ATTACHMENT 24

Waste Management Plan

(204 Pages)

Baffinland Iron Mines Corporation

WASTE MANAGEMENT PLAN

BAF-PH1-830-P16-0028

PHASE 2 PROPOSAL REVISIONS
FOR REVIEW PURPOSES ONLY

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1.0 INTRODUCTION

This Plan describes Baffinland Iron Mines Corporation's (Baffinland's) approach to effectively managing waste generated by the Mary River Project.

1.1 PURPOSE AND SCOPE

The Plan describes:

- Wastes generated at Project sites
- Various disposal methods for these wastes
- Means of minimizing and handling waste
- Operating procedures of each of the facilities used to manage and dispose of non-hazardous solid waste
- Roles and responsibilities relating to waste management
- Monitoring and adaptive management measures to ensure a high level of compliance with this plan and applicable legislation and standards

The following infrastructure has or is planned to be constructed at Project sites (Milne Port and the Mine Site) to handle, store, transport and dispose of non-hazardous solid waste:

- Waste management facilities to accommodate waste sorting and storage
- Incinerators
- Open burning facilities
- Landfills
- Landfarms

Other management plans that deal with liquid wastes (effluents) and hazardous wastes are identified and described in Section 1.2.

This Waste Management Plan (Plan) has been updated to support the environmental review and permitting of the Phase 2 Proposal. Further and continual modifications and revisions to this Plan shall be completed based on changes to Project infrastructure, waste management procedures, and protocols.

1.2 RELATIONSHIP TO OTHER MANAGEMENT PLANS

Other management plans relevant to waste management are described in Table 1.1.

TABLE 1.1 RELATIONSHIP TO OTHER MANAGEMENT PLANS

Referenced Management Plan	Document No.	Information Provided by Referenced Plan
Environmental Protection Plan (EPP)	BAF-PH1-830-P16-0008	Provides relevant environmental protection measures.
Fresh Water Supply, Sewage and Wastewater Management Plan	BAF-PH1-830-P16-0010	Describes plans for managing fresh water supplies and the disposal of effluents (sewage, oily water and mine contact water).
Hazardous Materials and Hazardous Waste Management Plan	BAF-PH1-830-P16-0011	Management of hazardous wastes, including used oils, contaminated fuel, used chemical products, biomedical waste, and spill clean-up materials.

Referenced Management Plan	Document No.	Information Provided by Referenced Plan
Interim Closure and Reclamation Plan	BAF-PH1-830-P16-0012	Closure measures including the waste disposal during active closure.
Spill Contingency Plan	BAF-PH1-830-P16-0036	Response measures associated with spills, including releases of wastes.
Emergency Response Plan	BAF-PH1-840-P16-0002	Process for responding to emergencies.
Adaptive Management Plan	TBD	Describes the generic approach to adaptive management on the Project, including management plans. Includes objectives, indicators, thresholds, and indicators (OITRs) related to the Project.

1.3 CORPORATE POLICIES

Baffinland has four corporate policies that apply to this management plan:

- **Sustainable Development (SD) Policy -** identifies Baffinland's commitment internally and to the public to operate in a manner that is environmentally responsible, safe, fiscally responsible and respectful of the cultural values and legal rights of Inuit.
- **Health, Safety and Environment (HSE) Policy -** describes the company's commitment to achieve a safe, healthy and environmentally responsible workplace.
- **Anti-Bribery and Anti-Corruption Policy -** describes Baffinland's commitment to ensuring its directors, officers, employees, contractors, and representatives conduct due diligence on third parties when promoting Baffinland's business.
- **Code of Business Conduct Policy -** describes Baffinland's minimum requirements for directors, officers, employees, contractors, and representatives to follow a Code of Business Conduct.

All employees and contractors must comply with the above mentioned policies. Copies of the first two plans are included in Appendix A.

1.4 REGULATORY REQUIREMENTS

This Plan outlines the Project's policies and procedures to ensure compliance with the relevant terms, conditions and regulations outlined in the following regulatory instruments:

- Type A Water Licence No. 2AM-MRY1325 issued by the Nunavut Water Board (NWB or the Board)
- Type B Water Licence No. 2BE-MRY1421
- Commercial Lease - Q13C301 (Commercial Lease) with the Qikiqtani Inuit Association (QIA)
- Project Certificate No. 005 issued by the Nunavut Impact Review Board (NIRB)
- Inuit Certainty Agreement (QIA and Baffinland, 2020)

Tables of concordance with the applicable regulatory approvals are provided in Appendix B.

The following legislation place specific requirements on the Project with respect to the management of wastes:

- *Territorial Lands Act* and Territorial Land Use Regulations
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act*
- *Canadian Environmental Protection Act*
- *Safety Act* and Occupational Health and Safety Regulations

- National Fire Code
- *Public Health Act* and regulations including:
  - General Sanitation Regulations
  - General Sanitation Exemption Regulations
  - Camp Sanitation Regulations
- *Fisheries Act*

The Government of Nunavut (GN) has published several guidelines to assist waste generators in effectively developing waste management plans:

- Contaminated site remediation (GN, 2009)
- General management of hazardous waste (GN, 2010a)
- Mercury-containing products and waste mercury (GN, 2010b)
- Waste antifreeze (GN, 2011a)
- Waste asbestos (GN, 2011b)
- Waste batteries (GN, 2011c)
- Waste solvents (GN, 2011d)
- Industrial waste discharges (GN, 2011e)
- Ozone-depleting substances (GN, 2011f)
- Used oil and waste fuel (GN, 2012a)
- Waste lead and lead paint (GN, 2014a)
- Biomedical and pharmaceutical waste (GN, 2014b)

These guidelines were considered in developing this Plan.

2.0 PLANNING

2.1 OBJECTIVES

The objectives and performance indicators of this Waste Management Plan are identified in Table 2.1.

TABLE 2.1 OBJECTIVES AND PERFORMANCE INDICATORS

Objective	Performance Indicator
Operate waste incinerators in compliance the with Water Licence (NWB, 2015) and the Government of Nunavut's waste management environmental guidelines[1,2]	• Chamber and stack temperature • Dioxins, furans and mercury in stack emissions • Toxicity Characteristic Leaching Procedure (TCLP) analytes in incinerator ash
Conduct open burning in compliance with this plan, the Open Burning of Untreated Wood, Cardboard and Paper Products Procedure, and Open Burn Permit	• Confirm waste types suitable for open burning
Maximize waste reduction, reuse and recycle opportunities	• n/a
Conduct landfill operations in compliance with this plan and the Landfill Operation and Maintenance Manual, and Waste Sorting Guidelines	• Requirements of the Landfill Operation and Maintenance Manual, and Waste Sorting Guidelines
Conduct landfarm operations in Compliance with this plan and the Landfarm Operation, Maintenance and Monitoring Manual	• Requirements of the Landfarm Operation, Maintenance and Monitoring Manual
No negative impact to receiving environment water quality at the landfill and landfarm areas	• Landfill: pH, total metals (As, Cu, Pb, Ni, Zn), TSS, oil and grease • Landfarm: pH, TSS, Oil and Grease, total Pb, Benzene, Toluene, Ethylbenzene
Maintain physical stability at the landfill and landfarm areas	• Physical instabilities (ponding water, erosion, settlement)
(Insert Inuit objectives)	(Insert Inuit performance indicators)

NOTES:

1. Stack emissions limits specified in the GN's *Environmental Guideline for the Burning and Incineration of Solid Waste* (GN, 2012b).
2. Discharge limits for landfilling incinerator ash in the GN's *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* (GN, 2011e).

Baffinland and the QIA are jointly implementing an adaptive management process into management plans developed for the Project (Section 2.3), and this includes the development of Inuit objectives and indicators, as noted in Table 2.1.

Baffinland has implemented, and continues to improve upon, a waste minimization program that focuses on the principles outlined in its EHS Management System Framework Standard. Remaining waste will be disposed of in non-hazardous landfill facilities, incinerated, or shipped offsite to licenced waste disposal facilities.

2.2 CONSIDERATION OF INUIT QAUJIMAJATUQANGIT

An Inuit Stewardship Plan (ISP) will be developed by the QIA pursuant to the Inuit Certainty Agreement referenced above. The ISP will describe how Inuit monitoring activities tie into the adaptive management system and other management, mitigation, and monitoring plans, and, how Inuit monitoring will relate to the protection and promotion of Inuit rights defined under the *Nunavut Agreement* and described under legal agreements with Baffinland related to management and stewardship of Inuit owned lands and resources. The ISP will be the framework for Inuit-led monitoring of impacts and changes within communities and on the land, waters and ice as a result of the Project. The ISP will embed a "boots on the ground" approach to monitoring whereby Inuit will be hired and trained as professional monitors for monitoring under the ISP. Through the ISP, Inuit will govern the use of Inuit knowledge and observations regarding the Project.

Further updates to this plan are expected as an outcome of the development of the ISP that articulate Inuit monitoring objectives, indicators, thresholds and responses (OITRs) related to the protection of surface waters and aquatic ecosystems.

In the interim, Table 2.2 summarizes the opportunities that Baffinland has explored to incorporate IQ into this Plan.

TABLE 2.2 INCORPORATION OF IQ INTO THIS MANAGEMENT PLAN

Element	Description
Environmental sensitivities and receptors	Environmental sensitivities and receptors can be integrated into a future revision of this Plan
Indicators and thresholds	Confirmation required with Inuit through QIA-Baffinland AMP Working Group; Interim Inuit objectives, indicators, thresholds and responses to be identified in this Management Plan and subject to later revision through the ISP and AMP reviews on a scheduled basis
Mitigation measures	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Monitoring	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Adaptive management	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Validation of IQ Integration	To be verified by Inuit Committee
Management review	To be verified by Inuit Committee

An important aspect of integrating IQ is validating such integration with Inuit. For this reason, only potential opportunities for IQ integration have been identified. A more fulsome effort to incorporate IQ into this draft plan will be undertaken in the future, based on feedback from the Inuit Committee (to be established) and a standing QIA-Baffinland Adaptive Management Working Group, and consistent with the Adaptive Management Plan (Baffinland, 2020). Adaptive Management

2.2.1 DEFINING THE ADAPTIVE MANAGEMENT PROCESS

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes (Canadian Environmental Assessment Agency, 2016). Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project.

Baffinland has developed a draft Adaptive Management Plan (AMP) that provides the framework by which adaptive management is to be incorporated into Project operations (Baffinland, 2020). The Project-wide adaptive management process begins with a planning phase, followed by iterative phases of implementing and monitoring the actions included in the plan(s), evaluating the effectiveness of actions included in the plans based on results of monitoring and other feedback mechanisms, and adjusting management strategies and actions and responses based on monitoring. The cycle begins anew with implementation and monitoring of a revised plan, which integrates the outcomes of the previous cycle. This cycle can occur, in real-time or over an extended period according to the nature of the situation or area of focus. In this way, a properly designed and well-implemented adaptive management process progressively diminishes uncertainty, as management strategies and processes are refined throughout a project's operational lifecycle.

Monitoring and responding to effects in the short-term is addressed in a Trigger Action Response Plan (TARP) described in Section 5.0. The TARP identifies the pre-defined actions to be taken should threshold levels be exceeded. A series of escalated actions to be implemented are detailed in Section 5.0. Longer term review of and response to monitoring data is addressed in an annual review of plan effectiveness in Section 6. The latter includes an annual comparison of project effects against impact predictions made in the Final Environmental Impact Statement (FEIS; Baffinland, 2012) and the addendums (Baffinland 2013, 2018), which are presented in Appendix B.

Implementation of the AMP will be overseen by a Baffinland-QIA Adaptive Management Working Group. Ongoing inputs from the Inuit Stewardship Plan as well as Baffinland's ongoing project monitoring will also form the basis of amendments and refinements to the objectives, indicators, thresholds, and response requirements over time.

Section 2.4 of the AMP states that with the QIA's approval of Baffinland's AMP and management plans, that implementation of pre-determined responses to effects as described in the management plan does not require additional approval by the QIA. Baffinland will communicate response actions to QIA prior to implementation unless this is not possible due to the expediency required by the circumstance. If, however, a new response not previously considered is proposed, QIA approval will be sought.

2.2.2 ADAPTIVE MANAGEMENT CHECKLIST FOR ENVIRONMENTAL MANAGEMENT

Table 2.3 presents an adaptive management checklist developed for the Waste Management Plan, identifying how adaptive management has been incorporated into the current revision of the Plan.

TABLE 2.3 ADAPTIVE MANAGEMENT IN THE WASTE MANAGEMENT PLAN

Adaptive Management Phases	Components	Proposed Adaptive Management Mechanisms	Status of Management Plan
Plan	Objectives	Are objectives clear and key desired outcomes defined?	In Progress Objectives are presented in Section 2.1. These will be augmented through the work of the AMP Working Group and later inputs by the Inuit Committee.
	Indicators	Are performance indicators adequately identified?	In Progress Performance indicators are presented in Sections 2.1 and 5.1. Resourcing in accordance with Inuit Agreements will need to be discussed through the AMP Working Group, with annual work plans and budgets developed.
	Identification of Thresholds	Are thresholds for specific responses identified (e.g., early warning triggers, action levels, quantitative metrics or qualitative descriptions)?	In Progress Thresholds are identified in Section 5.1. Additional thresholds tied to Inuit objectives and indicators will be established through QIA-Baffinland engagement.
	IQ Integration / Influence	Are mechanisms for IQ integration/influence identified?	In Progress Integration of IQ will be clarified in a future draft of the Roads Management Plan through the AMP Working Group, and later firmed up through inputs by the Inuit Committee.
Implement and Monitor	Management Strategies and Responses	Are management strategies and response options clearly identified?	In Progress Management strategies are described in Section 3. Threshold Action Response Plans are presented in Section 5.1. These will be augmented through the work of the AMP Working Group and later inputs by the Inuit Committee.
	Resourcing	Are all phases of the adaptive management cycle properly resourced (in accordance with Inuit Agreements) to be fully implemented?	In Progress Resourcing in accordance with Inuit Agreements will need to be discussed through the AMP Working Group, with annual work plans and budgets developed.
Implement and Monitor	Monitoring	Does the monitoring program provide the information needed to determine the effectiveness of management strategies and responses?	In Progress Section 5 presents Baffinland-led monitoring activities related to roads management. The role of Inuit monitors as per the Inuit Stewardship Plan, needs to be established and integrated into this Plan.
	Timeline for implementation	Is the possibility that rapid response may be necessary, considered in the implementation plan/process?	In Progress Trigger action response plans (TARPs) have been developed for key project activities (Table 5.1). This includes the identification of low, moderate, and high action responses that correspond to low, moderate, and high-risk conditions.

Adaptive Management Phases	Components	Proposed Adaptive Management Mechanisms	Status of Management Plan
Evaluate and Learn	Review Data and Feedback	Is the process for reviewing and evaluating management effectiveness (based on monitoring data and feedback) articulated?	Partially, further detail including adaptive management-related roles and responsibilities, reporting structures, and applicable response action forms need to be developed.
	Additional Mitigation	Are mechanisms for determining the need for additional mitigation described?	In Progress Table 5.1 identifies actions to be undertaken according to various triggers. Need for additional mitigation is determined based on results of monitoring programs described in Section 5.
	Input of IQ Holders	Are opportunities identified for IQ holders to review results and provide input into adaptive management responses / mitigations?	In Progress To be discussed at the AMP Working Group and later with the Inuit Committee. Mechanisms for this to occur to be defined in a future draft of the Waste Management Plan.
Adjust	Unanticipated Effects or Issues	Is it apparent how unanticipated effects or issues will be actioned and resolved?	Pending Approval Section 6 (Figure 6.1 in particular) describes the process for incorporating repeat non-compliance and unanticipated effects into future updates.
	Reporting	Are reporting mechanisms for new / revised strategies and response actions established?	Pending Approval Section 6 describes the process for reporting mechanisms for new / revised strategies. A review schedule of the plan is provided in Table 6.1.
	Scheduled Updates	Is the frequency of scheduled updates to the management plan identified?	In Progress A review of the plan is provided in Table 6.1.

3.0 IMPLEMENTATION

Project elements relevant to this plan include:

- Waste identification
- Waste generation, handling and collection
- Waste management facilities
- Incineration
- Open Burning
- Landfill Operations
- Landfarm Operations
- Hazardous Waste Storage and Disposal
- Miscellaneous Waste Storage and Disposal

This section of the plan describes the measures to be undertaken regarding waste management to protect the environment and minimize health and safety risks.

3.1 THRESHOLDS

3.1.1 DISCHARGE LIMITS AND CRITERIA

Table 3.1 outlines the discharge limits and references to various applicable project criteria for waste activities onsite.

TABLE 3.1 ACTIVITIES AND APPLICABLE PROJECT CRITERIA

Waste Management Facility	Monitoring Program	Discharge Limits / Criteria
Waste Incineration	Incinerator Operations Monitoring	Section 5.2.1
	Stack Testing	Table 3.2
	Incinerator Ash Testing	Table 3.3
Open Burning	Open Burn Monitoring	Section 5.3
Landfill	Landfill Operations Monitoring	Section 5.4.1
	Leachate/groundwater Monitoring	Refer to Surface Water Aquatic Ecosystem Management Plan
Landfarm	Landfarm Operations Monitoring	Section 5.6

Nunavut has adopted the Canada Wide Standards for Dioxins and Furans and Mercury Emissions from the Canadian Council of Ministers of the Environment (CCME). These are the emission standards presented in Table 3.2, corrected to 11% oxygen at stack.

