fire.	May form oxides of nitrogen upon thermal decomposition. Positive pressure self-contained breathing apparatus is required for fire-fighters. Contact with strong acids or oxidizing agents or combustion may generate toxic concentrations of sulphur dioxide, oxides of nitrogen, cyanides or hydrogen sulphide.
Sodium Nitrite white or slightly yellow solid	Apply aqueous film forming foam (AFFF) according to manufactures instructions or water in the form of fog for large fires. Use carbon dioxide or dry chemical media for small fires.	Thermal decomposition products include toxic oxides of nitrogen. Sodium nitrite promotes combustion. May explode if heated above 537 degrees Celsius.
Acetic Acid clear colourless liquid with sharp vinegar odour	Use water spray, dry chemical, carbon dioxide or alcohol foam to extinguish fire. Eliminate all nearby sources of ignition since flammable hydrogen gas will be liberated upon contact with some active metals.	Avoid alkalis, oxidizing or reducing materials and nitric acid.

APPENDIX A: FIRE FIGHTING INFORMATION

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Nitric Acid water white to slightly yellow liquid with nitrogen dioxide odour	Use an all purpose type AFFF foam according to manufacturers instructions. Carbon dioxide or dry chemical media for small fires. If only water is available, use it in the form of a fog.	Combustibles can have an increased flammability after contact with nitric acid. Nitric acid reacts with metals to liberate flammable hydrogen gas. Toxic oxides of nitrogen may also be liberated.
Caustic Soda, Anhydrous Odourless, white granular solid	Do not use water, foam, Carbon Dioxide, Dry Chemical. Use media appropriate for surrounding fire and or materials. Remove containers from fire zone wherever possible.	Avoid direct contact of this product with water as this can cause a violent exothermic reaction. Use self-contained breathing apparatus and protective clothing.
Ethylene Glycol Colourless liquid with mild odour	Extinguish fire with water fog, carbon dioxide or dry chemical. Direct application of water or foam into container may cause violent frothing and boilover.	Never use welding or cutting torch on or near drum (even empty or with small residue) because product can ignite spontaneously.

APPENDIX B: ENVIRONMENTAL RELEASE PROCEDURES

MATERIAL	SPILL AND LEAK PROCEDURES	WASTE DISPOSAL
Ammonium Nitrate - 83% solution colourless	- Prevent spills from entering water courses. Contain by dyking with earth or other inert material. Allow to freeze. Shovel into clean, non-combustible container. Wash remaining trace residues with water. Wear rubber gloves and chemical goggles to minimize contact with the skin and eyes. - Refer to Ekati Spill Contingency plan – section V page 55 for details on procedures for spills resulting from fuelling of equipment at fuel stations.	- Dispose of recovered material in approved landfill or other waste disposal facility.
Ammonium Nitrate Prill - odourless white to light tan crystalline solid	- Remove source of heat and ignition. Sweep or shovel spill into a clean, non-combustible container. Wash remaining trace residues with water. Wear rubber gloves and safety glasses to minimize contact with skin and eyes.	- Re-use if possible or dispose of as is in approved facility. Otherwise, dissolve in large amount of water. Add soda ash and mix and neutralize with 6M HCl to produce neutralized sludge. Sludge can then be buried in approved landfill. Sludge incineration requires scrubbing capability for oxides of nitrogen.
N-17 Clear to light blue liquid, sharp vinegar odor	Wear appropriate protective clothing and respiratory protection. Contain spills and avoid discharging into sewer or streams. Neutralize small spills with soda ash or lime. Absorb with vermiculite or other inert material.	- Re-use if possible, otherwise dispose of in approved landfill or other waste disposal facility
Citric Acid Odourless, white or opaque crystals	Sweep up material and place in tightly closed container in a cool, dry and well ventilated area. Avoid discharge into sewer and surface water. Spills to waterways will cause PH depression.	In accordance with Provincial and Federal regulations