TABLE 3.2 AIR EMISSIONS STANDARDS FOR SOLID WASTE INCINERATORS

Parameter	Numeric Standard	Explanation
Dioxins and Furans	80 pg. I-TEQ/cubic metre	Unit of measure is picograms of International Toxicity Equivalents per cubic metre of air
Mercury	20 µg/R cubic metre	Unit of measure is micrograms per Reference cubic metre (the volume of gas adjusted to 25°C and 101.3 kilopascals)

NOTE:

1. Values taken from Table 1, Environmental Guideline for the Burning and Incineration of Solid Waste (GN, 2012b).

Incinerator Ash samples will be tested using the Toxicity Characteristic Leaching Procedure (TCLP; US EPA Test method 1311), and test results will be compared to the guidelines for solid waste/process residual concentrations identified in Table 3.3.

TABLE 3.3 GUIDELINES FOR SOLID WASTE/PROCESS RESIDUALS SUITABLE FOR LANDFILL DISPOSAL

Parameter	Concentration Maximum (mg/L)
Arsenic	2.5
Barium	100
Cadmium	0.5
Chromium	5
Lead	5
Mercury	0.1
Selenium	1
Silver	5
Zinc	500
Carbon Tetrachloride (tetrachloromethane)	0.5
Methyl Ethyl Ketone	200
Polychlorinated Biphenyls (PCBs)	50 (concentration by mass)
Polychlorinated Dibenzo Dioxins and Furans	0.0000015 (I-TEQ)
Tetrachloroethylene	3
Trihalomethanes (Total)	10
Vinyl Chloride	0.2

NOTE:

1. Values taken from Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (GN, 2011e).

3.1.2 INUIT OBSERVATIONAL GUIDELINES

Inuit may identify thresholds that are applicable to waste management. Once provided through the AMP Working Group, Inuit Observational Guidelines can be further described in this section.

3.1.3 EFFECTS PREDICTIONS

Adaptive management includes short-term and longer-term review and response cycles (Section 2.3). The thresholds described in Section 3.1.1 and future Inuit observational guidelines to be presented in Section 3.1.2 are applied to guide short-term adaptive management through implementation of the TARPs (Section 5).

The effects predictions from the FEIS and addendums are thresholds that are appropriate for longer-term review and response cycles, such as the annual review of regulatory compliance and unexpected effects. The Company may also identify the need for further adaptive management when unanticipated effects or effects that exceed FEIS predictions occur. The effects predictions from the FEIS and addendums can be used comparison to the Project's performance as described in Section 6.1 - Annual Review of Compliance and Unanticipated Effects. The Company may also identify the need for further adaptive management when unanticipated effects or effects that exceed FEIS predictions occur.

3.2 WASTE IDENTIFICATION

Table 3.4 list the wastes generated at the Project by source location along with the prescribed disposal method(s). A more comprehensive list of specific wastes and disposal methods is presented in Appendix C.

TABLE 3.4 WASTE DISPOSAL BY GENERATION LOCATION

Source	Waste Description	Waste Type	General Disposal Method
Offices	Computers and other electronic wastes, fluorescent lights	Recycle	Off-site recycling or disposal
	Wastepaper	Combustible/non-hazardous	Incineration
Wastewater treatment facilities	Biological sludge (dried solids)	Combustible/non-hazardous	Incineration
Maintenance complexes	Used batteries, waste hydrocarbon products, engine oil, oil filters, glycols, aerosol cans, refrigerants, solvents, etc.	Hazardous	Off-site recycling or disposal, possible reuse of fuel and oil for heating and other uses.
	Scrap metal, rubber, plastic	Inert	Landfill or off-site disposal or recycling
Laboratories	Chemical laboratory wastes, toxic substances	Hazardous	Off-site recycling or hazardous waste disposal
Domestic waste from accommodation facilities and kitchens/cafeterias	Accommodation facility garbage, food wastes	Combustible/non-hazardous	Incineration
Inert waste from construction sites and	Treated wood, plastics, cement, sand, used construction materials, metal, pipes, glass, insulation, etc.	Inert	Reuse or landfill

Source	Waste Description	Waste Type	General Disposal Method
materials from operations	Untreated wood/cardboard	Combustible/non-hazardous	Incineration (cardboard)/ open burning
Medical facilities	Biomedical wastes	Hazardous	Off-site hazardous waste disposal
Incinerators	Ash (placed in closed drums)	Inert	Landfill if non-hazardous; offsite disposal if hazardous
Fuel spills	Hydrocarbon-contaminated soil	-	Landfarm
	Hydrocarbon-contaminated snow/water /ice	-	On-site treatment and reuse if practical

3.3 PROJECT WASTE FLOW

Waste management facilities are shown on the Site Layouts in Appendix D. Waste flow block diagrams have been developed for the Mine Site and Milne Port waste streams and are provided in Appendix E. Project waste streams are illustrated by their storage and treatment paths.

3.3.1 GENERATION POINTS

Waste generated at the Project will be sorted and collected. To facilitate efficient and effective waste management, waste will be required to be disposed of in labelled receptacles based on waste type and disposal methods outlined in Table 3.4 and outlined in the Waste Sorting Guidelines (Appendix F).

Project waste will be managed to ensure that it is prevented from entering nearby waterbodies. Areas designated as waste disposal or storage locations will be located at a minimum distance of thirty-one (31) metres from the ordinary High-Water Marks of nearby waterbodies.

3.3.2 WASTE COLLECTION

Collection of wastes at Project sites, including permanent shelters along the Tote Road, will be completed by trained personnel from the Site Services Department and transported to the appropriate waste management facilities where it is sorted (visual inspection) upon arrival to ensure proper segregation.

3.3.3 WASTE MANAGEMENT FACILITIES

Each Project site (Milne Port and the Mine Site) is equipped with the waste management facilities summarized in Table 3.5. The waste management buildings at each Project site are the central facilities for waste management. Each building is comprised of a heated all-season building and adjacent laydown areas that provide the following ancillary, functions:

- A central depot where waste will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for reuse onsite or shipment offsite
- Incinerators (refer to Section 3.4)
- Concrete floors for containment
- Large bay doors for transferring waste and equipment
- Drum crushing machine (only at the Mine Site)

Waste oil storage tanks, oil filter draining, and crushing equipment are located at Project Mobile Maintenance Facilities.

TABLE 3.5 MARY RIVER PROJECT WASTE MANAGEMENT FACILITIES SUMMARY

Facility Type	Components	Function	Applicable Guideline/SOP	
			Title (Document No.)	Location
Waste management buildings	Heated waste management buildings	Central depots at each Project site where hazardous waste and waste suitable for incineration generated across the site is managed, properly processed, packaged, labeled, inventoried, and treated prior to storage.	Waste Sorting Guidelines BAF-PH1-830-P25-0001	Appendix E
	Incinerators		Incinerator Operation Procedure BAF-PH1-320-PRO-0002 Incinerator Ash Sampling Procedure BAF-PH1-830-PRO-0006	Appendix G Appendix H
Waste storage areas	Secure lined containment areas	Secondary containment areas where hazardous waste is stored prior to offsite disposal.	Hazardous Materials and Hazardous Waste Management Plan BAF-PH1-830-P16-0011	Separate Plan
	Used tire storage area (seacans)	Dedicated storage areas for used tires.	On Site Tire Disposal Procedure BAF-PH1-300-PRO-0020	Appendix I
Landfarm/ contaminated snow containment pond	Engineered geomembrane lined containment cells	Dedicated cells for the bio-treatment of contaminated soil.	Landfarm Operation Maintenance and Monitoring Manual BAF-PH1-320-T07-0005	Appendix J
		Lined cells to contain hydrocarbon contaminated snow collected during winter operations.	Fresh Water Supply, Sewage and Wastewater Management Plan BAF-PH1-830-P16-0010	Separate Plan
Landfill	Gated and locked non-hazardous waste landfill facilities	Disposal of inert, non-combustible and non-hazardous wastes.	Landfill Maintenance and Operation Manual BAF-PH1-320-T07-0004	Appendix K
Open burn areas	Gated and locked burn boxes (modified seacans)	Disposal method for untreated wood, cardboard, and paper products generated onsite.	Open Burning of Untreated Wood, Cardboard and Paper Procedure BAF-PH1-300-PRO-0001	Appendix L

3.4 WASTE HANDLING AND MINIMIZATION BY CATEGORY

The principles of reduction, recovery, reuse and recycling will be implemented for the following waste streams:

- Used oil
- Non-hazardous waste - construction materials
- Domestic waste from accommodations complexes
- Sewage
- Hazardous waste
- Office paper

Details are provided below.

3.4.1 USED OIL

Used oil will be generated from mechanical equipment use and maintenance activities. Used oil will be collected and transported to secondary containment where it will be stored in 1,000 L totes. There is potential to dispose of used oil and recover heat in waste oil burners as a means of avoiding offsite disposal, provided the feedstock meets the impurity limits allowable by the GN (2012a), as described in the Hazardous Materials and Hazardous Waste Management Plan. Oil that cannot be reused onsite will be shipped offsite.

3.4.2 NON-HAZARDOUS CONSTRUCTION WASTE

Construction waste material including packing and building materials, cables and wiring and other miscellaneous items (e.g., used tools, equipment, etc.) generated during construction activities will be disposed of according to waste type. Most construction waste will be segregated into the waste streams described below.

3.4.2.1 LUMBER

Lumber will be generated by unpacking and from the disposal of temporary supports/infrastructure. Where possible, shipments will be received on pallets that can be reused onsite. Other clean lumber waste will be stacked and made available for reuse or burned onsite in accordance with the Open Burning of Untreated Wood, Cardboard and Paper Products Procedure (Appendix L; see Section 3.6). Chemically treated lumber will be separated for reuse onsite. Treated lumber that cannot be reused will be shipped offsite for disposal at licenced waste disposal facilities.

3.4.2.2 PLASTICS

Polyethylene film and other construction plastics include packaging (containers), insulation, pipelines, wire sheath and various other construction consumables. Ad-hoc opportunities for recycling these materials will be investigated and where practical materials will be reused. Otherwise, plastics will be landfilled onsite.

3.4.2.3 STEEL AND SCRAP METAL

Steel and scrap metal waste will be separated from the other solid waste produced during construction activities by those who generate it. If it is determined to be economically feasible, steel and other scrap metal waste will be shipped offsite for recycling. Otherwise, scrap metal will be landfilled onsite.

3.4.2.4 UNSET CONCRETE AND CONCRETE WASTE

During construction periods, concrete will be provided from a batch plant located at a construction laydown area. Waste concrete will arise from off spec mixes, residual concrete at the end of a pour and from wash down of equipment.

A purpose-built pond shall be used to receive all of the waste concrete and concrete contaminated wash water. The pond that will receive wash water will be designed to allow for settling of solids, decant and analysis, and if necessary, pH adjustment.

3.4.2.5 MISCELLANEOUS CONSTRUCTION WASTE

All other non-hazardous construction waste will be segregated at its source into categories, based on potential for reuse, such as metal containers, plastics and corrugated board. If these materials are not suitable for reuse onsite, they will be landfilled onsite.

3.4.3 DOMESTIC WASTE FROM ACCOMMODATIONS COMPLEXES

Accommodation complexes house Project personnel in addition to providing meals and other domestic support facilities (e.g., office and recreation facilities). Wastes generated from these facilities will be similar in nature to general residential domestic waste and will be comprised of a higher percentage of organic (food) wastes.

Project domestic waste will be collected in secure containers and removed daily. All containers containing food waste or items potentially contaminated by food (e.g., food packaging) will be required to be secured in animal-proof storage waste bins or sea cans to prevent access by wildlife.

The Site Services Department maintains responsibility for waste management, including source separation and disposal, of waste generated at Project accommodation complexes in accordance with the Waste Sorting Guidelines (Appendix E).

3.4.4 SEWAGE

Sewage generated by Project activities will be managed by the principals and procedures provided in the Fresh Water, Sewage and Wastewater Management Plan.

3.4.5 HAZARDOUS WASTE

Hazardous waste generated by Project activities will be managed by the principals and procedures provided in the Hazardous Materials and Hazardous Waste Management Plan.

3.4.6 MISCELLANEOUS REFUSE

Disposal of miscellaneous items (e.g., tools, equipment, electronics, clothing, etc.) requiring special handling will be completed by the owner/generator under the direction of the Environment Department. Large items containing components of variable waste types will be required to be broken-down and disposed of in accordance with the Waste Sorting Guidelines (Appendix E).

Mechanical/equipment parts will be drained of oil or other fluids prior to disposal. Drained fluids will be disposed of in accordance with Baffinland's Hazardous Materials and Hazardous Waste Management Plan.

3.4.7 OFFICE PAPER

White paper waste (e.g., printer paper) generated at the Project accommodations complexes and ancillary offices will be collected for recycling. The following procedures have and will continue to be implemented to reduce the amount of paper waste generated onsite:

- Electronic Distribution - Electronic forms and notifications increase the amount of desk/shelf space available.
- Double-Sided Printing - When practical ensure all documents are double sided. Double-sided printing has been set as default on all office copiers.
- Print Only the Pages You Need - Rather than printing the entire document consider saving the file electronically as well as cutting and pasting relevant information. Only reprint pages of documents that have been revised rather than the full document.
- Reuse - Collect single-sided paper in a bin so that it could be reused for printing, faxing or scratch pad.
- Route Hardcopy Memos and Newsletters - Instead of making numerous copies, route one copy around the office or post in a centralized area.
- Copier Maintenance - Only qualified personnel are permitted to complete maintenance on copiers and printers.

3.5 INCINERATORS

Combustible non-hazardous wastes generated at the Project will be incinerated to minimize the negative impacts of attraction vectors to wildlife. Project Incinerators are located in waste management buildings at Milne Port and the Mine Site and are identified on the site layouts provided in Appendix D. Incinerator volume capacities for Project sites are provided in Table 3.6.

TABLE 3.6 INCINERATOR ALLOCATION

Site	Incinerator Waste Produced (t/day)	Incinerators Type	Total Capacity (as per design basis)
Mine Site	1.23	ECO 2TN Mobile Incinerator	2 tonnes
Milne Port	0.50	ECO 2TN Mobile Incinerator	2 tonnes

Incinerators at the Mine Site and Milne Port have the option of using a liquid waste system to burn waste petroleum products such as used oil or off-spec fuels, which would decrease diesel requirements but would increase power consumption. Larger or additional incinerators may be brought on-line as required to meet the Project's needs during construction or expansion.

3.5.1 INCINERATOR OPERATION

The Incinerator Operation Procedure in Appendix G outlines the following regarding incinerator operation:

- Personal Protective Equipment (PPE)
- Training requirements
- Responsibilities
- Operating instructions
- Daily preventative maintenance requirements

Incinerator waste will be segregated according to the Incinerator Operation Procedure (Appendix G) to ensure that only suitable materials are incinerated to achieve a complete burn-cycle. Incineration of hazardous wastes, non-combustible materials, or treated wood products is prohibited. The incineration of plastics will be minimized to

the maximum extent practicable. Incineration of some food-related and other plastics will be unavoidable; however, best efforts will be made to reduce/prevent incineration of plastics containing chlorine molecules, which can generate dioxins and furans in the air emissions released from the incinerator stack.

3.5.2 OPERATOR TRAINING

Only personnel trained in the Incinerator Operation Procedure (Appendix G) will be permitted to operate the incinerators. The incinerator manufacturer will be requested to provide support and guidance, including onsite specialized training, as required.

3.5.3 AIR EMISSIONS

Air emission standards establish limits on the levels of contaminants that can be released to the atmosphere. These standards are expressed as a concentration in the exhaust gases leaving the stack and are capable of being achieved using available technology or waste diversion practices. Stack testing is conducted upon commissioning of any new incinerators, and once every five years following, as described in Section 5.1.1.

Air emissions are dependent upon the types of waste being incinerated, the proportion of each waste type placed in the incinerator, and the size of the load. The Incinerator Operation Procedure describes the recommended waste load design including the maximum proportion different waste types a waste load should contain, and the waste materials not suitable for incineration.

Each incinerator is equipped with a continuous opacity monitor in the incinerator stack to monitor emissions quantity. Although not an emission standard, opacity provides an indication of the general performance of the incinerator during normal operation. Opacity in the incinerator stack should not exceed 5%. While it is not anticipated that opacity levels will exceed 1% to 2% under normal operation, values greater than 5% indicate the incinerator is not performing properly and additional performance evaluation and adjustments are required.

3.5.4 ASH DISPOSAL

The incineration process produces bottom ash as a process residual. Several factors influence this process including the operating conditions in the burn chamber (i.e., temperature, holding time, air turbulence and waste compaction), and the wetness and chemical composition of the waste. Disposal of incinerator bottom ash and other unburned residue from incinerator operations will be completed with caution due to physical (e.g., glass, nails) and chemical hazards. Appropriate PPE will be required when operating the incinerator and handling the residual ash (Appendices G and H). Bottom ash will only be handled once it has completely cooled.