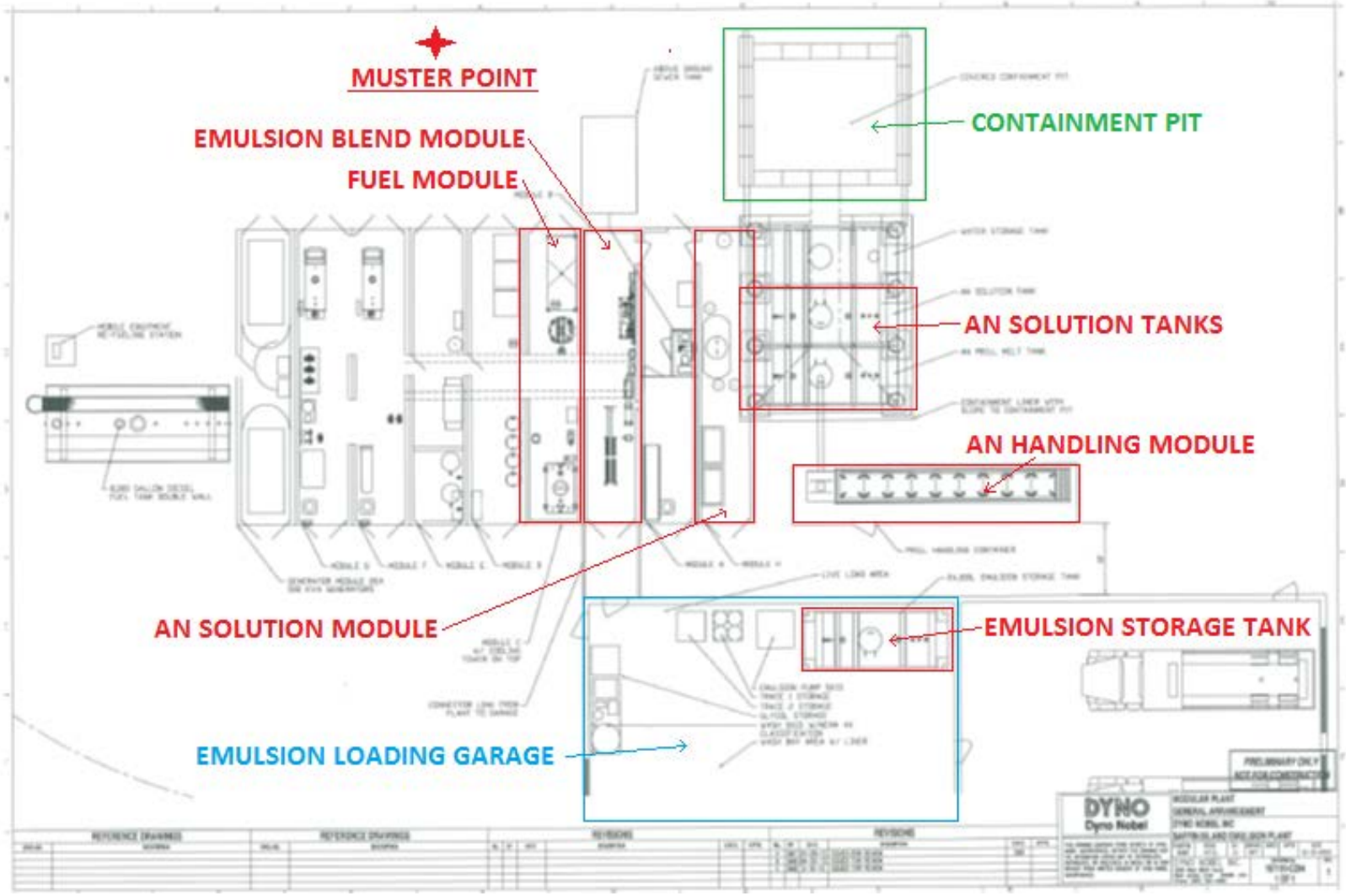
APPENDIX B: ENVIRONMENTAL RELEASE PROCEDURES

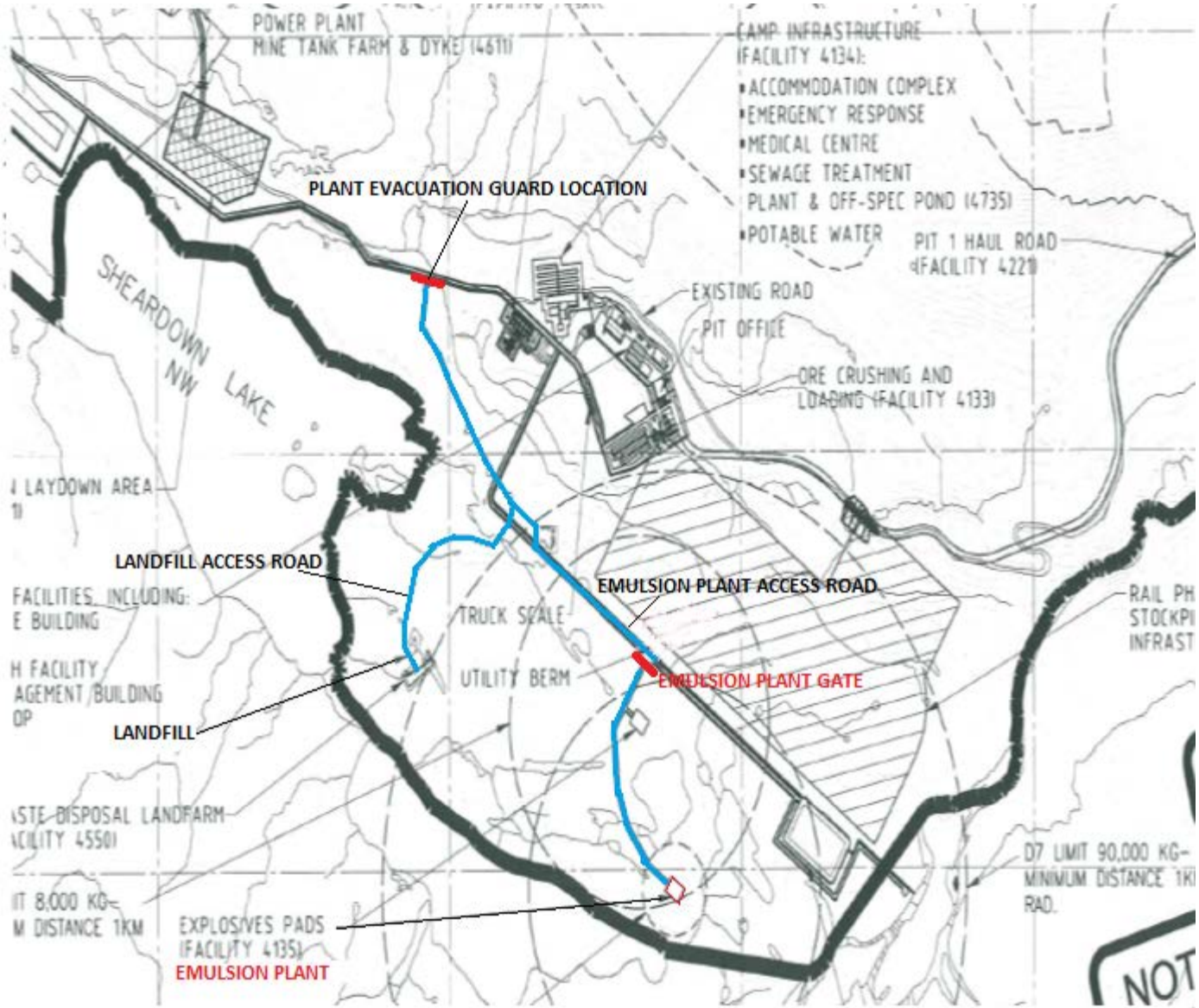
MATERIAL	SPILL AND LEAK PROCEDURES	WASTE DISPOSAL
L-2 Clear to pale yellow liquid. Very little if any odor	Wear appropriate chemical resistant clothing including rubber gloves, rubber boots. Contain spill and keep out of sewer, storm draines, surface water and soil. Keep away from incompatible materials.	- Dispose of recovered material in approved landfill or other waste disposal facility. Check with Provincial and Federal regulation.
Fuel Oil (No. 2 diesel dyed or pale yellow liquid with petroleum odour.	- Eliminate any source of ignition. Prevent spills from entering water courses. Contain with sand or earth. Recover with pump or inert adsorbent material into clean container. Wear safety glasses and rubber gloves to prevent contact with the eyes and skin.	- Dispose of recovered material in approved landfill or other waste disposal facility.
5168D Emulsifier dark viscous liquid with hydrocarbon odour	- Contain with sand or earth. Recover with inert adsorbent material and transfer into clean container. Wear chemical goggles and rubber gloves to prevent contact with the eyes and skin. Wash area with suitable detergent and rinse with water.	- Dispose of recovered material in approved landfill or other waste disposal facility.
Sodium Thiocyanate Colourless crystals with slight ammoniacal odour	- Sweep or shovel spill into a clean container. Prevent spills from entering any water courses. Wash remaining trace residues with water. Wear rubber gloves and chemical goggles to minimize contact with skin and eyes.	- Dispose of recovered material in approved landfill or other waste disposal facility.
Sodium Nitrite white or slightly yellow solid	- Sweep or shovel into clean, non-combustible drum. Remove any flammable materials and sources of ignition. Flush remaining trace residues with water. Wear chemical goggles and rubber gloves to minimize contact with the eyes and skin.	- Dispose of recovered material in approved landfill or other waste disposal facility.