Non-hazardous ash from the incineration process will be buried at one of the landfills. Closed or covered containers will be used when transporting bottom ash from the incinerator to the landfill. The ash once deposited in the landfill will be promptly covered over with material to prevent migration. Periodic leachate testing of composite samples of the bottom ash will be conducted as described in Section 5.2.3. Any bottom ash that was deemed hazardous according to testing would need to be disposed of offsite as hazardous waste.

3.6 OPEN BURNING

Untreated wood, cardboard, and paper products generated onsite will be disposed of by authorized open burning in burn boxes, which are modified seacans. Open burning disposal reduces the volume of inert waste to be landfilled. Dedicated open burning facilities are located at both Milne Port and the Mine Site, at the locations identified on the site layouts presented in Appendix D. Baffinland's open burning authorization prohibits the burning of hazardous wastes, non-combustible materials, food waste, plastics, Styrofoam or treated wood products (plywood, pressure treated).

To ensure removal of prohibited wastes, secondary waste segregation will be completed during the loading process at Project Open Burn Facilities.

Installation of locked gates will limit access to Open Burn Facilities to authorized personnel only. Signs and Baffinland's Open Burning of Untreated Wood, Cardboard and Paper Products Procedure (Appendix L) will be posted to outline acceptable and unacceptable waste types at Open Burn Facilities.

3.6.1 OPERATOR TRAINING

Site personnel responsible for open burning activities will be required to be trained on the specific requirements necessary to maintain compliance with Baffinland's Open Burning Authorization. Training will include a review of both the Waste Sorting Guidelines (Appendix F), as well as the Open Burning of Untreated Wood, Cardboard and Paper Products Procedure (Appendix L). Training records are maintained onsite and provided upon request to the Inspector (CIRNAC) or the NWB.

3.6.2 ASH DISPOSAL

Bottom ash from the open burning of paperboard packing and untreated wood waste should be removed from the Open Burn facilities weekly or as required for disposal at the landfills.

3.7 LANDFILL FACILITY OPERATIONS

All inert, non-combustible (plastics, cement, used construction materials, scrap metal, pipes, glass, etc.) waste generated by Project activities will be disposed of at Project Landfill Facilities. Non-hazardous waste, including ash from incineration and open burning of clean wood processes, and waste which cannot be salvaged or incinerated, will also be deposited at the Project Landfill Facilities. Disposal of all domestic (food) waste, hazardous and biomedical materials at Project Landfill Facilities will be prohibited. Landfill Facilities are identified on site layouts provided in Appendix D.

3.7.1 LANDFILL FACILITY OPERATIONS

Project Landfill Facilities' operation and management procedures are provided in the Landfill Maintenance and Operation Manual (Appendix K).

3.7.2 OPERATOR TRAINING

Landfill Facility Operators will be trained in the operational and safety procedures associated with Project Landfill Facilities. Training will include a review of both the Waste Sorting Guidelines (Appendix F) and the Landfill Maintenance and Operation Manual (Appendix K). Landfill Facility Operator training records will be maintained onsite and provided upon request to the Inspector (CIRNAC) or the NWB.

3.8 LANDFARM OPERATIONS

Soils contaminated by hydrocarbons from spills and site decommissioning initiatives will be managed as described in the Hazardous Materials and Hazardous Waste Management Plan.

3.9 HAZARDOUS WASTE STORAGE AND DISPOSAL

Project waste streams will be classified as hazardous wastes based on potential risk to human health and safety, property and the environment. Hazardous wastes generated onsite include, but are not limited to: used oils, solvents and paints, used and/or surplus chemicals, biomedical wastes, gas cylinders, electronic waste, batteries, light bulbs and smoke detectors (Appendix D).

Baffinland will ensure that all hazardous waste generated at the Project is effectively managed, properly stored, transported, treated, and disposed. All site personnel (including contractors) will be responsible for managing the waste they generate and will be required to comply with the procedures provided in the Hazardous Materials and Hazardous Waste Management Plan and will be subject to monitoring and enforcement.

3.10 OILY WATER

Oily water generated by Project activities will be managed as described in the Fresh Water, Sewage and Wastewater Management Plan.

3.11 SHIP WASTE MANAGEMENT

Baffinland will not accept waste originating from ships and/or vessels servicing Milne Port. Waste generated by ships and/or vessels servicing Milne Port will disposed of at the receiving port.

3.12 USED TIRES

Used tires are a significant waste stream at most mining operations. Used tires will be stockpiled in shipping containers in designated areas at both Milne Port and the Mine Site, as outlined by the On Site Current Tire Disposal Procedure (Appendix I). Baffinland will continue to investigate options that increase Project sustainability and allow for the reuse of tires at Project sites in an environmentally and safe manner (e.g., ballast along containment berms, road barriers).

3.13 RELEVANT OPERATIONAL ENVIRONMENTAL STANDARDS

EPP Operational Environmental Standards (OESs) that are relevant to this Plan are identified in Table 3.7. As required, where there is a modification to a relevant OES, this Plan will be revised to reflect that change.

TABLE 3.7 RELEVANT OPERATIONAL ENVIRONMENTAL STANDARDS

Section	Title/Description
4.1	Equipment Operations
4.2	Fuel Storage and Handling
4.6	Concrete Production
5.1	Sewage Treatment
5.2	Hazardous Waste Management
6.1	Road Construction and Borrow Development
7.1	Geotechnical Drilling Operations
7.2	Exploration Drilling Operations
Appendix A.12	Off-Site Waste Disposal Log

3.14 ADAPTIVE MANAGEMENT MEASURES

Company performance related to waste management is most often binary: activities are either compliant or non-compliant. Adaptive management in this context involves identifying and implementing measures to address repeat instances of non-compliance, such as:

- Increasing the frequency of inspections
- Increasing the frequency of, or providing supplementary training sessions to inform employees on proper waste disposal
- Using communication tools such as posters at Project facilities reminding employees of:
  - Proper waste disposal methods
  - To whom waste disposal issues should be reported

4.0 ROLES AND RESPONSIBILITIES

Roles and responsibilities for waste management at the Project are described in Table 4.1.

TABLE 4.1 ROLES AND RESPONSIBILITIES

Position	Responsibilities and Accountabilities
Chief Operations Officer (COO)/General Manager	Reports to the Chief Executive Officer. Responsible for providing oversight for all Project operations and allocating the necessary resources for the operation, maintenance and management of the Project's waste management facilities.
Senior Director of Health, Safety, Environment, Security and Training (HSEST), or designate	Reports to the COO / General Manager. • Coordinates on-site resources supporting health, safety and environment associated with verifying compliance of waste management activities. • Arranges the appropriate training and site orientation for all relevant employees regarding compliance with waste management requirements.
Port & Logistics Manager/Superintendent	Reports to the Chief Operations Officer. Responsible for providing support to the Site Services Manager in regard to shipping wastes offsite for disposal at licensed waste disposal facilities.
Site Services Manager	Reports to the COO / General Manager. Responsible for providing oversight for all Site Services operations, including the operation, maintenance and management of the Project's waste management facilities (containment berms, incinerators, landfill facilities, open burn facilities and landfarm facilities). The Site Services Manager will also be responsible for ensuring that Site Services personnel operating and managing the Project's waste management facilities receive the appropriate training.
Fixed Plant Superintendent	Reports to the Site Services Manager. Responsible for maintaining the Project's incinerators and waste management buildings.
Surface Works Superintendent	Reports to the Site Services Manager. Responsible for the operation and management of the Project's incinerators, containment berms, landfill facilities, open burn facilities and landfarm facilities.
Surface Works Supervisor	Reports to the Surface Works Superintendent. Responsible for the implementation of the operational and management practices for the Project's incinerators, containment berms, landfill facilities, open burn facilities and landfarm facilities, as outlined in the Project's: • Incinerator Operation Procedure • Landfill Maintenance and Operation Manual • Landfarm Operation, Maintenance and Monitoring Manual • Hazardous Materials and Hazardous Waste Management Plan • Open Burning of Untreated Wood, Cardboard and Paper Products Procedure • On Site Tire Disposal Procedure

Position	Responsibilities and Accountabilities
Landfill Operator	Reports to the Surface Works Supervisor. Responsible for operating Project Landfill Facilities in accordance with the Landfill Maintenance and Operation Manual. Key landfill operational tasks will include: • Conducting visual inspections of deposited landfill waste prior to processing waste at Project Landfill Facilities to confirm waste sorting and conformance with the Project's Waste Sorting Guidelines. • Compacting and managing waste along the working face. • Placing cover material on compacted waste to prevent windblown debris and complete areas/cells.
Incinerator Operator	Reports to the Surface Works Supervisor. Responsible for operating Project Incinerators in accordance with the Incinerator Operation Procedure and guidance documentation provided by the manufacturer. Key incinerator operational tasks will include: • Conducting visual inspections of incinerator waste prior to incineration to confirm proper waste sorting and conformance with the Project's Waste Sorting Guidelines. • Combining waste streams to achieve incinerator waste loads with appropriate waste compositions to ensure optimal incineration of Project waste. • Monitoring incinerator operational parameters (i.e., temperature of primary and secondary chambers, fuel levels, etc.) to ensure optimal combustion conditions are achieved. • Recording waste volumes, waste type and date/time of burns in the incinerator logs.
Project Employees and Contractors	All Project employees and contractors will be responsible for sorting and disposing of their waste as outlined in this Plan.
QIA Regulatory Manager (IIBA)	• Directs QIA's onsite environmental resources. • Liaise with Baffinland's Permitting and Compliance Manager and/or Environmental Superintendents. • Reviews regulatory submissions on behalf of the QIA. • Member of the QIA-Baffinland Adaptive Management Working Group.
QIA Environmental Monitor (IIBA)	• Monitors implementation of commitments, environmental compliance, and QIA interests. • Participate in routine compliance inspections and monitoring alongside Baffinland staff. • Participate follow-up corrective action undertaken regarding non-compliance events including spills. • Weekly reporting to the QIA Regulatory Manager. • Presents annual monitoring data to communities. • The core responsibilities of this position are described completely in the IIBA.

Position	Responsibilities and Accountabilities
Environment Department	Reports to the Senior Director of HSEST The Environment Department will be responsible for: • Conducting biweekly environmental inspections of Project's waste management facilities to confirm conformance with the Project's established operational and management practices and reporting any identified deficiencies to the appropriate department for corrective action. • Sampling and monitoring incinerator bottom ash to confirm conformance with the applicable guidelines. • Conducting periodic waste audits to ensure waste streams are being properly segregated • Providing environmental awareness training to Project employees and contractors, including waste management practices. • Reporting data and results of the Project's waste monitoring programs to the appropriate regulators and stakeholders. • The Environment Department will also support the Site Services Department in scheduling stack emissions test required for the Project's incinerators.
Health and Safety Department	Reports to the Senior Director of HSEST. The Health & Safety Department will be responsible for conducting routine inspections of the Project's waste management facilities to confirm conformance with the Project's established operational and management practices, as it relates to the health and safety of Project personnel. Identified deficiencies will be reported to the appropriate department for corrective action.

5.0 MONITORING

Consistent with the adaptive management plan described in Section 2.3, trigger action response plans (TARPs) have been developed for key project activities and related monitoring plans (Table 5.1). This includes the identification of low, moderate, and high action responses that correspond to low, moderate, and high-risk conditions.

Monitoring programs associated with the TARP focus on short-term detection of impacts and immediate to short-term responses. These short-term impacts and responses are intended to provide immediate feedback pertaining to the effectiveness of mitigation measures, allowing changes to be made in real-time. They also generate most of the monitoring data that feeds into annual reporting, which includes analysis and reporting of annual monitoring data along with trend analyses using historical monitoring data.

The review of trends over time through the annual review process will inform adaptive management in the long term. This may include triggering of plan updates as described in Section 6.

5.1 ROUTINE INSPECTIONS AND AUDITS

The Environment Department conducts periodic visual inspections and audits of the various components of the waste management system.

In addition to specific monitoring and reporting requirements under the Project's regulatory approvals, such as the Type A and B Water Licences, Commercial Lease and Project Certificate, the Environmental Department will schedule routine inspections of various aspects of Project operations. Bi-weekly inspections of the waste management facilities will be conducted to confirm overall conformance with the requirements of this Plan, the EPP, and SOPs.

Inspection forms will be used to document the findings and required corrective actions. These reports are generated as an internal operational management tool to promote continuous improvement in environmental performance and stewardship. Checklists will be used as internal operational monitoring and compliance tools. These checklists are integrated into the EPP and other operating procedures/work instructions.

The quantity of wastes processed onsite and transported offsite are recorded and are reported monthly and annually in accordance with the Type A Water Licence.

The waste management system is also monitored at least annually by the following agencies:

- Qikiqtani Inuit Association
- CIRNAC Waters Inspector
- CIRNAC Lands Inspector
- NIRB Monitoring Officer

Though Baffinland does not depend upon these external audits and inspections to ensure compliance, the Company nonetheless acts on any issues of non-compliance and recommendations from these agencies.

TABLE 5.1 TRIGGER ACTION RESPONSE PLANS FOR WASTE MANAGEMENT

Project Activity	Objective	Performance Indicator	Monitoring Program / Plan	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Waste incineration	Comply with Water Licence and the Government of Nunavut's waste management environmental guidelines	Temperature (in primary and secondary burn chambers, and the stack)	Operations monitoring	Occurrence of inappropriate incinerator feed waste	Occurrence of inappropriate incinerator feed waste not identified prior to incineration.	Sustained non-compliance with Waste Sorting Guidelines.	Incinerator Operator: Waste is removed. Env't Dept: Identify source of non-compliance and increase training of Waste Sorting Guidelines.	Site Services Dept: Investigate source of non-compliance, including review and/or revision of Waste Sorting Guidelines. Env't Dept: Increase inspections (weekly vs. bi-weekly); Increase training of employees on Waste Sorting Guidelines.	In addition to moderate risk actions: Site Services Dept: Mandatory review and revision of Waste Sorting Guidelines. Env't Dept: Conduct internal waste audit and present the findings to various departments.
		Dioxins, furans, and mercury	Stack testing	Not applicable[1]	Exceeds thresholds for dioxins, furans, or mercury in Table 3.1.	Repeated exceedance of thresholds for dioxins, furans, or mercury in Table 3.1.	Not applicable	Env't Dept: Determine cause of exceedance (e.g., feedstock, waste loading, incinerator performance) or sampling error / sampling equipment malfunction. Perform follow-up stack test to confirm results. Retesting is done within 1 year to verify exceedance.	In addition to moderate risk actions: Cease incineration of waste until subsequent testing confirms emissions below guidelines defined in Table 3.1 or an appropriate mitigation and action plan is developed with the QIA.
		TCLP analytes: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, uranium and zinc	Incinerator ash TCLP testing	Not applicable[1]	Exceeds guidelines (of one or more parameters) identified in Table 3.2.	Repeated exceedance of guidelines (of one or more parameters) identified in Table 3.2.	Not applicable	Site Services Dept: Investigate source of non-compliance, including review and/or revision of Waste Sorting Guidelines. Env't Dept: Increase inspections (weekly vs. bi-weekly); Increase training of employees on Waste Sorting Guidelines. Ash is diverted from landfill for backhaul as hazardous waste.	In addition to moderate risk actions: Site Services Dept: Mandatory review and revision of Waste Sorting Guidelines. Env't Dept: Conduct internal waste audit and present the findings to various departments.
Open Burning	Compliance with this plan, the Open Burning of Untreated Wood, Cardboard and Paper Products Procedure, and Open Burn Permit	Waste types suitable for open burning	Open burning monitoring	Occurrence of inappropriate open burn feed waste.	Open burning of waste is not being carried out in accordance with Waste Management Plan, Open Burning Protocol, and/or Open Burn Permit.	Sustained non-compliance with Waste Management Plan, Open Burning Protocol, and/or Open Burn Permit.	Site Services Operator: Waste is removed. Env't Dept: Identify source of non-compliance and increase training of Waste Sorting Guidelines.	Site Services Dept: Investigate source of non-compliance, including review and/or revision of Waste Sorting Guidelines. Env't Dept: Increase inspections (weekly vs. bi-weekly); Increase training of employees on Waste Sorting Guidelines.	In addition to moderate risk actions: Site Services Dept: Mandatory review and revision of Open Burning of Untreated Wood, Cardboard and Paper Products Procedure. Env't Dept: Conduct internal investigation. Cease open burning of waste until investigation of cause is complete or an appropriate mitigation and action plan is developed with the QIA.