APPENDIX B: ENVIRONMENTAL RELEASE PROCEDURES

MATERIAL	SPILL AND LEAK PROCEDURES	WASTE DISPOSAL
Acetic Acid clear colourless liquid with sharp vinegar odour	- Eliminate any source of ignition. Prevent spills from entering water courses. Contain with sand, earth or other inert adsorbent material. Transfer into clean, non-combustible container. Wash remaining trace residues with water. Wear chemical goggles and rubber gloves to prevent contact with the eyes and skin.	- Neutralize with soda ash or lime. Dispose of recovered material in approved landfill or other waste disposal facility.
Nitric Acid water white to slightly yellow liquid with nitrogen dioxide odour	- Eliminate any source of ignition. Prevent spills from entering water courses. Contain with sand, earth or other inert adsorbent material. Transfer into clean, non-combustible container. Wash remaining trace residues with water. Wear chemical goggles and rubber gloves to prevent contact with the eyes and skin.	- Neutralize with soda ash or lime. Dispose of recovered material in approved landfill or other waste disposal facility.
Caustic Soda, Anhydrous Odourless, white granular solid	- Sweep or shovel into clean, non-combustible drum. Neutralize the area carefully with weak acid to PH of 6 to 9. Neutralization is expected to be exothermic. Effervescence may result.	Neutralize the area carefully with weak acid to PH of 6 to 9. - Dispose of recovered material in approved landfill or other waste disposal facility
Ethylene Glycol Colourless liquid with mild odour	- Prevent spills from entering water courses. Contain with sand, earth or other inert adsorbent material. Transfer into clean, non-combustible container. Wash remaining trace residues with water. Wear chemical goggles and rubber gloves to prevent contact with the eyes and skin.	- Dispose of recovered material in approved landfill or other waste disposal facility.

APPENDIX C: EMULSION PLANT LAYOUT




POWER PLANT
MINE TANK FARM & DYKE (4611)
CAMP INFRASTRUCTURE
(FACILITY 4134):
•ACCOMMODATION COMPLEX
•EMERGENCY RESPONSE
•MEDICAL CENTRE
•SEWAGE TREATMENT
PLANT & OFF-SPEC POND (4735)
•POTABLE WATER
PLANT EVACUATION GUARD LOCATION
PIT 1 HAUL ROAD
(FACILITY 4221)
SHEARDOWN NW LAKE
EXISTING ROAD
PIT OFFICE
ORE CRUSHING AND
LOADING (FACILITY 4133)
LAYDOWN AREA
LANDFILL ACCESS ROAD
EMULSION PLANT ACCESS ROAD
FACILITIES, INCLUDING:
E BUILDING
TRUCK SCALE
H FACILITY
AGEMENT BUILDING
OP
UTILITY BERM
EMULSION PLANT GATE
LANDFILL
STE DISPOSAL LANDFARM
CILITY 4550)
IT 8,000 KG-
M DISTANCE 1KM
EXPLOSIVES PADS
(FACILITY 4135)
EMULSION PLANT
D7 LIMIT 90,000 KG-
MINIMUM DISTANCE 1K
RAD.
NOT

Baffinland Iron Mines Corporation

Landfarm Operation Maintenance and Monitoring Manual

BAF-PH1-320-T07-0005

Rev 0

Prepared By: Trevor Myers
Department: Environmental
Title: Environmental Superintendent
Date: March 18, 2015
Signature:

Approved By: Bikash Paul
Department: Site Services
Title: Site Services - Manager
Date: March 18, 2015
Signature: for

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
03/18/15	0	TM	BP	Use

TABLE OF CONTENTS

1 PURPOSE AND SCOPE

The purpose of this manual is to outline and prescribe Standard Operating Procedures to ensure that Baffinland Iron Mine's Milne Port landfarm facility is operated in an efficient manner that is consistent with Baffinland's commitments to health, safety and environmental protection.

This manual has been designed to be used as a field reference document and training manual for classroom and self-instruction purposes. All employees with accountabilities and responsibilities as outlined in this manual are expected to be familiar with its use and location at the site. This manual contains the basic knowledge regarding responsibilities, environmental protection measures and regulations, safety practices and overall procedures for operating the Milne Port landfarm facility.

2 REQUIREMENTS

2.1 HAZARDS AND ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT (PPE)

The following section provides the hazards, personal protective equipment (PPE), and safety and environmental equipment requirements associated with landfarm facility operation and maintenance activities.

2.1.1 HAZARDS

There are numerous hazards associated with the operation and maintenance of the landfarm. They include:

- Equipment collision or rollover
- Flying dust and small particles
- Petroleum hydrocarbon (PHC) vapor inhalation
- Spills

2.1.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Wear Standard P.P.E. - Safety glasses, hard hat, safety boots and reflective vest[1].
- Optional - Respirator fitted with an organic vapor cartridge(s) when dealing with heavily contaminated soils or when unusually high levels of hydrocarbon vapor may be present.

2.1.3 SAFETY AND ENVIRONMENTAL EQUIPMENT

- Spill kits (at landfarm and on mobile equipment)
- Radio Communication
- Optional - Gas monitor (for air quality testing)

[1] PPE is not required for operators inside enclosed cabs of heavy equipment.

2.2 Training, Qualifications and/or Certification

Any operator who may be working at the landfarm shall complete the documented training in this procedure and demonstrate their understanding of their responsibilities, and of the hazards and controls. Verification of training will be kept by the Training Department.

3 RESPONSIBILITES

The following roles have specific accountabilities that must be met to ensure the Milne Port landfarm facility is operated in compliance with this manual. The following roles and responsibilities have been assigned to site personnel required to complete landfarm facility operations; however, this may not include all duties required to safely and successfully operate the facility.

3.1 Site Services Manager/ Superintendent

The Site Services Manager, or the Site Services Superintendent in the Manager's absence, is accountable for the overall operation of the landfarm facility. Specifically, he/she shall:

a. Implement and enforce this procedure.
b. Plan and coordinate the use of the landfarm facility to conserve space and optimize remediation efficiency;
c. Assist in the development, implementation and enforcement of landfarm specific safety protocols;
d. Meet routinely with the Site Services Supervisor(s) to maintain proper control of the site and identify existing or anticipated problems considering the following:
    i. Operational issues;
    ii. Regulatory Requirements;
    iii. Equipment issues; and
    iv. Special operating instructions; e.g., inclement weather, repairs, fertilizer addition, etc.
    e. Schedule routine work as required (e.g., snow removal, tilling and spreading, irrigation, etc.);
f. Ensure that the need for any special operating conditions are identified and planned for in advance. This may include the identification of features (e.g. stockpiles) with stakes in advance of winter and the ground freezing;
g. Coordinate a biannual summer earthworks inspection which shall be conducted by a geotechnical engineer.

3.2 Site Services Supervisor

The Site Services Supervisor, under the supervision of the Site Services Manager/Superintendent, is responsible for supervising all activities at the landfarm facility in accordance with this manual. Specifically, the Site Services Supervisor shall:

a. Implement this procedure;
b. Regularly brief the Site Services Manager/Superintendent on the status of routine operations and any potential issues;

c. Ensure that soils under remediation are spread evenly to a soil depth determined to optimize hydrocarbon degradation rates;
d. Maintain thorough, accurate and detailed records of landfarm operations and additional requirements as determined;
e. Provide timely response to incidents and inquiries to ensure the landfarm is operated in compliance with this procedure;
f. Inspect and organize the landfarm facility layout;
g. Direct site users to the proper stockpiles or dumping area according to the incoming soils' contaminant type;
h. Perform all the duties of the landfarm Operator/Labourer in his/her absence;
i. Restrict access to landfarm facility, closing and locking gate after use or as required.

3.3 Landfarm Operator/ Labourer

The Landfarm Operator/Labourer, under the supervision of Site Services Supervisor, is responsible for executing the following tasks at the landfarm facility. Specifically the Operator/Labourer shall:

a. Be trained and experienced in operating the mobile heavy equipment necessary for the work;
b. Work in conjunction with the Site Services Supervisor in executing general facility operations according to this procedure;
c. Prepare landfarm facility for summer treatment operations prior to freshet (e.g. snow removal, etc.);
d. Apply water and/or nutrients to remediating soil under the direction of the Site Services Supervisor and the guidance of the Environment Department;
e. Inspect incoming contaminated soils and direct site users to proper stockpiles according to contaminant type; and
f. Assist the Environment Department in treating water collected in the facility sump and contaminated snow containment.
g. Report all violations of site user rules (Attachment A) to their supervisors for further action and incident reporting.

3.4 Environment Department Personnel

To ensure all employees and contractors are following the guidelines outlined in this manual, the Environment Department will conduct biweekly inspections of the Milne Port landfarm facility. In addition to conducting inspections, Environment personnel shall:

a. Provide guidance to site personnel with regards to acceptable soils at the landfarm;
b. Assist Site Services in optimizing soil remediation rates by monitoring parameters including:
    i. Soil characteristics; grain size, soil texture, bulk density, moisture content and permeability;
    ii. Residual petroleum hydrocarbon concentrations;
    iii. Soil chemistry; nutrients, salts, pH; and
    iv. Tilling frequency.
c. Sample remediating soils throughout summer treatment season to monitor remediation progression;
d. Assist Site Services in the treatment of water collected in the landfarm sump and contaminated snow containment;

e. Identify treated soils that meet remediation objectives and are acceptable for reintroduction to the environment;
f. Liaise with regulators and stakeholders on matters related to landfarm operations (e.g. notification of planned reintroduction of remediated soil to the environment);
g. Install groundwater wells and monitor groundwater quality along the perimeter of the landfarm facility; and
h. Audit record keeping associated with landfarm facility operations.

4 DEFINITIONS

Landfarm: Bioremediation treatment facility that uses naturally occurring microorganisms (mainly aerobic) and soil aeration (tilling) to remediate soils impacted by petroleum hydrocarbon (PHC) spills.

Contact Water: All irrigation water, precipitation and snowmelt that collect within the landfarm sump.