Project Activity	Objective	Performance Indicator	Monitoring Program / Plan	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Landfill Operations	Compliance with this plan and the landfill operation and maintenance manual	Requirements of the Operations and Maintenance Manual	Landfill Operations Monitoring	Not applicable	Landfill operation is not carried out in accordance with Waste Management Plan, Landfill Operation and Maintenance Manual, and Waste Sorting Guidelines.	Sustained non-compliance with Waste Management Plan, Landfill Operation and Maintenance Manual, and Waste Sorting Guidelines.	Not applicable	Site Services Dept: Investigate source of non-compliance and take corrective action[2], if appropriate, including review and/or revision of Waste Sorting Guidelines and/or Landfill Operation and Maintenance Manual. Env't Dept: Increase inspections (weekly vs. bi-weekly); Increase training of employees on Landfill Operation and Maintenance and Waste Sorting Guidelines.	In addition to moderate risk actions: Site Services Dept: Mandatory review and revision of Waste Sorting Guidelines and/or Landfill Operation and Maintenance Manual. Env't Dept: Conduct internal investigation.
	No negative impact to receiving environment water quality	pH, total metals (As, Cu, Pb, Ni, Zn), TSS, oil and grease	Leachate monitoring	See Surface Water and Aquatic Ecosystems Management Plan					
	Maintain physical stability at the landfill	Physical instabilities (ponding water, erosion, settlement)	Biannual geotechnical inspections / Bi-weekly inspections	Localized ponding of water. Evidence of potential slope erosion.	Ponding of water observed throughout landfill. Localized erosion of slope impacting stability.	Drainage not controlled on site. Slope failure (slumping of waste and/or berms).	Site Services Dept: Identify drainage and/or stability issue; undertake remedial measures if appropriate. Actions to address ponded water may include: pump/remove ponded water; backfilling local depression; or installing drainage improvements. Slope erosion may be repaired, contingency erosion and sediment control measures put in place. Consult geotechnical engineer on record to confirm appropriate actions. Continue to monitor. Env't Dept: Identify drainage and/or stability issue during routine inspections or biannual geotechnical inspections; notify Projects Dept.	Site Services Dept: Identify drainage and/or stability issue; immediately undertake remedial measures such as those identified in low action response. Consult geotechnical engineer on record to confirm appropriate actions. Stop landfill operations to implement remedial measures. Monitor effectiveness of remedial measures. Env't Dept: Identify drainage and/or stability issue during routine inspections or biannual geotechnical inspections; Consult geotechnical engineer on record to confirm appropriate actions and notify Projects Dept that action must be taken immediately to address issue(s).	In addition to moderate risk response: Site Services Dept: Stop use of landfill; notify Env't Dept immediately. Implement remedial measures immediately before resuming work. Env't Dept: Investigate effect; notify appropriate regulatory bodies. Consult geotechnical engineer on record on appropriate actions. Investigate reasons why issues were not addressed under moderate risk condition and report this to the QIA.

Project Activity	Objective	Performance Indicator	Monitoring Program / Plan	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Landfarm Operations	Compliance with this plan and the Landfarm Operation, Maintenance and Monitoring Manual	Requirements of the Landfarm Operation, Maintenance and Monitoring Manual	Landfarm operations monitoring	Occurrence of inappropriate waste in landfarm.	Landfarm operation is not carried out in accordance with Waste Management Plan and the Landfarm Operation, Maintenance and Monitoring Manual.	Sustained non-compliance with Waste Management Plan and the Landfarm Operation, Maintenance and Monitoring Manual.	Site Services Operator: Inappropriate waste is removed. Env't Dept: Identify source of non-compliance and increase training of landfarm operators.	Site Services Dept: Investigate source of non-compliance, including review and/or revision of Waste Sorting Guidelines and/or Landfarm Operation, Maintenance and Monitoring Manual. Env't Dept: Increase inspections (weekly vs. bi-weekly); Increase training of employees on Waste Sorting Guidelines.	In addition to moderate risk actions: Site Services Dept: Mandatory review and revision Waste Sorting Guidelines and/or Landfarm Operation, Maintenance and Monitoring Manual. Env't Dept: Conduct internal investigation.
	No negative impact to receiving environment water quality	pH, TSS, Oil and Grease, total Pb, Benzene, Toluene, Ethylbenzene	Effluent monitoring	See the Fresh Water Supply, Sewage and Wastewater Management Plan					
	Maintain physical stability at the landfill	Physical instabilities (ponding water, erosion, settlement)	Biannual geotechnical inspections / bi-weekly inspections	Evidence of physical instabilities (potential erosion of berms/slope) or liner showing signs of wear.	Evidence of physical instabilities (localized erosion of berm/slope) or compromised liner integrity presenting risk of release of contaminated materials.	Evidence of physical instabilities (slope / berm failure) or compromised liner integrity has resulted in the release of contaminated materials.	Env't Dept: Notify Site Services Dept immediately. Continue to monitor. Consult geotechnical engineer on record to confirm appropriate actions. Site Services Dept: Implement remedial measures as recommended by the Geotechnical Engineer, according to the recommended level of urgency. Repair liner if damaged before freeze-up if possible.	Env't Dept: Notify Site Services Dept immediately. Continue to monitor. Consult geotechnical engineer on record to confirm appropriate actions. Site Services Dept: Cease adding new contaminated materials to the facility. Implement remedial measures as recommended by the Geotechnical Engineer, according to the recommended level of urgency. Remove contaminated materials from facility if remedial measures cannot be undertaken as recommended.	Site Services Dept: Implement Spill Contingency Plan; cease adding new contaminated materials and relocate existing wastes to an alternate facility or package for offsite disposal. Consult geotechnical engineer on record to confirm appropriate actions. Env't Dept: Investigate effect; notify appropriate regulatory bodies. Assist Site Services Dept in implementing remedial actions. Investigate reasons why issues were not addressed under moderate risk condition and report this to the QIA.

NOTES:

1 A low level action has not been proposed for this project activity, for a regulatory exceedance related to incinerator ash or stack testing, this has been identified as a moderate risk and response level.

2 Corrective action could include: relocating waste unsuitable for landfilling to the correct disposal facility; maintaining adequate cover of landfilled waste; addressing poor drainage, etc.

5.2 BIANNUAL GEOTECHNICAL INSPECTIONS

The following waste management facilities are subject to geotechnical inspections as prescribed by the Type A Water Licence:

- Landfills
- Landfarms
- Sediment ponds, collection ponds and polishing waste stabilization ponds (addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan)

The geotechnical inspections are conducted biannually between July and September by a Professional Engineer to monitor for settlement, soil creep and permafrost degradation in accordance with the Canadian Dam Safety Guidelines (CDA, 2007, 2013). Based on the findings of the routine and geotechnical inspections, maintenance will be completed as required. Inspection and maintenance records will be maintained onsite and provided upon request to the Inspector (CIRNAC) or the NWB.

5.3 INCINERATOR MONITORING

In addition to periodic inspections by the environment department, monitoring related to the incinerators consist of the following:

- Monitoring during operation of the incinerators by incinerator operators
- Stack testing at initial commissioning of incinerators and every five years
- Periodic testing of bottom ash to determine if hazardous or non-hazardous

Each of these are described below.

5.3.1 OPERATIONS MONITORING

Monitoring of incinerators will be completed to ensure they are functioning as designed and that appropriate wastes are being incinerated as described in Section 3.4 of this Plan and the Incinerator Operation Procedure (Appendix G).

Monitoring of incinerators will include routine inspections for signs of leakage, corrosion and other physical defects. If defects are identified, an assessment of health, safety, and environmental risks will be required prior to further operation of the incinerator, and if significant risks are identified, repairs will be required to be completed before the equipment is used again.

Operation of incinerators at the Project will be monitored using on-line sensors capable of continuous monitoring of combustion processes; this includes temperature in both the primary and secondary burn chambers, as well as in the stack. Temperature readings outside of the normal range provide warning to the operator that the system is not functioning properly. The combustion process monitor is equipped with visible alarms to warn operators of poor incinerator operation.

The following incinerator operation records will be maintained on-site:

- Data from the process monitoring instruments
- Repairs and maintenance performed on the incinerator and monitoring instruments
- Modifications to operation procedures

- Quantity, condition and TCLP analysis results of collected bottom ash
- Operator training
- Incinerator logs recorded by operators, detailing waste volumes and date/time of burns

These records will be provided to the CIRNAC Inspector and/or the NWB upon request.

5.3.2 STACK TESTING

Immediately following commissioning of the incinerators, Baffinland will conduct a stack test to confirm they are operating within applicable air emission standards. Follow up stack tests will be competed every five (5) years for dioxins, furans and mercury to confirm incinerators continue to remain within the applicable air emission standards.

Stack test results will be provided in the NIRB Annual Report, as required by the Project Certificate. Should stack testing results exceed the air emissions standards as shown in Table 3.2, corrective action will be undertaken to determine the cause of the exceedance (e.g., feedstock, waste loading, incinerator performance) and repeat testing to confirm results. Changes to the Incinerator Operation Procedure will be made so that the emissions standards will be met.

5.3.3 BOTTOM ASH LEACHATE TESTING

A composite sample of bottom ash will be collected by Environmental Department staff periodically in accordance with the Incinerator Ash Sampling Procedure (Appendix H), to determine if the ash is deemed hazardous or non-hazardous. The sample will be tested using the Toxicity Characteristic Leaching Procedure (TCLP; US EPA Test method 1311), and test results will be compared to the guidelines for solid waste/process residual concentrations identified in Table 3.2.

A more intensive short-term sampling program will be utilized to audit the routine ash sampling schedule and yield detailed information on small batches of bottom ash each year.

If laboratory results are below guidelines for process residuals, the ash will be considered suitable for landfill disposal.

If monitoring indicates ash exceeds applicable guidelines and is therefore not suitable for landfilling, an investigation will be undertaken to identify the cause and identify a solution. Ash that does not meet guidelines following TCLP analysis will be reprocessed onsite or transported offsite for disposal at a licenced waste disposal facility. Records of analytical results and volumes of ash will be maintained onsite and will be made available upon request.

5.4 OPEN BURNING MONITORING

On-going monitoring of open burning operations will be completed by Environment Department personnel to ensure operator compliance with this Plan and the Open Burning of Untreated Wood, Cardboard and Paper Products Procedure (Appendix L) and Open Burn Permit.

Biweekly inspections of Open Burn Facilities will be completed to ensure that wastes deposited remain in compliance with the established procedures.

Operators are required to document waste type and volume (based on visual estimation of volume to nearest cubic meter) for each burn event.

5.5 LANDFILL MONITORING

Monitoring and the landfills will consist of the following:

- Operations monitoring
- Leachate monitoring
- Biannual geotechnical inspections

Each of these are described below.

5.5.1 OPERATIONS MONITORING

Operations monitoring will involve bi-weekly visual inspections by the Environmental Department for various components of Project Landfill Facilities, including geotechnical stability, fencing, waste volume, to ensure the disposal of inert non-hazardous wastes only (compliance with the Waste Sorting Guidelines), and that adequate cover is provided to contain waste and prevent wind dispersal in accordance with the Landfill Operation and Maintenance Manual (Appendix K). The annual volume of waste disposed of at Project Landfill Facilities will be determined by established survey methods. This information will be reported to the NWB under the Type A Water Licence and the QIA as a condition of the Commercial Lease.

5.5.2 LEACHATE MONITORING

Leachate production is not expected based on the relatively dry, inert nature of the waste that will be placed in landfills. However, periodic surface water monitoring will be used to detect landfill leachate, in the unlikely event leachate is generated. Two shallow groundwater monitoring wells located downgradient the Mine Site landfill are monitored in accordance with Condition 23 of the Project Certificate and Part F, Item 21 of the Type A Water Licence. The landfill leachate/groundwater monitoring program is presented in the Surface Water and Aquatic Ecosystems Management Plan.

Exceedances of the discharge limits for surface water monitoring of landfills as specified in the Type A Water Licence will trigger an investigation of the cause and remedial measures.

5.6 HAZARDOUS WASTE MONITORING

All hazardous waste will be monitored as described in the Hazardous Materials and Hazardous Waste Management Plan.

5.7 LANDFARM MONITORING

The landfarms will be monitored as described in the Landfarm Operation, Maintenance and Monitoring Manual (Appendix J). This includes:

- Soils will be sampled to determine the remediation objectives for impacted soils. As a minimum Tier 1 criteria for PHC and metals parameter will be used to determine soil remediation objectives. Sampling will begin each summer treatment season and continue throughout the treatment season to characterize soil additions from recent spills and monitor progression of PHC degradation in soils undergoing remediation.
- Testing effluent collecting in the landfarm cells (from precipitation or additions of contaminated water/snow) as described in the Freshwater Supply, Sewage, and Wastewater Management Plan. Effluent not meeting

discharge limits specified in the Type A Water Licence is classified as oily water and must be treated using the mobile oil-water separator and resampled prior to discharge to ensure it meets the discharge limits.

- Landfarm operations will be inspected for compliance as per outlined in the Manual (Appendix J).
- Soil will be tested periodically including prior to final disposal, and must meet Nunavut's soil remediation objectives (GN, 2009).

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

5.8 DATA MANAGEMENT

The Environmental Department will be responsible for managing the data collected during the Project's waste management and monitoring activities.

Records of all backhauled wastes from Project sites are maintained onsite and confirmation of proper disposal using waste manifest tracking systems will be obtained from licenced waste disposal facilities. These records will be made available upon request.

5.9 REGULATORY REPORTING

Submission of quarterly and annual reports, containing the following information, will be completed to meet the requirements specified by the Type A and B Water Licences, Commercial Lease, and the Project Certificate:

- Status and locations of the Project's waste management facilities
- Quantities and disposal methods for the various types of waste generated by the Project
- The location and name of the disposal facility (onsite and offsite) for each waste type
- Other information as requested by regulators or stakeholders

Baffinland will submit to the NWB and the Inspector (CIRNAC), thirty (30) days prior to the removal and transfer of waste, a declaration of authorization from any community in Nunavut receiving waste from the Project, which clearly states that authorization has been granted for the deposit by Baffinland at the Hamlet's appropriately licenced facilities.

Records of waste disposal activities will be available upon request to the Inspector (CIRNAC) or the NWB, concerned stakeholders and the public.

6.0 REVIEW OF PLAN EFFECTIVENESS

An important element of Baffinland's management system is reviewing the continued suitability, adequacy and effectiveness of each management plan. This will occur through an annual review process as well as scheduled updates.

6.1 ANNUAL REVIEW OF COMPLIANCE AND UNANTICIPATED EFFECTS

Baffinland conducts internal inspections and audits throughout the year, as described in Section 5. In addition, the Project is subject to external audits as noted in Section 5.1. Throughout the year, immediate corrective actions are taken as appropriate to address instances of non-compliance, as well as unanticipated effects observed. Follow-up corrective actions may also be required. These immediate and follow-up corrective actions are documented in the annual report.

One follow-up corrective action may be to revise mitigation measures or monitoring programs described in the applicable management plans. During the annual reporting cycle, Baffinland staff will review instances of non-compliance as well as unanticipated effects and determine if a review of plan effectiveness is appropriate. Should there be a significant unanticipated effect determined by the Inuit Committee and/or community observations, a review of plan effectiveness will be completed. This process is articulated on Figure 6.1.

Part of this annual review cycle is the incorporation of IQ, which may include feedback from the Inuit Committee and/or community observations. This process may occur annually whether repeat non-compliance and/or unanticipated effects are identified (Figure 6.1).

6.2 SCHEDULED UPDATES

In addition to the annual review cycle described above, scheduled Plan reviews will occur according to the schedule presented in Table 6.1.

TABLE 6.1 PLAN REVIEW SCHEDULE

Review Event	Description
Post-construction	Mandatory management review
Every 3 years during operation	Mandatory management review

Plan updates will be recorded in the Document Revision Record located at the front of the Plan. Each plan update will be provided to the QIA for review and approval before being finalized for implementation.

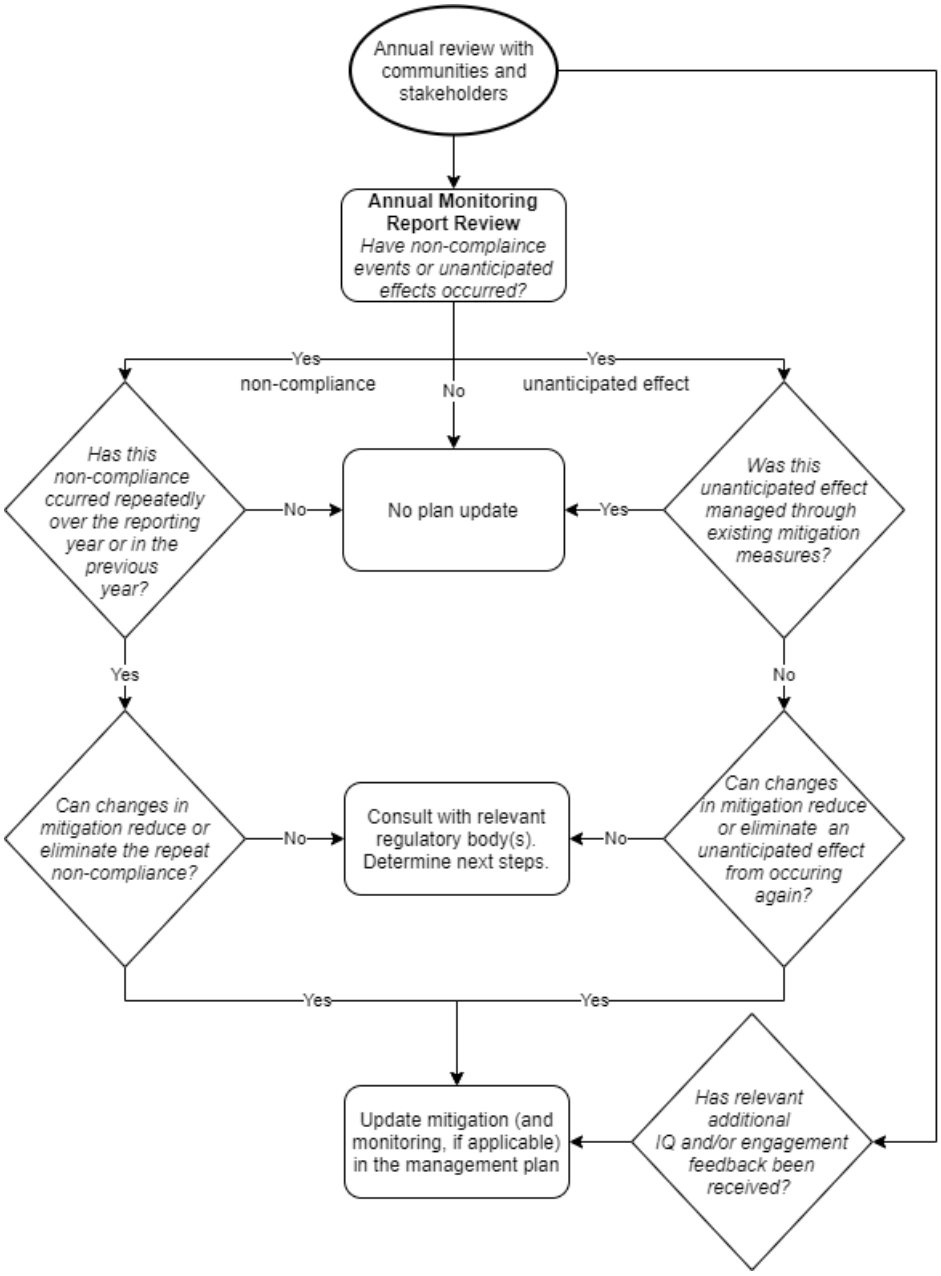

FIGURE 6.1 ANNUAL REVIEW OF PLAN EFFECTIVENESS

7.0 DEFINITIONS

Project:	The necessary tasks and work executed during the lifespan of the Project at the Project Site, including the construction, operation, closure and reclamation phases, of the Project.
Site:	The areas occupied by the Project facilities (permanent or temporary) during the construction, operation, closure and reclamation phases of the Project.
Contractor:	A person or business which provides goods, material, equipment, personnel, and/or services to Baffinland under terms specified in a contract.
Waste:	The residual waste material (hazardous, non-hazardous or putrescible) generated during the construction, operation, closure and reclamation phases of the Project.
Hazardous Waste:	The wastes generated during the lifespan of the Project that present a threat to the human health or the environment because they exhibit one or more of the following characteristics: corrosive, reactive, explosive, toxic, inflammable, or biologically infectious.
Non-Hazardous Waste:	The wastes generated during the lifespan of the Project that do not present a threat to human health or the environment.
Putrescible Wastes:	The wastes generated during the lifespan of the Project that degrade very rapidly, i.e., plants, food scraps or animal remains.
Incinerator Waste:	Waste identified as suitable for incineration based on incineration technology used on-site, applicable regulations and project approvals. Includes: food waste, domestic waste, packaging waste, wood waste, absorbents, and some types of filters (e.g., air filters).
Clean Wood Products:	Clean untreated wood waste including wood or timber, not suitable for recycling or reuse, which is substantially free of glue, petroleum-based materials, other chemicals, or contains other non-wood chemical products.
Opacity:	Opacity is the degree to which the exhaust gases reduce the transmission of light and obscure the view of any object in the background. It is expressed as a percentage representing the extent to which an object viewed through the gases is obscured. Although not an emission standard, opacity provides an indication of the general performance of the incinerator during normal operation.

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Appendix A
Corporate Polices

Baffinland Iron Mines Corporation

Health, Safety and Environment Policy

BAF-PH1-800-POL-0001

Rev 2

Approved By: Brian Penney

Title: Chief Executive Officer

Date: April 20th, 2018

Signature: 

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
05/07/15	0	EM	TP	For Use
03/07/16	1	JS	BP	Minor edits
04/20/18	2	TS	SA/BP	Minor edits

This Baffinland Iron Mines Corporation Policy on Health, Safety and Environment is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goals.

We implement this Policy through the following commitments:

- Continual improvement of safety, occupational health and environmental performance
- Meeting or exceeding the requirements of regulations and company policies
- Integrating sustainable development principles into our decision-making processes
- Maintaining an effective Health, Safety and Environmental Management System
- Sharing and adopting improved technologies and best practices to prevent injuries, occupational illnesses and environmental impacts
- Engaging stakeholders through open and transparent communication.
- Efficiently using resources, and practicing responsible minimization, reuse, recycling and disposal of waste.
- Reclamation of lands to a condition acceptable to stakeholders.

Our commitment to provide the leadership and action necessary to accomplish this policy is exemplified by the following principles:

- As evidenced by our motto “Safety First, Always” and our actions Health and Safety of personnel and protection of the environment are values not priorities.
- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution through courageous leadership is essential for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

The health and safety of all people working at our operation and responsible management of the environment are core values to Baffinland. In ensuring our overall profitability and business success every Baffinland and business partner employee working at our work sites is required to adhere to this Policy.

Brian Penney
Chief Executive Officer
April 2018

Sustainable Development Policy

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

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The four pillars of our corporate responsibility strategy are:

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

Health and Safety

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

Environment

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

Upholding Human Rights of Stakeholders

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region

Sustainable Development Policy

- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance

Transparent Governance

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

Brian Penney
Chief Executive Officer
March 2016

Appendix B
Concordance Tables

Tables B.1, B.2 and B.3 show the terms and conditions of the Project's Type A Water Licence (2AM-MRY1325 - Amendment No. 1), Type 'B' Water Licence (2BE-MRY1421) and the Project Certificate (No. 005 - Amendment No. 1) and the location within the Waste Management Plan.

TABLE B.1 CONCORDANCE TABLE WITH TYPE A WATER LICENCE TERMS AND CONDITIONS

Part	Item	Condition	Section
D	17	The Licencee shall submit a Construction Monitoring Report to the NWB, within ninety (90) days following the completion of any structure designed to contain, withhold, divert or retain Waters or Wastes. The construction summary report shall be prepared by an Engineer(s) in accordance with Schedule D, Item 1.	Within 90 days of the completion of any structure designed to contain, withhold, divert or retain Waters or Wastes Baffinland will submit a Construction Summary Report.
D	19	The Licencee shall prevent any chemicals, fuel or wastes associated with the undertaking from entering any Water body.	Section 3.7 Refer to the Hazardous Materials and Hazardous Waste Management Plan
F	1	The Board has approved, the Plan entitled Waste Management Plan (BAF-PH1-830-P160028, Rev 3), March 20, 2015, submitted as additional information with the 2014 Annual Report.	N/A
F	5	The Licencee shall locate areas designated for waste disposal at a minimum distance of thirty-one (31) meters from the ordinary High Water Mark of any water body such that the quality, quantity or flow of water is not impaired, unless otherwise approved by the NWB in writing.	Section 3.2.1
F	6	The Licencee is authorized to dispose of all acceptable food waste, paper waste and untreated wood products in an Incinerator System.	Section 3.3
F	7	The Licencee shall test the bottom ash generated by all Incinerator Systems, by using the acceptable test procedures for analyzing residuals, prior to being disposed of at any Landfill Facility. If the composition of the ash makes it unsuitable for disposal at the Landfill facilities, the Licencee shall direct the Waste to an appropriate facility for disposal. The records of analysis results and volumes of ash shall be maintained and provided to an Inspector upon request.	Section 3.4.4, 5.2.3
F	8	The Licencee shall not open burn plastics, wood treated with preservatives, electric wire, Styrofoam, asbestos or painted wood, to prevent the deposition of waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding waters, unless otherwise approved by the NWB in writing.	Section 3.5, 5.3
F	10	The Licencee shall submit to the NWB and the Inspector (CIRNAC), thirty (30) days prior to the removal and transfer of waste, a declaration of authorization from any community receiving waste from the Project, which clearly states that authorization has been granted for the deposit by the Licencee at the Hamlet's appropriately licenced facilities.	Section 5.8

Part	Item	Condition	Section
F	11	The Licencee shall provide at least ten (10) days' notice to the Inspector (CIRNAC) prior to planned Discharges from any Waste Management Facility, Oily Water/Wastewater Treatment Facilities, Sewage Treatment Facilities, and any other relevant facilities associated with the Project. The notice shall include the estimated volume proposed for Discharge and the location and description of the receiving environment.	Refer to the Hazardous Materials and Hazardous Waste Management Plan and Fresh Water Supply, Sewage and Wastewater Management Plan
F	13	The Licencee shall remove any waste generated from temporary and permanent shelters along the Tote Road and along the railway corridor for treatment at appropriately licenced Waste Management Facilities.	Section 3.3.2 Section 3.3.3
F	29	The Licencee shall maintain records of all Waste backhauled from the Mary River Project and confirmation of proper disposal through the use of Waste manifest tracking systems and registration with the Government of Nunavut, Department of Environment. These records shall be made available upon request, to an Inspector or the NWB.	Section 3.0, 5.0

TABLE B.2 CONCORDANCE TABLE WITH TYPE 'B' WATER LICENCE TERMS AND CONDITIONS

Part	Item	Condition	Section
D	1	The Licensee shall locate areas designated for waste disposal at a minimum distance of thirty-one (31) metres from the ordinary High Water Mark of any water body such that the quality, quantity or flow of Water is not impaired, unless otherwise approved by the NWB in writing.	Section 3.2.1
D	2	The Licensee shall not practice on-site landfilling or open-burn plastics, wood treated with preservatives, electric wire, Styrofoam, asbestos or painted wood so as to prevent the deposition of waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding Waters, unless otherwise approved by the NWB in writing.	Section 3.5, 5.3
D	3	The Licensee is authorized to dispose of all acceptable food waste, paper waste and untreated wood products in an incinerator.	Section 3.3.2.1, 3.3.3, 3.3.7
D	4	The Licensee shall provide to the NWB with documented authorization from all communities in Nunavut receiving Wastes from the Mary River Exploration Project prior to any backhauling and disposal of wastes to those communities.	Section 5.8
D	5	Licensee shall provide to the NWB a copy of the written authorization received from the Licensee of 2AM-MRY1325 at least 30 days prior to backhauling waste from facilities and undertakings under this licence to facilities associated with Licence 2AM-MRY1325.	Section 5.8
D	6	The Licensee shall backhaul and dispose of all hazardous wastes, waste oil and non-combustible waste generated through the course of operation at a licensed waste disposal facility.	Refer to the Hazardous Materials and Hazardous Waste Management Plan
D	7	The Licensee shall maintain records of all waste backhauled and records of confirmation of proper disposal of backhauled waste. These records shall be made available to an Inspector or the NWB upon request.	Section 3.0, 5.0

TABLE B.3 CONCORDANCE TABLE WITH PROJECT CERTIFICATE TERMS AND CONDITIONS

No.	Condition	Section
11	The Proponent shall develop and implement an Incineration Management Plan that takes into consideration the recommendations provided in Environment Canada's Technical Document for Batch Waste Incineration (2010).	Section 3.4; Appendix H Incinerator Operation Procedure
12	Prior to commencing any incineration of on-site Project wastes, the Proponent shall conduct at least one stack test immediately following the commissioning of each temporary and permanent incinerator.	Section 3.4.3, 5.2.2
64	The Proponent shall ensure that its Environment Protection Plan incorporates waste management provisions to prevent carnivores from being attracted to the Project site(s). Consideration must be given to the following measures: The Proponent shall ensure that its Environment Protection Plan incorporates waste management provisions to prevent carnivores from being attracted to the Project site(s). Consideration must be given to the following measures: Installation of an incinerator beside the kitchen that will help to keep the food waste management process simple and will minimize the opportunity for human error (i.e. storage of garbage outside, hauling in a truck (odors remain in truck), hauling some distance to a landfill site, incomplete combustion at landfill, fencing of landfill, etc.); and Installation of solid carnivore-proof skirting on all kitchen and accommodation buildings (i.e., heavy-duty steel mesh that would drop down from the edge of the buildings/trailers and buried about a half meter into the ground to prevent animals from digging under the skirting).	This Condition has been addressed in the Environmental Protection Plan

Appendix C
Disposal Methods by Waste Type

Table C.1 Waste Handling and Disposal by Waste Type

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Absorbents - and other similar spill response material	Petroleum	Hazardous if used for a spill clean-up; not TDG regulated	Collect in white Quatrex bags. Store full bags in the hazardous waste storage areas until final disposal.	Offsite disposal
Activated Carbon	Petroleum	Hazardous; not TDG regulated	Collect in white Quatrex bags. Store in the hazardous waste storage areas until final disposal.	Offsite disposal
Aerosol Cans	HHW	Hazardous. TDG regulated as “Aerosol, Flammable, Class 2.1, UN 1950”	Disposal bins located at various locations inside the main facilities, and at the waste management building. Store full drums in the hazardous waste storage areas in open top drums.	Offsite disposal
Appliances	Inert/ Chemical	May be hazardous	Appliances may contain ozone depleting substances (refrigerator) or electronic boards. May require removal of hazardous components before final disposal in the landfill. Manage accordingly. Store in contained location until approval is received by the onsite Environment Department to dispose in landfill.	Onsite landfilling
Batteries, wet (lead - acid)	Chemical	Hazardous. TDG regulated as “Batteries, wet, filled with acid, Class 8, UN 2794”	Collect in black Quatrex bags in workplace sorting areas. Vehicle batteries should be drained of power and terminals should be covered with electrical tape. Stacked layers of vehicle batteries should be separated by a layer of cardboard. Store full bags in the hazardous waste storage areas until final disposal.	Offsite disposal

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Batteries, Lithium Ion	HHW	Hazardous. TDG regulated as "Lithium Batteries, Class 9, UN 3090" and "Lithium Batteries Contained in Equipment; or Lithium Batteries Packed with Equipment, Class 9, UN 3091"	Collect and store batteries separately in water-tight containers with chalk ($CaCO_3$), lime powder (CaO) or Vermiculite. Store in a sea container with proper identification away from other flammable and combustible materials. Batteries should be drained of power and terminals should be covered with electrical tape. Care must be taken to ensure that the batteries are not damaged while awaiting disposal.	Offsite disposal
Batteries, rechargeable (NiCad, Mercury, Lithium, Silver-Oxide)	HHW	Hazardous; small household-Type 'Batteries are generally not TDG regulated	Disposal bins (same as for alkaline batteries) are located at various locations inside the main accommodation facilities. Segregate per Type And transfer to different 20L pails. Transfer to 20L pail, then in open top drums. Store in the hazardous waste berm until final disposal. Computer batteries should be brought to the onsite Environment Department.	Offsite disposal
Batteries, dry (alkaline)	HHW	Hazardous; not TDG regulated	Disposal bins (same as for rechargeable batteries) are located at various locations inside the main accommodation facilities. Transfer to 20L pail, then in open top drums. Store in the hazardous waste storage areas until final disposal.	Offsite disposal
Biomedical Waste - Sharps, human anatomical, blood, and body fluids	Biomedical	Biomedical hazard	Contain and store in suitable biohazard containers at the medical office until disposal.	Offsite disposal

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Calcium Chloride	Chemical	Hazardous; not TDG regulated	Collect and store in white Quatrex bags.	Offsite disposal or use as dust suppressant on roads (as authorized)
Cardboard	Inert	Non-hazardous	Suitable for open burning, incineration or disposal in the landfill. Store accordingly in adequate container before final disposal. Incinerate if cardboard has come in contact with food.	Open burning/ onsite landfilling
Cement	Inert	Non-hazardous, inert waste	May be used as a landfill cover if crushed.	Onsite landfilling
Chemicals - Spent lab reagents	Chemical	Hazardous. Shipping TDG instructions should follow MSDS recommendations.	Management method should follow MSDS recommendations. SDS sheets are found in the laboratory.	Offsite disposal
Cigarette Butts	Chemical	Hazardous; not TDG regulated	Collect in cigarette butts receptacles outside each main entrance.	Incineration
Compressed Gas Cylinders	Chemical	Hazardous; TDG regulation varies depending on gas	Safely empty cylinders of all gases. Store away from sources of heat and ignition. Return containers to manufacturer for reuse following TDG procedures. When not shipped offsite, remove valves and purge cylinder with compressed air or inert gas. Dispose of as metal.	Offsite reuse/landfill
Contaminated Soils	Petroleum	Hazardous; not TDG regulated	Store and remediate onsite in landfarm facilities.	Onsite treatment