5 PROTOCOL

5.1 Facility Design, Locations and Layout

The Milne Port landfarm facility was designed in accordance with Environment Canada's Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils to ensure both the protection of the environment and the health and safety of all personnel. It is located north of Milne Port Quarry 1 (MP-Q1) along the former Tote Road access. The facility consists of two containments, a landfarm containment and a contaminated snow containment (figure 1):

- The layout of the landfarm consists of a lined, containment area for stockpiling and remediating contaminated soils, a sump in the southwest corner for contact water collection and a ramp in the southeast corner for transporting soils in and out of the facility. It is designed to accommodate approximately 3,383 m3 of contaminated soils.
- Located on the east side of the landfarm, the contaminated snow containment is designed to store contaminated snow and ice generated from spills during the winter months. It is designed to hold 929 m3 of snow and ice (assuming a freeboard of 30 cm) and is accessed by a ramp on the south side.

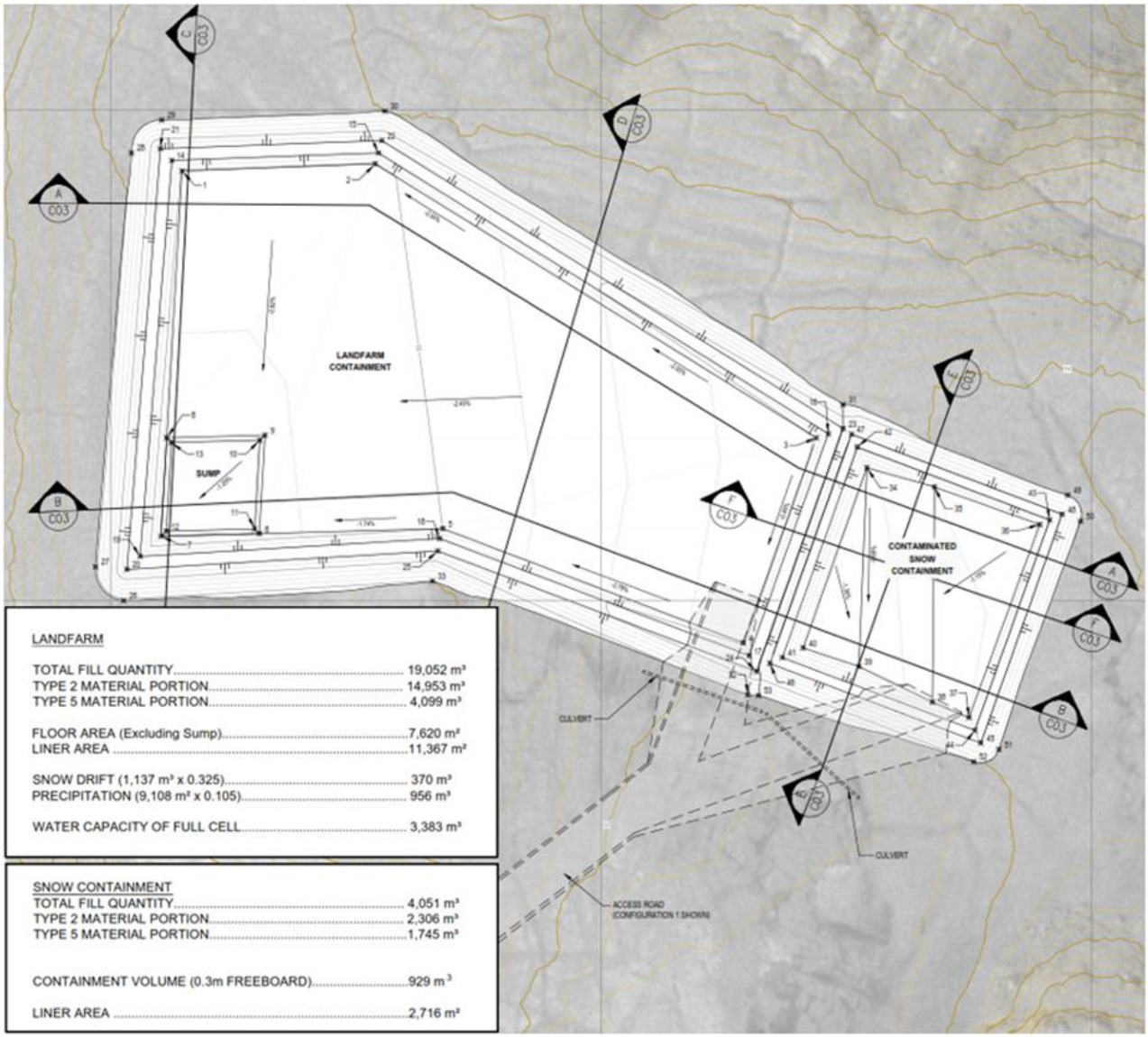


Figure 1 – Landfarm and Contaminated Snow Containment Facility

5.2 Acceptable Soil Criteria

- Impacted soils destined for the landfarm shall be inspected to ensure the material is acceptable for treatment.
- All hydrocarbon contaminated soils are accepted at the landfarm (e.g. diesel, Jet-A, hydraulic oil).

- In case of major hydrocarbon spills or spills of unknown substance, soils should be sampled prior to being introduced in the landfarm and should meet the following chemical acceptability criteria[2] :
  - Total PHCs less than 4%;
  - Electrical conductivity <4 dS/m; sodium adsorption ratio (SAR) <6;
  - pH greater than 5 and less than 10; and
  - CCME metals up to Tier 1 values or up to natural background concentrations
- Salts contaminated soil shall not be deposited in the landfarm. They may be harmful to biodegradation in high concentrations.
- Rock fragments and cobble exceeding 100 mm (4 in.) in diameter shall not be deposited at the landfarm. They have the potential to damage the containment liner during tilling.
- Acceptable soil types and criteria shall be posted at the entrance of the facility and the unloading or stockpiling area.

5.3 Acceptable Snow Criteria

- Hydrocarbon contaminated snow and ice shall be deposited in the contaminated snow containment.
- Sewage contaminated snow and ice shall not be deposited in the snow containment. It should be deposited in the Milne Port Polishing Waste Stabilization Ponds (PWSPs).

5.4 Stockpiling

- Soils should be separated into stockpiles according to contaminant type.
- Each stockpile shall be clearly labelled with signage in order to direct trucks unloading contaminated material to the proper location at the facility.
- The Landfarm Operator/Labourer shall ensure that adequate signage and barricades are in place at the required locations at the beginning of each day and relocate signs and barricades as required at the end of each day.