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Contaminated Snow, Ice	Petroleum	Hazardous; not TDG regulated	Store at landfarm facilities (snow dump) and treat using onsite oil/water separator.	Onsite treatment
Contaminated Water	Petroleum	Hazardous; not TDG regulated	Collect in trays, drums, or pumped via pipeline. Store in closed top drums or bladders in hazardous waste storage areas until treatment in oil/water separator. Or store at landfarm facilities (snow dump) and treat using onsite oil/water separator.	Onsite treatment
Diesel Fuel	Petroleum	Hazardous; TDG regulated as “Diesel, Class 3, UN 1202, FP 39°C”	Collect in trays, drums, or pumped via pipeline. Store in closed top drums in hazardous waste storage areas until final disposal. Not a waste unless contaminated by a substance that makes it unusable as a fuel. Diesel not suitable as mobile fuel can be used for heating purposes.	Onsite recovery/ Offsite disposal
Drums - Empty	Petroleum	Hazardous; not TDG regulated	“Empty” containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. “Empty” drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. Consult the MSDS of the substance previously contained in the drums for guidance on handling and disposal.	Offsite disposal
Drums - Residuals	Petroleum	Hazardous. Considered the same hazard as original product	Drum residuals are to be collected in different containers for reuse (diesel, Jet A, oil) or disposal (antifreeze or other product). Reuse diesel and oil for heating and other uses.	Onsite recovery/ Offsite disposal

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Electronic Equipment	HHW	Hazardous. Not TDG regulated. May contain heavy metals.	Typical electronic wastes consist of used computers, cell phones, cameras, TVs and monitor screens, media players, switches, and testing equipment. Electronic wastes shall be brought to the onsite Environment Department or placed in a Quatrex bag in a contained storage facility until offsite shipment for recycling or final disposal. Batteries shall be removed of equipment and managed accordingly.	Offsite recycling or disposal
Fluorescent Lamps - Bulbs and Tubes	HHW	Hazardous in large quantities (trace amount of mercury); not TDG regulated	Bulbs will be brought to the onsite Environment Department to be processed using an onsite bulb eater that crushes the bulbs and captures residual mercury vapour. Crushed bulbs and filters generated by the bulb eater will be sent off site for final disposal in sealed drums/barrels.	Onsite processing /offsite disposal
Filters - Lube Oil	Petroleum	Hazardous; not TDG regulated	Drain and crush filters. Collect in open top drums and store in the hazardous waste storage areas until final disposal offsite.	Offsite disposal
Food Waste/Putrescible	Domestic	Non-hazardous	Collect in plastic bags. Store in animal proof steel bins outside kitchens. Incinerate on a regular basis.	Incineration
Gasoline	Petroleum	Hazardous. TDG regulated as “Gasoline, Class 3, UN 1203, FP -39°C”	Collect in trays, drums, or pumped via pipeline. Store in closed top drums in the hazardous waste storage areas until final disposal. Gasoline will not be considered a waste unless contaminated by a substance that makes it unusable as a fuel.	Offsite disposal
Clean Glass	Inert	Non-hazardous, inert waste	Collect and store in landfill bins.	Onsite landfilling
Glycol	Chemical	Hazardous; not TDG regulated	Collect in trays, drums, or pumped via pipeline. Store in closed top drums or totes in the hazardous waste storage areas until final disposal.	Offsite disposal
Grease	Petroleum	Non-hazardous	Store in open top drums in the hazardous waste storage areas until final disposal.	Offsite disposal

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Human Waste	Domestic	Hazardous; not TDG regulated	Human waste that cannot be treated by onsite WWTP (i.e. deposited in barrels at satellite camps - Bruce Head) will be stored in closed drums in the hazardous waste storage areas until final disposal.	Offsite disposal
Hydraulic Fluid	Petroleum	Hazardous; not TDG regulated	Collect in trays, drums, or pumped via pipeline. Store in closed top drums in the hazardous waste storage areas until final disposal.	Offsite disposal
Incinerator Ash	Inert/ Chemical	Inert	Composition of incinerator ash will depend on the wastes that were incinerated. Stored in open top drums. Non-hazardous ash will be landfilled. Hazardous ash will be shipped offsite for final disposal. Routine ash sampling and testing will be conducted to classify incinerator ash generated by the Project.	Onsite landfilling/ offsite disposal (if hazardous)
Jet A Fuel	Petroleum	Hazardous; TDG regulated as “Aviation gas, UN 1863, FP 39°C”	Collect in trays, drums, or pumped via pipeline. Store in closed top drums in the hazardous waste storage areas until final disposal. Jet A will not be considered a waste unless contaminated by a substance that makes it unusable as a fuel. Jet A not suitable as aviation fuel can be used for heating purposes.	Onsite recovery/ offsite disposal
Kitchen Grease/Oil	Domestic	Non-hazardous	Collect in closed-top drums or 20L pails in a sea container outside the kitchen. Suitable for incineration or stored in sea cans until offsite disposal.	Incineration/offsite disposal
Lube Oil	Petroleum	Hazardous; not TDG regulated	Collect in trays, drums, or pumped via pipeline. Store in totes in the hazardous waste storage areas until final disposal. Possible reuse as heating oil or other uses in approved furnaces.	Onsite reuse/ offsite disposal
Metal	Inert	Non-hazardous, inert waste	Collect and store in landfill bins.	Onsite landfilling
Methanol	Chemical	Hazardous; TDG regulated as “Methanol, Class 3, UN 1230, P.G. II”	Collect in UN certified container. Store in the hazardous waste storage areas until final disposal.	Offsite disposal

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Oily Rags and Similar Debris	Petroleum	Not hazardous if used for cleaning; classified as absorbent if used to clean-up spills	Suitable for incineration. Collect in drums at workplace sorting areas. Bring to incinerator and disperse between waste loads.	Incineration
Ozone Depleting Substances (ODS, i.e. air conditioning and refrigerant gases)	Chemical	Hazardous	ODS must be removed by certified technician before disposal of unit. ODS must be stored as per instructions from certified technician.	Offsite disposal
Paint	Petroleum	May be hazardous if oil-based	Collect in white Quatrex bags. Store in the hazardous waste storage areas until final disposal.	Offsite disposal
Paper Products	Domestic	Non-hazardous	Collect in incinerator waste bins. If product is cardboard, manage accordingly.	Incineration
Plastics - Food Packaging, Bags, etc.	Domestic	Non-hazardous	Collect in garbage bags.	Incineration
Plastics - Oil/ Hydrocarbon Containers, Contaminated Berm Liner	Petroleum	Hazardous; not TDG regulated	Drain fluid in appropriate tote or drum. Collect in white Quatrex bags. Store in the hazardous waste storage areas until final disposal.	Offsite disposal
Plastics - Bulky	Inert	Non-hazardous	Collect and store clean containers or other clean component in landfill bins.	Onsite landfilling
Plastics - PVC	Inert	Non-hazardous	Collect and store in landfill bins.	Onsite landfilling
Plastics - Styrofoam	Inert	Non-hazardous	Collect in white Quatrex bags. Store in landfill bins.	Onsite landfilling

Waste Material	Waste Type	Classification	General Management Method	Final Disposal
Textiles	Inert	Non-hazardous	Collect and store in landfill bins. Incinerate if textiles came in contact with food.	Onsite landfilling/ incineration
Tires	Inert	Non-hazardous	Collect and store in laydown until final disposal.	Offsite disposal
Unusual Waste	To be determined	To be determined	Bring to the onsite Environment Department, if size permits. Proper management and disposal will be determined on a case-by-case basis.	To be determined
Vehicles	Inert/ Petroleum/ Chemical	Non-hazardous if drained of all fluids	Drain all fluids and dispose appropriately. Store in laydown area until approval is given by the onsite Environment Department to landfill the vehicle.	Onsite landfilling
Wood - Scraps	Inert	Non-hazardous, inert waste	Collect and store in landfill bins. Suitable for incineration if in small amount.	Onsite landfilling/ Incineration
Wood - Treated	Inert	Non-hazardous, inert waste	Collect and store for shipment offsite.	Offsite disposal
Wood - Untreated	Inert	Non-hazardous, inert waste	Collect in untreated wood bin.	Open burning

Appendix D
Site Layouts: Mine Site and Milne Port

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7,917,000 7,916,000 7,915,000 7,914,000 7,913,000 7,912,000

EMULSION PLANT
AMMONIUM NITRATE STORAGE
MS-08
ULTIMATE WASTE ROCK STOCKPILE
OPEN BURN SITE
MS-MRY-9
MS-MRY-10
HAUL ROAD
WEST STORMWATER POND
WATER PUMPHOUSE
MS-MRY-1
MS-MRY-6
MS-MRY-4
MQ-C-A
MQ-C-D
Camp Lake
EXPLORATION CAMP AREA
MS-MRY-4A, B, C
ULTIMATE DEPOSIT 1 PIT LIMITS
AIRSTRIP
MQ-C-B
ORE HAUL TRUCK PAD
LAYDOWN AREA
ROM STOCKPILES
45 ML TANK FARM
MS-C-A
MS-C-B
MS-03B
MINE SITE COMPLEX POWER PLANT
MS-C-E
MS-03
MS-C-F
MS-01
MS-02
QUARRY D1Q2
MS-07
EXPLOSIVE MAGAZINE
Mary River Tributary F
Mary Lake
SAILIIVIK CAMP
MS-MRY-11
MS-01B
MS-C-D
MS-C-C
MS-06B
Sheardown Lake NW
STACKER/ RECLAIMER
CRUSHER FACILITY SEDIMENTATION POND
MS-06
Mary River
MQ-C-E
SECONDARY CRUSHER BUILDING
NORTH RAIL CRUSHER FACILITY AND RAIL LOAD OUT
18 Mtpa ORE STOCKPILES
OVERLAND CONVEYOR
MS-MRY-13B
MS-MRY-13A
EXISTING LANDFILL
MS-05
MS-05B
MS-C-H
EFFLUENT DISCHARGE POINT
Sheardown Lake SE
MS-C-G
EMULSION PLANT

LEGEND

- Proposed Phase 2 Surveillance Network Program (SNP) Station
- Water Licence Surveillance Network Program (SNP) Station
- Monitored not officially SNP (Requested to add to SNP in Water Licence Application)
- Inactive
- Open Burn Site
- Borrow Area
- Quarry Area
- Infrastructure
- Project Development Area
- Commercial Lease Boundary
- Approved Infrastructure
- Additional Phase 2 Proposed Infrastructure

ᓄᓇᕗᑦ ᐅᖃᖅᓯᐅᑦᑐᖅ MARY RIVER PROJECT

Mine Site Layout Phase 2 Proposal

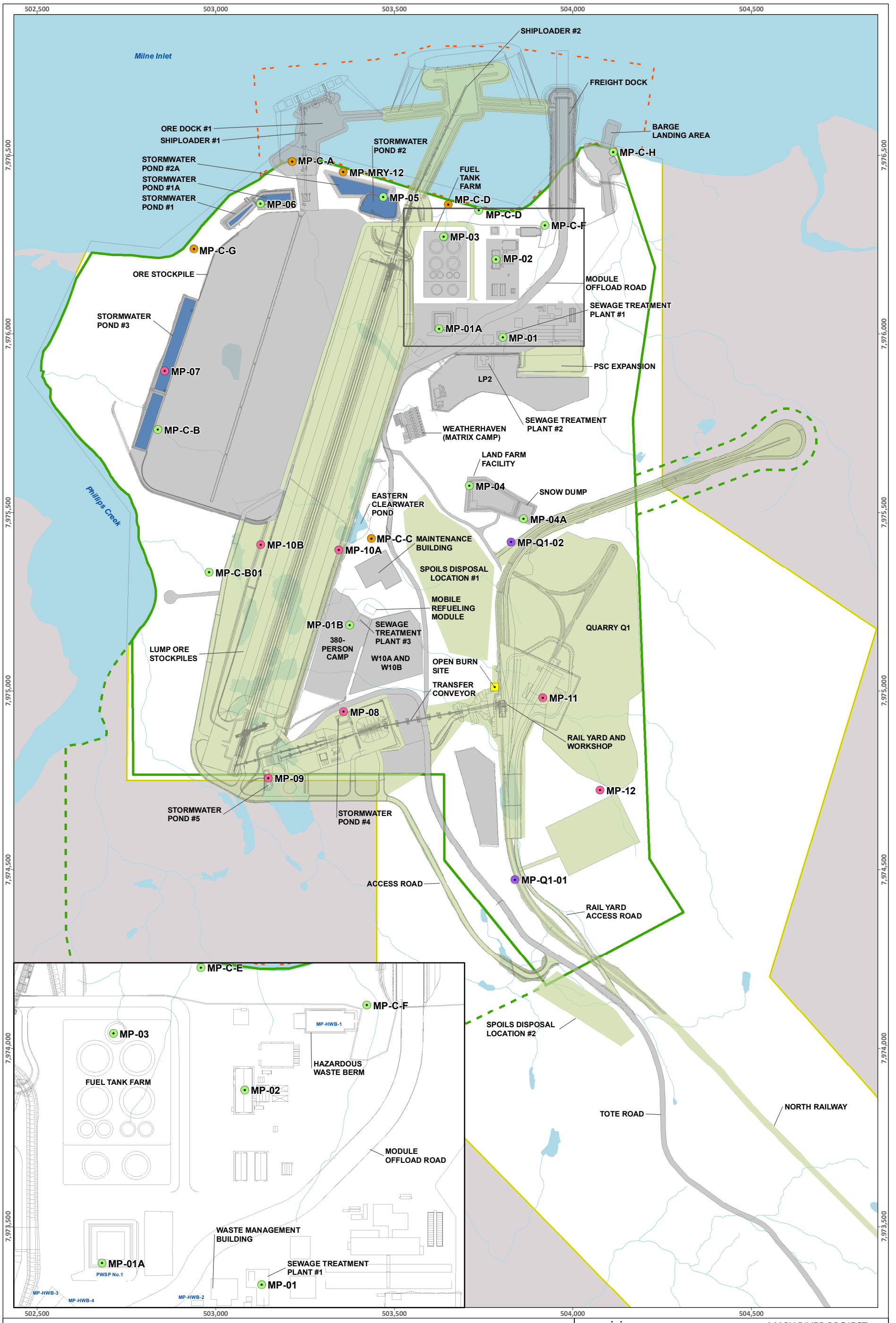
Projection: NAD 1983 UTM ZONE 17N.
Base Map: © Her Majesty the Queen in rights of Canada Department of Natural Resources (2009). All rights reserved.

0 200 400 800 Meters
Scale 1:30,000
N

Baffinland

ᑎᑎᕋᐅᓯᖏᓐᓄᑦ FIGURE 2

SAVED: C:\Users\katie.mcguire\Documents\4 - Maps\External\KPMP\BIM_2_MineSite - SNP mxd: 14-Apr-20



- Proposed Phase 2 Surveillance Network Program (SNP)
- Water Licence Surveillance Network Program (SNP)
- Monitored not officially SNP (Requested to add to SNP in Water Licence Application)
- Inactive
- Open Burn Site
- Foreshore Lease Boundary
- Project Development Area
- Commercial Lease Boundary
- Approved Infrastructure
- Additional Phase 2 Proposal Infrastructure

ᓄᓇᕗᑦ ᐅᓴᖏᓐᓄᑦ MARY RIVER PROJECT

Milne Port Site Layout Phase 2 Proposal

Projection: NAD 1983 UTM ZONE 17N.