5.5 Cell Development, Soil Thickness and Tilling

- **Cell development:** Soil should be tilled as it is spread, continuing until all of the intended soil has been deposited to ensure that the material is well-mixed and aerated.
- **Soil thickness:** Remediating soil should have an approximate soil depth of 30 cm (12 in.) and should maintain a 2 m (6 ½ ft.) perimeter from the inside toe of the berm.

[2] These characteristics detail the optimal chemical composition of suitable landfill soils and will be used as a guideline in determining treatability of soils generated by spills.

- **Optimum soil condition:** Landfarm soil should be loose and moist. During the summer treatment season, the soils should be tilled every week. Optimizing the moisture content will enhance biodegradation and avoid dust generation.
- **Dry soil:** Very dry soils should not be tilled. The landfarm should be irrigated prior to tilling to increase the soil moisture content to 40% to 85% of the soils' water-holding capacity.
- **Wet soil:** Soils that are too wet should not be tilled. Passing equipment over wet or saturated soils could compact the material, reducing aeration and overall microbial activity. If soils appear muddy, or stick to the tracks of the tilling equipment, the soils are too wet to process.
- **Tilling equipment:** All tilling should be done with a plow pulled by a tracked skid steer to reduce soil compaction and optimize soil aeration. To avoid unnecessary soil compaction, only tilling equipment shall be permitted on remediating soil plots while actively tilling.

5.6 Water Management and Monitoring

5.6.1 Irrigation and Routine Operation

- **Sump water:** Contact water that accumulates in the sump from precipitation or snowmelt may be recycled as irrigation water to increase soil moisture or to supress dust within the landfarm area during dry periods.
- **Sheen:** Recycled water from the sump should not contain any PHC sheen. If a sheen is observed it should be removed with absorbents or avoided by drawing water from beneath the water surface.
- **External water requirements:** As per the Type A Water License No. 2AM-MRY1325, Part E, Item 5, MBR effluent or treated water from the Milne Port PWSP may be used to irrigate dry soil, if such waters meet their respective appropriate discharge criteria. Consumption of fresh water should be avoided.

5.6.2 Water Treatment and Discharge Criteria

- The level of contact water within the landfarm sump shall be monitored and maintained within the determined range during the summer months to maintain adequate freeboard and avoid flooding the soils undergoing treatment.
- Contact water should be drained prior to freeze-up in September.
- All water from the landfarm sump and contaminated snow containment pond shall be sampled and analysed prior to discharge to ensure the water quality meets the landfarm discharge criteria outlined in Baffinland's Type A Water License No. 2AM-MRY1325, Part F, Item 24, Table 9.
- All water that does not meet discharge criteria shall be treated using the onsite mobile Oily Water Treatment System (OWTS). All water sampling shall be conducted in accordance with Baffinland's Surface Water Sampling QA/QC Plan.

5.6.3 Groundwater Monitoring

- Groundwater monitoring wells shall be installed around the perimeter of the landfarm facility to ensure the structural integrity of the facility's containment liner throughout facility operations.
- Groundwater wells shall be sampled at a minimum of once annually, between mid-August and mid-September when groundwater monitoring becomes possible.
- All sampling groundwater sampling shall be conducted in accordance with Baffinland's Surface Water Sampling QA/QC Plan.

5.7 Soil Management and Monitoring

5.7.1 Remediation Objectives

- Remediation objectives for impacted soils shall be determined by the source of contamination and the subsequent use of the remediated soils.
- Tier 1 criteria for PHC and metals parameters will be used as a minimum to determine soil remediation objectives, as outlined in the Government of Nunavut Environmental Guideline for Site Remediation (2009), as per Baffinland's Type A Water Licence No. 2AM-MRY1325, Part J, Item 6.
- Analysis of additional parameters will depend on the source of contamination.

5.7.2 Soil Sampling and Analysis

- At the beginning of each summer treatment season, soils shall be evaluated for optimal nutrient, moisture and pH conditions.
- Soil sampling should be conducted throughout the treatment season to characterize soil additions from recent spills and monitor the progression of PHC degradation in soils undergoing remediation.
- Parameters may include soil bulk density, salts, moisture content, field capacity, and nutrients.
- All soil samples shall be collected using best industry practices and in accordance with the principles outlined in Baffinland's Surface Water Sampling QA/QC Plan.

5.7.3

- Any transport of soils out of the landfarm shall be preapproved by the Environment Department.
- The use of remediated soil for back fill or general site grading may be carried out only upon consultation and approval by the Government of Nunavut, Department of Environment and an Inspector, as per Baffinland's Type A Water License No: 2AM-MRY1325, Part J, Item 6.

5.7.4 Winter Management and Freshet Preparation

- **Winter management:** Contaminated soil can be stockpiled up to 5 m (5 yd.) to minimize the amount of contact precipitation.

- **Freshet preparation:** Snow and ice accumulated within the landfarm that has not come in contact with the underlying contaminated soil can be removed and placed outside the landfarm facility to melt.
- Approximately 10 cm (4 in.) of contact snow cover should remain on all surfaces during the snow removal process.
- If the landfarm soils are disturbed, contact snow should remain in the landfarm area and be deposited in the sump to melt.
- Snow accumulation within the sump area should be removed to within 10 cm (4 in.) of the ice surface.

5.8 Summary of Inspections and Reporting

Table 6.1 summarizes the documentation and due diligence required to ensure compliance throughout the landfarm operations. All site personnel responsible for completing landfarm facility operations shall be familiar with documentation and reporting requirements.