0 50 100 200 Meters
Scale 1:10,000

N

Baffinland

ᑎᑎᕋᐅᓵᕐᒪᓂᖅ FIGURE 1

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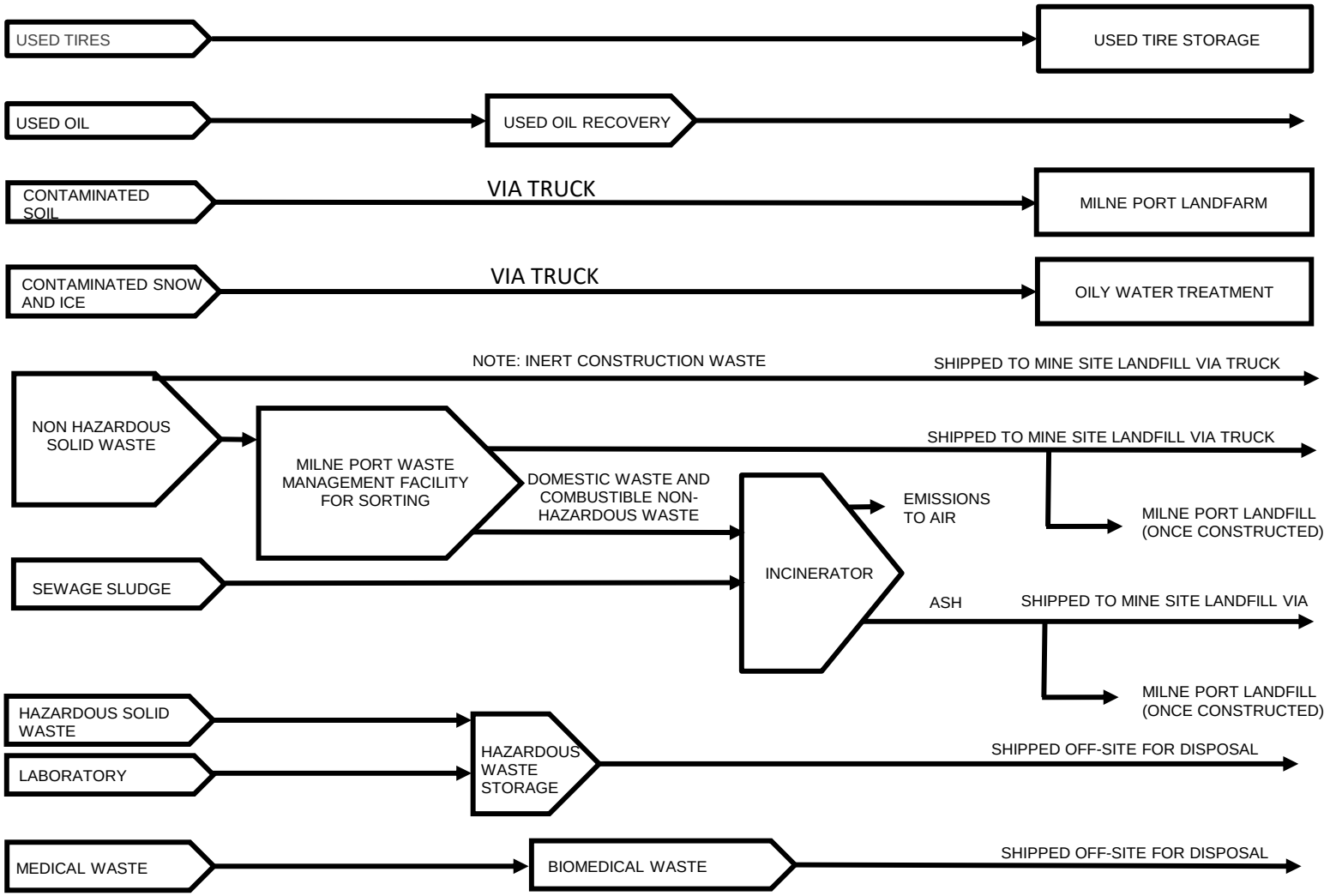
Appendix E
Waste Management Flow Diagrams



NOTES:

1. MODIFIED FROM HATCH DRAWING NO. H337697-7000-007-002-0001.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
1	16JUN'21	ISSUED WITH TRANSMITTAL	AMH	RAC
0	15APR'20	ISSUED WITH REPORT	AMB	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MILNE PORT
WASTE MANAGEMENT BLOCK FLOW DIAGRAM

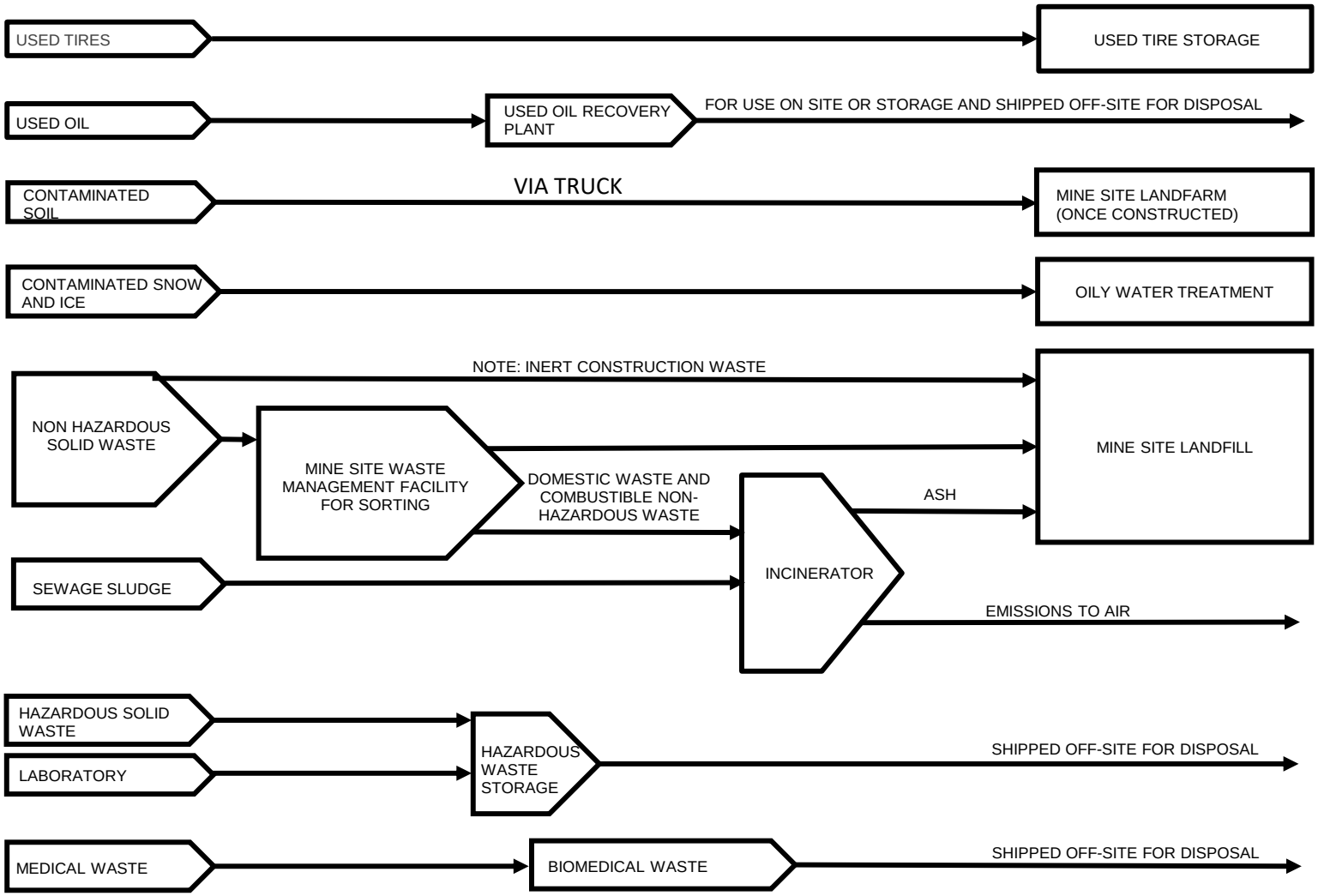
Baffinland

P/A NO. NB102-181/65

REF. NO. NB21-00152

FIGURE E.1

REV 1



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0	15APR'20	ISSUED WITH REPORT	AMB	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MINE SITE
WASTE MANAGEMENT BLOCK FLOW DIAGRAM

Baffinland

P/A NO. NB102-181/65

REF. NO. NB21-00152

FIGURE E.2

REV 1

Appendix F
Waste Sorting Guidelines

Waste sorting guidelines

All employees and contractors need to sort their waste into proper containers. When containers are full contact Site Services – Surface Works for pick-up. Unless authorized by the site services supervisor, only site services employees are authorized to transport and store hazardous waste.

Indoor incinerator trash can

Waste generation

Hazardous and non-hazardous wastes are generated during normal day to day work activities.

Outdoor landfill or open burn bin (labelled)

Overpack drum for hazardous waste

Waste sorting

Each department is responsible for organizing and re-stocking their waste sorting areas with required supplies.

Incinerator bin with closing lid

Hazardous

Hazardous waste can be harmful to people and the environment when not properly managed. Proper storage and labeling of hazardous waste is mandatory.

Hydrocarbon spills

Soils and snow/water contaminated with hydrocarbons are sent to the Milne Port Landfarm and Contaminated Snow Facility.

Environment and Site Services – Surface Works must be contacted for disposal of these materials.

Hazardous waste

Each type of hazardous waste has a proper container that must be used for safe storage and off-site disposal. See accompanying chart for types of hazardous waste and proper containers.

Non-hazardous

Non-hazardous waste is mainly disposed of on-site at the Landfill, the Incinerator or may be sent to open burning. This depends on the type of non-hazardous waste.

Landfill

- Treated wood
- Hard plastic
- PVC pipe
- Rubber
- Concrete
- Glass
- Empty containers (approved)
- Metal
- Unusable equip-ment (drained, approved)
- Bulky packaging material

Disposal

Outdoor bins labeled ‘landfill’.

Unauthorized entry to the landfill is prohibited.

Incinerator

- Food
- Food packaging
- Paper
- Small cardboard
- Small plastics
- Unusable PPE

Disposal

Stored indoors in trashcans or in outdoor bins with a closing lid.

Call Site Services – Surface Works for removal of incinerator bins.

Open burn

- Clean, untreated wood
- Cardboard (un-corrugated)

Disposal

Outdoor bins labelled “Open Burn”.
Contact Site Services – Surface Works for removal of burnable waste.

Unauthorized entry to the burn pit is prohibited.

For more information, refer to BAF-PH1-830-P16-0028 r4 - Waste Management Plan

Hazardous wastes and containers

Not sure how to dispose of your hazardous waste? Use the guide below to sort it out.

Remember, if you ever have a hazardous material and you aren't sure where it should go, contact the environmental staff. We all have a role to play in protecting the environment!

Hazardous waste type	Storage container
Absorbent pads or oily rags	White Quatrex bags or sealable drums
Aerosol cans	White Quatrex bags or sealable drums
Antifreeze	Cubes
Batteries (trucks & equipment)	Black Quatrex bags
Batteries (all other small types)	Sealable drums
Contaminated water	Cubes
Electronic wastes	White Quatrex bags
Glycol	Cubes
Kitchen grease	Sealable drums
Lightbulbs	Sealable drums
Chemical/lab wastes	White Quatrex bags
Oily or contaminated waste containers	White Quatrex bags
Solvents	Sealable drums
Waste coolant	Cubes
Waste fuel	Totes or 45g (re-used) drums
Waste grease	Sealable drums
Waste oil	Cubes or sealable drums
Waste oil filters	Sealable drums or white Quatrex bags

If you are looking for spill pads or Quatrex bags, here's where you can find them in the warehouse.

Product	Warehouse
Spill pads (hydrocarbon)	2000497
Spill pads (oil/water)	2000498
White Quatrex bag	2001096
Black Quatrex bag (batteries only)	2001095
Overpack (sealable) drum	2000251

For more information refer to BAF-PH1-830-P16-0011 r4 - Hazardous Materials and Waste Management

Appendix G
Incinerator Operation Procedure

Baffinland Iron Mines Corporation

INCINERATOR OPERATION PROCEDURE

BAF-PH1-320-PRO-0002

Rev 1

Prepared By:	Eli Iannelli
Department:	Surface Works
Title:	
Acting Supervisor:	
Date:	April 18, 2017

Approved By:	Jeff Bush
Department:	Site Services
Title:	Superintendent-Surface Works
Date:	April 18, 2017
Signature:	

DOCUMENT REVISION RECORD

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03/10/14	0	TM	BP	Use
04/18/17	1	EI	JB	Use

TABLE OF CONTENTS

List of Appendices

1.0 PURPOSE AND SCOPE

Baffinland Iron Mines Corporation is committed to taking the necessary steps to ensure that the collection, handling, storage, transportation and disposal of wastes generated during the construction, operation and closure of the Mary River Project is conducted in a safe, efficient and environmentally compliant manner.

The purpose of this procedure is to provide a set of operational requirements for the safe incineration of waste in an environmentally acceptable manner at the Mary River Project. The incineration of waste is one of a number of elements of the Mary River Project source segregation and waste management program.

2.0 REQUIREMENTS

2.1 HAZARDS AND ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT (PPE)

2.1.1 HAZARDS

There are numerous specific hazards associated with the management of the incinerator. They include:

- Explosive Gases (aerosol cans/ batteries)
- High temperature
- Sharp objects (i.e. barrel lids, broken glass)
- Flying dust and small particles
- Potential fuel spills
- Encounter with wildlife (wildlife attractants)
- Electricity
- Fire
- Smoke

2.1.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Wear Standard P.P.E. - Safety glasses, hard hat with reflective tape, safety boots, reflective vest, clothing in good condition, gloves or mitts in good condition and hearing protection if required.
- A half face dust mask with disposable cartridges (such as 3M 7502 Half-face respirator and 3M 2091 p100 particulate cartridge).

2.1.3 SAFETY AND ENVIRONMENTAL EQUIPMENT

- 20lb Fire Extinguisher
- Sea cans for storage of wastes to be burnt
- Ash bins with quick attach for 930 loader
- Spill kits
- Radio Communication

2.2 TRAINING AND/ OR QUALIFICATIONS

New operators will be instructed on the proper use to the incinerator operations. Record of training will be documented and records will be kept by the training department, in the employee training file.

General Safety Instructions:

- Keep the electrical panel doors closed at all times except when performing electrical maintenance or troubleshooting.
- Allow only qualified operators to perform maintenance and troubleshooting on the machine.
- Open and lockout the Main Disconnect Switch on the electrical control panel while working on the machine.
- Do not bypass or tie down any of the door safety limit switches.
- Do not open any of the doors while the Primary or Secondary Chambers are above 200°F (93 °C).
- Do not enter the Primary Chamber unless the Emergency Stop Button is pushed.
- When opening or closing the Primary Chamber door keep clear of the door and ensure that the path for the door is clear.
- Secure the Primary Chamber door, with a safety chain and personal lockout lock, when it is open so it cannot move accidentally. Each employee loading the incinerator must have a personal lock on the safety chain.
- Immediately correct any fuel leaks and report all fuel leaks to supervisor.
- Do not fill the Primary Chamber above the breech opening. Overfilling can result in poor burning and damage to the Incinerator.
- Do Not block the primary burner at the back top left of the primary chamber, or the opening on the front right, to the secondary chamber.
- Be aware of component-specific safety hazards listed within each section of this manual.

3.0 DEFINITIONS

Refractory:	Insulating ceramic liner inside the primary and secondary chambers that is able to withstand high temperatures without fusion or decomposition.
Purge Cycle:	First step of the burn cycle which exhausts potentially explosive gases that could be remaining in the system and burners. The primary and secondary blowers will run to purge both chambers. The primary and secondary blower indicators on the Top View screen on the Operator Interface will say “Primary Chamber Blower On” and “Secondary Blower On”.
MSC:	Mine Site Complex
PSC:	Port Site Complex

4.0 RESPONSIBILITIES

The following roles have specific accountabilities that must be met to ensure the Mine Site Complex (MSC) and Port Site Complex (PSC) incinerators are operated in compliance with this procedure and its permit. The following roles and responsibilities shall be followed to safely and successfully operate the incinerator.

Site Services Superintendents/Supervisors are responsible for ensuring that all personnel are fully trained and competent to meet the expectations of this policy.

4.1 MSC/PSC Site Services Supervisor

The Site Services Supervisor is responsible for supervising the operation of the incinerator in accordance with this procedure. Specifically, the Site Services Supervisor shall:

- Supervise the incinerator operator in the safe execution of this procedure.
- Implementing this procedure and ensuring that Incinerator Operators are qualified and knowledgeable in the operation of the Incinerator and training documents are submitted to the training department.
- Providing Personal Protective Equipment required for the safe operation of the incinerator and the protection of workers.

4.2 Incinerator Operator

The Incinerator operator, under the general supervision of the Site Services Supervisor, is responsible for executing the following tasks at the incinerator:

- Understanding and following this Procedure, including:
  - Ensuring that no inappropriate materials are processed and that each batch contains an average mix of waste that resembles the design waste characteristics (particularly volume/weight per batch, average density, and overall heat value).
  - Understanding the commitments made by Baffinland Iron Mines to regulatory bodies, with regards to emission targets, monitoring and recording requirements. Refer to “NU Guideline - Burning and Incineration of Solid Waste 2012”.
  - Ensuring the burn cycle is long enough to allow for thorough burn-out and the generation of high-quality ash residual that is safe for disposal. (generally 720 minutes / 12 hours).
  - Minimize particulate matter (dust) emissions during ash removal and handling.
- Wearing the proper P.P.E. when operating the incinerator.

4.3 Environment Department

The Environment Department is responsible for executing the following tasks:

- Overseeing Incinerator Operations to ensure that practices are in compliance with the guidelines as set out in Baffinland's Waste Management Plan.
- Collect monthly incinerator data from the PLC.
- Complete the required ash sampling and testing program.