Table 6.1 – Monitoring Summary and Documentation

Item	Purpose	Responsible Party	Frequency	Type of Record(s)
General Operations	Record keeping of treatment operations	Site Services and Environment	Ongoing	• A working log detailing the following: - Dates, volumes (m^3) and source of soils entering and exiting facility - Start and end date of soils under remediation - Dates and volumes of contact water treated, discharged and recycled - Dates, volumes and source of soil amendment additions (e.g. wastewater effluent, fertilizer) • A current layout sketch identifying origin and contaminant type of remediating soils and stockpiles • Photographic record.
Soil Sampling	Characterization and acceptance at landfarm	Environment	As required (e.g. major spill, spill of unknown substance)	• Soils origin and associated spill report. • Field notes detailing sampling methodology, soil texture, moisture content, odor and suspected contaminants. • Laboratory-issued analysis reports including QA/QC and chain of custody. • Documentation of fate of rejected soils. • Record of any treatability tests done.

Item	Purpose	Responsible Party	Frequency	Type of Record(s)
Soil Sampling	Remediation Progress Monitoring Determination of amendment additions	Environment	Monthly during the frost-free months	• Field notes detailing sampling methodology, sample location and depth, soil texture, moisture content and odor. • Photographic record. • Laboratory-issued reports including QA/QC and chain of custody. • Summary tabulation of results. • Analysis of percent removal of PHC constituent treated and treatment time.
Soil Sampling	Verification of remediation	Environment	Once per year at the end of the season Otherwise, as circumstances require	• Field notes and sketch detailing sampling methodology, sample location and depth, soil texture, moisture content and odor. • Photographic record. • Laboratory-issued reports including QA/QC and chain of custody. • Summary tabulation of results. • Analysis of percent removal of PHC constituent treated and treatment time. • Documentation of fate of treated soils including date and volume (m^3).

Contact and Contaminated Water Sampling	Conformity to Water License requirements
	
	Remediation Progress Monitoring
		Environment	Monthly, or as required	• Document notification to Inspector (written notification at least 10 days prior to discharge).
				• Field notes detailing:
				  • Discharge start and stop times
				  • Date and time of samples taken
				  • Daily discharge volumes (m^3)
				  • Photographic record of OWTS setup
				• Laboratory-issued reports including QA/QC, chain of custodies and summary tabulation of results.

Groundwater Monitoring and Sampling	Groundwater quality assessment	Environment	At least once per year	• Laboratory-issued reports including QA/QC, chain of custodies and summary tabulation of results • Field notes detailing sampling methodology, date and time of sampling, depth of active layer, weather and condition of wells. • Trend analysis (after a minimum of four years of data, if applicable).
Construction Summary Report	As-built and construction report as per Water License.	Projects	Submit to Nunavut Water Board within 90 days of completion of construction	• Construction field notes and observations. • Record and as-built drawings. • Monitoring well installation details. • Summary of any geotechnical testing, compaction, moisture content, particle size analysis.

Item	Purpose	Responsible Party	Frequency	Type of Record(s)
Site Safety Inspections	Hazards identification	Health and Safety	Weekly	• Any unsafe condition/near-miss/incident reports and records. • Any unsafe conditions reported by workers must be reported to the Safety Department immediately for prompt action.
Geotechnical Inspection	Earthworks integrity and maintenance requirements identification	Site Services Engineering Consultants	Biannually during the summer	• Inspection of geotechnical performance of facility. • Berm performance with emphasis on observations of cracking or any signs of instability • Document recommendations of any repair/maintenance work. • Record of any repair work made to the facility.

6 REFERENCES AND RECORDS

- Government of Nunavut. Department of Sustainable Development. Environmental Protection Service. Environmental Guideline for Contaminated Site Remediation. March 2009.
- Environment Canada. Federal Contaminated Sites Action Plan (FCSAP): Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. ISBN no. 978-1-100-22284-4. Cat. No. En14-19/3-2013E-PDF. 2013.
- Nunavut Water Board - Type A Water Licence No: 2AM-MRY1325
- EBA. Preliminary Hydrocarbon Impacted Soils Storage and Landfarm Facility – Operations, Maintenance and Monitoring Plan. EBA File No. E14101092. Milne Inlet, September 2011.
- EBA. Laboratory Biotreatability Study to Evaluate Biodegradation of Petroleum Hydrocarbons. SiREM Ref: TL0307B. Milne Inlet, July 2012.
- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011)

Attachment A

Landfarm Facility User Rules

1. **RESTRICTED ACCESS – ONLY SITE SERVICES PERSONNEL ARE ALLOWED TO ENTER THIS FACILITY.**
2. **Only HYDROCARBON contaminated snow and soil are accepted at this facility.**
3. **Incinerator, hazardous and/or landfill waste are NOT accepted at this facility.**
4. **All placement of soil and contaminated snow in the facility must be preapproved by Site Services Supervisor prior to dumping.**
5. **Vehicles shall follow posted speed limits and directions to the unloading area - Unloading in other areas is strictly prohibited.**
6. **No unloading by rapid acceleration or deceleration is permitted.**
7. **All spills are to be stopped if safe to do so, and immediately reported to the Site Services Supervisor.**
8. **Personal Protective Equipment (PPE) is required to be worn at the facility.**
9. **In case of Emergency – Immediately contact the Site Services Supervisor or call a Code 1, if necessary, providing your location, your name and the nature of the emergency.**

Attachment B

LANDFARMING - BASIC PROCESSES AND PRINCIPLES

The Milne Port landfarm is a bioremediation treatment facility that remediates soils impacted by PHC spills and releases. Remediation is achieved by spreading contaminated soil in a thin layer (30 – 45 cm) across the landfarm area and allowing two natural processes to remove the PHCs from the soil: (1) PHC degradation by naturally occurring microorganisms; and (2) chemical volatilization.

The breakdown of PHC by aerobic microbial degradation is the dominant process of the two and results in three main end products: water, carbon dioxide and microorganism protein. The stimulation of microbial growth and activity for the removal of PHCs is accomplished primarily through the addition of air and nutrients. Microorganisms that degrade PHCs require optimal quantities of water, oxygen, and macronutrients (carbon, nitrogen, hydrogen, oxygen, sulphur, phosphorus, potassium, and magnesium), and have an ideal soil pH between 6 and 8. In addition, excessive salt compounds reduce the osmotic potential of the soil and can slow, or even halt biodegradation. Salts that are harmful to biodegradation in excessive concentrations include sodium chloride and particular fertilizer amendments.

The overall effectiveness of landfarming depends on the following three main parameters:

1. Soil characteristics; grain size, soil texture, bulk density, moisture content and permeability;
2. Type of petroleum hydrocarbon or contaminant; and
3. Climatic conditions.

Soil characteristics influence the rate of at which impacted soils remediate by affecting several factors including PHC retention, water holding capacity, surface area, permeability and bioavailability. Most soil microorganisms that breakdown PHCs in a landfarm require an aerobic environment, making remediation of soil with low permeability, such as clay, more difficult. Because of this, tilling is conducted to loosen and aerate the soils in order to enhance microbial activity.

Moreover, the type of PHCs present in impacted soils is one of the main factors that determines the amount of time required for remediation. Soils impacted by diesel and/or Jet-A remediate significantly faster than soils contaminated with hydraulic and engine oils due to the differences among the PHCs chemical composition.

Climatic conditions including rainfall, snow, wind effects and temperature also influence remedial efficiency. Rain and snow melt will change the moisture content of the treated soil which in turn can alter the activity of the microorganisms responsible for PHC degradation. In contrast, wind and low humidity have the potential to increase water evaporation and dry out remediating soil. Maintaining the moisture content of impacted soils within a range of 40% to 85% of the soil's water-holding capacity will enhance biodegradation and avoid dust generation.

Baffinland Iron Mines Corporation

MSDS Approval and Management Procedure

BAF-PH1-810-PRO-0025

Rev 0

Prepared By: Shiwley Paul
Department: Health and Safety
Title: Health and Safety Analyst
Date: February 26, 2015
Signature:

Approved By: Tony Noseworthy
Department: Health and Safety
Title: Health and Safety - Superintendent
Date: February 26, 2015
Signature:

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
02/26/15	0	S.P	T.N	Use

TABLE OF CONTENTS

1 PURPOSE

The purpose of this procedure is to ensure that any and all controlled or non-controlled products which have an external material safety data sheets (MSDS) shall be reviewed and authorized prior to use at any Baffinland site including Steensby, Mine Site, Port Site and Oakville corporate office. In addition, this procedure outlines proper management of MSDS to ensure timely updating and site wide access for all personnel who work with or around controlled/uncontrolled substances.

2 SCOPE

This document applies to all controlled and non-controlled products which are to be procured for use on any Baffinland site, including Steensby, Mine Site, Port Site and Oakville corporate office.

3 RESPONSIBILITES

3.1 REQUISITIONER

The requisitioner shall complete the Product Approval Form and submit the form to Health and Safety and Environment Departments with the most current version of the MSDS attached. The requisitioner shall create a purchase requisition (PR) and attach the MSDS as well as the product approval form to the PR in SAP.

3.2 BUYER

The Buyers shall place the order for the product and request an up-to-date version of the MSDS from the vendor.

3.3 WAREHOUSE

Warehouse Technicians/Supervisors shall receive the products and update the MSDS Online database. If the MSDS provided by the vendor is newer than the version available on MSDS Online, the Warehouse Technician/Supervisor shall upload the newer version into the system.

Warehouse shall set the location as “Warehouse” for all Controlled and Un-Controlled products which are received into the warehouse. Furthermore, the Warehouse shall update the location on all items requiring an MSDS once those items are signed out of the warehouse.

The warehouse shall ensure that no products are shipped to site from Kitchener Airport without proper authorization and approvals. The warehouse shall hold any products that do manage to arrive on site without proper approval, until such approval is obtained.

3.4 HEALTH AND SAFETY

The Health and Safety department may approve all requested products after ensuring that there is no other product which is safer for use and will accomplish the same thing, and that proper PPE available for use with the product. Furthermore, the safety department shall perform annual audits of MSDS in the field.

3.5 ENVIRONMENT

The Environment department may approve requested products after conducting a review that includes an assessment of the product based on the following aspects:

- Are there alternative products already available, or more suitable products which will accomplish the same purpose?
- Will the use of the product lead to a high potential for violation of existing environmental permits, or pose significant issues with respect to clean-up in the event of spill, and potential issues associated with proper disposal.
- Will the substance be captured under federal environmental reporting or other regulations?
- Will the product require particular storage (e.g. heated, ventilated, segregated for incompatibility)?
- If inadvertently disposed in the sewer system, could the product pose risk to the wastewater treatment plant operation?

The environment department shall keep and file all original copies of the product approval forms.

4 DEFINITIONS

Material Safety Data Sheets: A document that contains information of the potential hazards (health, fire, reactivity, etc) and how to work safely with the chemical product.

Controlled Product: Any products, materials or substances that are regulated by WHMIS legislation. All controlled products fall under one or more of the six WHMIS categories.

Non-Controlled Products: Products that do not fall under one of the six WHMIS categories.

5 REFERENCES AND RECORDS

N/A

Appendix A

Baffinland Product Approval Form

Appendix A: Baffinland Product Approval Form

Department: _____ Date: _____

Contact Person: _____ Telephone #: _____

Approval Required By (Date): _____

Name of Product: _____

Chemical Name: _____

Manufacturer: _____

Area/ Department to be used: _____

Usage: TRIAL ONE TIME USE PERMANENT

Revision date of MSDS (must be valid within three years): _____

Product to be used as follows (be specific):

_____

_____

_____

Is there an existing chemical on site used for the same purpose? _____

Will this new product replace the existing chemical? _____

List alternate chemicals considered: _____

Type of container for the chemical: _____

Order quantity: _____

Projected usage rate: _____

***Below is to be completed by BIM Environment and H&S Coordinator.**

Personal Protective Measures:

_____

_____

_____

Storage Requirements

_____

_____

_____

Waste management:

_____

_____

_____

Disposal method:

_____

_____

HEALTH AND SAFETY

Approval: _____ Date: _____

ENVIRONMENT

Approval: _____ Date: _____

BAF-PH1-810-FOR-0016 Rev0