5.0 PROTOCOL

5.1 Waste Load Design

The types of waste that can be processed in the incinerator are described in table 1. Waste materials not suitable for processing are described in table 2. When preparing a waste load, the operator shall follow these requirements:

- System capacity is 2,000 kg/day.
- Table 1 describes a typical one metric ton load. Respect proportions as much as possible.
- Weigh and record the weight of the waste loaded pre burn.
- Prepare the load in layers: Start with cardboard or wood at the bottom, then kitchen waste, then more cardboard, etc. Note: Do not burn used kitchen grease.
- Waste shall be loose, as received and not compacted prior to loading.
- When receiving large volume of PET bottles (clear plastic), some compaction is recommended.
- The system shall not be overloaded with plastics or wood, or any other high heat value materials.
- Materials containing large air spaces (empty plastic bottles, cardboard boxes) shall be flattened before loading.
- When processing batches of very wet materials (more than 60% food waste), the burn cycle time should be increased to accommodate the additional time required to dry the waste before it can combust.
- Do not load the system with more than 25% by volume of extremely wet materials such as wet garbage.
- Unauthorized waste materials shall never be processed in the system

TABLE 5.1 WASTE MATERIALS SUITABLE FOR INCINERATION

Waste Type	Description	Origin	Proportion
Food Waste	Food, food packaging and containers, plastic and paper waste from food preparation	Kitchen and dining areas, office areas	55% or 550 kg/ton load
Domestic Waste	General refuse such as paper, plastics, cans, bottles, cardboard, newsprint	Dormitory areas, recreation facilities, office areas, warehouse, plant and production facilities	30% or 300 kg/ton load
Packaging	Cardboard boxes, paper, plastic containers, plastic film, Styrofoam, poly-weave bags	Inbound supplies to all work areas	10% or 100 kg/ton load

Waste Type	Description	Origin	Proportion
Wood Waste	Skids, pallets crates	Construction activity, inbound supplies	
Absorbents	Rags, wipes, spill cleanup materials	From all work areas	5% or 50 kg/load
Filters - Air and Fluid	Filters coated with fine particles and trapped solids, saturated with water or fluids (glycol, lube, oils, fuel)	From water treatment facility, or generated at point of maintenance of vehicles, machinery and equipment	
Biomedical Waste	Bandages, dressings, gloves, swabs, syringes, sharps	Medical clinic	

TABLE 5.2 UNACCEPTABLE WASTE MATERIALS

Solid Waste	Examples
Bulky Materials	Automotive or heavy equipment parts such as engine blocks and transmissions
Non-Combustible Materials	Drywall, asbestos, bricks, concrete, soils
Radioactive Materials	Smoke detectors, laboratory wastes
Potentially Explosive Materials	Pressurized vessels including, but not limited to propane tanks, aerosol cans (deodorant, shaving, cleaning, etc) and the like. Actual explosives.
High Alkaline or High Acid Materials	By-products of industrial processes, unrefined fuels, batteries
Solvents	Solvents such as acetone, xylene, methanol

5.2 Operating Instructions

The operation of the incinerator package follows 4 general steps that take place over a 24-hour period:

5.2.1 General Inspection of the System

- Ensure that manual slide gates for each blower are in the open position for free airflow into the Primary and Secondary Chambers
- Ensure the Primary Chamber has been cleaned out, and the chamber floor is cool (less than 40 ^{o}C). If the floor is hotter than this temperature the waste may spontaneously catch on fire during loading
- Ensure that the fuel tank is full (valves, levels)
- Perform a visual inspection of the primary and secondary chambers
- If the reset light is illuminated on the primary or secondary burners, call the Housing maintainer or Fixed plant maintenance department

5.2.2 Load Waste into Primary Chamber and Close Doors

- When loading the waste, avoid contact with refractory (wall modules, door jams, sills, lintel, etc.). Doing so will damage the ceramic blanket refractory
- Ensure that the waste is loaded according to the Waste Load Design
- Ensure that the waste is not blocking the burner cone and the breach between primary and secondary burners.

- Close the door
- Ensure all four latches are closed

5.2.3 Start Burn Cycle from Control Panel

- Ensure that there are no faults on the panel
- Ensure the burn time is adequate. The burn time for a one ton load respecting table 1 proportions should be of 720 minutes.
- Ensure that "Solid Waste Only" is selected on the top view
- At the control panel, on the Panel View press the "Start System" button. The system will initiate the Purge Cycle, followed by the Burn Cycle and then ending with the Cool down Cycle.
  - Observe Systems Purge
  - Observe Start 120 sec.
  - Observe Burners Purging
  - Observe Primary blower + burner + secondary blower will shutdown
  - Observe Firing of Secondary Burner
  - Observe secondary chamber reach 1015 ^{o}C (within approximately one hour)
  - Observe primary burner starts + secondary blower
- Periodically check unit

5.2.4 Clean out ash and Dispose

- Once fully cooled and the temperature is below 90 ^{o}C, proceed to the Primary Chamber Clean Out procedure.
- Unlock all door latches on the access door to the Primary Chamber.
- While standing in front of the Primary Chamber door, slowly open the door to its fully open position. Secure Primary Door in the open position with the safety chain and personal lockout lock.
- Proceed around to the back and open up secondary chamber doors. This will help the cool down process by air flow.
- Inspect the interior for wear and inspect around the door seals to ensure the door will maintain a tight seal upon closure.
- Inspect colour of the ash:
  - If whitish-grey, burn cycle was complete.
  - If ash appears wet and dark, it should be reintroduced in the waste load of the following burn cycle.
- Remove ash and dispose in metal ash bin. If over pack drums are used for ash disposal, labelled MS-ASH-# or MP-ASH-# (MSC and MPC, respectively).
- Collect 1 liter of ash from metal ash bin or over pack drum with metal sampler jar and put in 20 L pail. Refer to Baffinland Document, "Incinerator Ash Sampling Procedure".
- Once the metal ash bin or drum is full, switch to a new bin or drum & pail and notify Environment Department.
- The Environment Dept. will take a sample of the 20L pail for analysis, and the pail can then be reused for the next drum.
- Fill out incineration ash log.
- Check the air inlet holes and remove any obstructions if necessary.
- Inspect the door seals to ensure there are no gaps between the door gasket and the door jamb.

- Close the Primary Chamber access door by clamping each latch until it is tight.
- 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.

5.3 Daily Preventive Maintenance

- Allow only qualified operators to perform maintenance and troubleshooting on the machine as per Eco Waste Solutions Incinerator Equipment Manual.

6.0 REFERENCES AND RECORDS

- *Nunavut Mine Health and Safety Act* and Regulations
- NORCAT, LOTO (Lock out / Tag out) training and procedures
- Canadian Standards Association
- Baffinland Iron Mines Corporation Mary River Project Waste Management Plan for Construction, Operation and Closure, dated April 19, 2013
- Nunavut Water Board Type A Water Licence No: 2AM-MRY1325
- Commercial Lease No.: Q13C301

Appendix A
Environmental Guideline for the Burning and Incineration of Solid Waste

Environmental Guideline for the

Burning and Incineration of Solid Waste

Department of Environment
Government of Nunavut

GUIDELINE: BURNING AND INCINERATION OF SOLID WASTE

Original: October 2010
Revised: January 2012

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 the burning and incineration of solid waste. This Guideline does not replace the need for the owner or person in charge, management or control of a solid 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 solid 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: Nunavut Department of Environment (left and bottom right), Aboriginal Affairs and Northern Development Canada (top right)

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Appendices

Introduction

People living and working in Nunavut often have limited options available for cost effective and environmentally sound management of household and other solid waste. The widespread presence of permafrost, lack of adequate cover material and remote locations make open burning and incineration a common and widespread practice to reduce the volume of solid waste and make it less of an attractant to wildlife. A wide variety of combustion methods are used ranging from open burning on the ground to high temperature dual-chamber commercial incinerators. Generally, high temperature incinerators are more expensive to purchase and operate and cause less pollution than do the less expensive and lower temperature methods. However, high temperature incinerators can safely dispose of a wider variety of waste than can the lower temperature open burning methods.

The Guideline for the Burning and Incineration of Solid Waste (the Guideline) is not intended to promote or endorse the burning and incineration of solid waste. It is intended to be a resource for traditional, field and commercial camp operators, communities and others considering burning and incineration as an element of their solid waste management program. It examines waste burning and incineration methods that are used in Nunavut, their hazards and risks and outlines best management practices that can reduce impacts on the environment, reduce human-wildlife interactions and ensure worker and public health and safety. This Guideline does not address incineration of biomedical waste, hazardous waste and sewage sludge. The management of these wastes requires specific equipment, operational controls and training that are beyond the scope of the current document.

The *Environmental Protection Act* enables the Government of Nunavut to implement measures to preserve, protect and enhance the quality of the 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 solid 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 solid waste.

1.1 Definitions

Biomedical Waste	Any solid or liquid waste which may present a threat of infection to humans including non-liquid tissue, body parts, blood or blood products and body fluids, laboratory and veterinary waste which contains human disease-causing agents, and discarded sharps (i.e. syringes, needles, scalpel blades).
Bottom Ash	The course non-combustible and unburned material which remains at the burn site after burning is complete. This includes materials remaining in the burn chamber, exhaust piping and pollution control devices where such devices are used.
Burn Box	A large metal box used to burn solid waste. Combustion air is usually supplied passively through vents or holes cut above the bottom of the box. An exhaust pipe or stack may or may not be attached.

Commercial Camp	A temporary, seasonal or multi-year facility with a capacity greater than 15 people and which has been established for research, commercial or industrial purposes. A commercial camp does not include a traditional camp or field camp.
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 the 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.
Determined Effort	The ongoing review of opportunities for reductions and the implementation of changes or emission control upgrades that are technically and economically feasible and which result in on-going reductions in emissions. Determined efforts include the development and implementation of waste management planning which is focussed on pollution prevention.
De Novo Synthesis	The creation of complex molecules from simple molecules.
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.
Field Camp	A temporary, seasonal or multi-year facility consisting of tents or other similar temporary structures with a capacity of 15 people or less and which has been established for research, commercial or industrial purposes. A field camp does not include a traditional camp or commercial camp.
Fly Ash	Unburned material that is emitted into the air in the form of smoke or fine particulate matter during the burning process.
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.
Incineration	A treatment technology involving the destruction of waste by controlled burning at high temperatures.

Incinerator	A device or structure intended primarily to incinerate waste for the purpose of reducing its volume, destroying a hazardous substance in the waste or destroying an infectious substance in the waste. An incinerator has means to control the burning and ventilation processes.
Inspector	A person appointed under subsection 3(2) of the *Environmental Protection Act* and includes the Chief Environmental Protection Officer.
Modified Burn Barrel	A metal drum used to burn waste that has been affixed with devices or features which provide limited increased heat generation, heat retention and holding time.
Open Burning	Burning of waste with limited or no control of the burn process. For clarity, open burning includes burning on the open ground or using a burn box or unmodified or modified burn barrel.
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.
Smoke	The gases, particulate matter and all other products of combustion emitted into the atmosphere when a substance or material is burned including dust, sparks, ash, soot, cinders and fumes.
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.
Traditional Camp	A temporary or seasonal camp used primarily for camping, hunting, fishing or other traditional or cultural activities. A traditional camp does not include a field camp or commercial camp.
Unmodified Burn Barrel	A metal drum used to burn waste that has not been affixed with devices or features which provide for enhanced heat generation, heat retention and holding time.
Untreated Wood	Wood that has not been chemically impregnated, painted or similarly modified to improve resistance to insects or weathering.
Waste Audit	An inventory or study of the amount and type of waste that is produced at a location.

1.2 Roles and Responsibilities

1.2.1 Department of Environment

The Environmental Protection Division is the key environmental agency responsible for ensuring the proper management and disposal of solid waste and other contaminants on Commissioner's Land. 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.

The Wildlife Management Division is responsible for managing wildlife in Nunavut. Section 90 of the *Wildlife Act* prohibits the intentional feeding of wildlife and the placement of any food or garbage where there is a reasonable likelihood that it would attract wildlife. Once wildlife has been 'conditioned' to obtaining food associated with human activities, it can become dangerous and often will have to be destroyed. Further information on ways to reduce contact between wildlife and humans can be obtained by contacting the local Conservation Officer or by visiting the web site at:

http://env.gov.nu.ca/programareas/wildlife.

The Department of Environment will provide advice and guidance on the burning and incineration of solid waste. However, it remains the responsibility of the owner or person in charge, management or control of the solid waste to ensure continued compliance with all applicable statutes, regulations, standards, guidelines and local by-laws.

1.2.2 Generators of Solid Waste

The generator, or responsible party, is the owner or person in charge, management or control of the solid waste at the time it is produced or of the facility that produces the waste. The responsible party must ensure the waste is properly and safely managed from the time it is generated to its final disposal. This is referred to as managing the waste from cradle-to-grave.

Contractors may manage solid 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* or *Wildlife 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 burning and incineration of solid waste 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.

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.

The Office of the Fire Marshal is responsible for delivering fire and life safety programs including reviewing plans to ensure incinerators and other heating devices comply with all legislation, codes and standards. The Office of the Fire Marshal derives its authority from the *Fire Prevention Act*, *National Fire Code* and *National Building Code*.

Department of Health and Social Services

Activities related to the burning and incineration of solid 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.*

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* (CEPA) and Canada's Toxic Substances Management Policy. Many pollutants that are released into the atmosphere from the incomplete combustion of unsegregated, or mixed, solid waste are listed as Toxic Substances in Schedule I of CEPA, or are targeted for phase-out through the Toxic Substances Management Policy. Environment Canada is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act* and for regulating the international and interprovincial movement of solid and liquid hazardous waste under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*.

The Air Quality Research Division of Environment Canada is responsible for conducting research into atmospheric releases of chemicals in commercial use in Canada, measuring exhaust emissions from stationary and mobile sources and undertaking ambient air quality monitoring in partnership with provinces and territories.

Aboriginal Affairs and Northern Development Canada

Aboriginal Affairs and Northern Development Canada is responsible under the *Territorial Lands Act* and *Nunavut Waters and Nunavut Surface Rights Tribunal Act* for the management of federal lands and waters, including the impact solid 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 solid waste. Under the Nunavut Land Claims Agreement, municipalities are entitled to control their own municipal disposal sites. Local environmental and safety standards are determined, in part, by how the land is designated under municipal government development plans (i.e. land use zoning). Solid 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, environmental impact assessment and the administration of land and water. Activities involving the burning and incineration of solid 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 Burning and Incineration

2.1 The Combustion Process

The combustion, or burning, of solid waste proceeds through a series of stages. Water is first driven from the unburned waste by heat produced from material burning nearby or from an auxiliary burner. As the waste heats up, carbon and other substances are released and converted into burnable gases. This is referred to as gasification. These gases are then able to mix with oxygen. If the temperature inside the burn chamber is high enough and maintained for a long enough period of time, the hot gases are completely converted into water vapour and carbon dioxide, which is then released into the air. If the temperature inside the burn chamber is not high enough and the burn time is too short, complete conversion of the burnable gases does not occur and visible smoke is released into the air. Another result of burning at low temperatures is the creation of pollutants that were not originally present in the waste. This process is known as *de novo* synthesis. Dioxins, furans and other complex chemical pollutants can be formed through this process.

Ash produced from combustion takes the form of either fly ash or bottom ash. Fly ash is the fine particles carried away in the form of smoke while bottom ash is the course non-combustible and unburned material that remains after the burn is complete. The type and amount of pollutants in the fly and bottom ash depend upon what waste is burned and completeness of the combustion process.

The completeness of combustion is determined by all of the following factors:

Temperature

The temperature generated is a function of the heating value of the waste and auxiliary fuel, incinerator or burn unit design, air supply and combustion control. Complete combustion requires high temperatures. Generally, temperatures that exceed 650^{o}C with a holding time of 1-2 seconds will cause complete combustion of most food and other common household waste. Segregation of waste is required when using methods that don't routinely achieve these temperatures. Dual chamber incinerators, which are designed to burn complex mixtures of waste, hazardous waste and biomedical waste, must provide a temperature higher than 1000^{o}C and a holding time of at least one second to ensure complete combustion and minimize dioxin and furan emissions. When these high temperatures and holding times are achieved, waste will be completely burned and ash, smoke and pollutant concentrations will be minimized.

Because exhaust gas temperatures vary from ambient to greater than 1000°C each time a batch waste incinerator is used, optional air pollution control systems with evaporative cooling towers and scrubbers are seldom recommended. However, it may be necessary to employ these systems with large continuous feed incinerators if additional cleaning of exhaust gas is required by regulatory authorities.

Holding Time

Complete combustion takes time. Holding time, otherwise known as retention or residence time, is the length of time available to ensure the complete mixing of air and fuel, and thus the complete burning of waste. Low temperatures, low heating values of the waste and reduced turbulence require that the holding time be increased to complete the combustion process.

Turbulence

The turbulent mixing of burnable gases with sufficient oxygen is needed to promote good contact between the burning waste and incoming air. This will help in achieving the high temperatures at which waste can be completely burned. The amount of mixing is influenced by the shape and size of the burn chamber and how the air is injected. Passive under-fire ventilation achieved during open burning does not result in sufficient turbulence for the burning of a wide variety of waste. Also, it is important not to overfill the burn chamber as airflow may be blocked and the amount of turbulence further reduced. The more advanced incineration designs provide effective turbulence through the forced introduction of air directly into hot zones.

Composition of the Waste

The heating value, wetness and chemical properties of the waste affect the combustion process and the pollutants that are contained in the resulting smoke and ash. The higher the burn temperature, holding time and turbulence that are achieved, the less effect the composition of the waste has on completeness of the burn.

2.2 Pollutants of Concern

Extreme care must be exercised when burning or incinerating solid waste. Open burning and the improper incineration of solid waste can result in environmental, health and safety hazards from the pollutants found in smoke and exhaust gases and in the bottom ash. These pollutants may either be found in the original waste itself, or may be created through *de novo* synthesis if sufficient temperature, holding time and turbulence is not achieved in the burn chamber.

Many different types of pollutants can be released during burning and incineration. A few of these pollutants include acid gases, trace metals, fine particulates, volatile organic compounds and semi-volatile organic compounds. Acid gases such as hydrogen chloride and sulphur oxides result from burning waste that has high levels of chlorine and sulphur (i.e. plastics). Mercury, lead and cadmium are examples of trace metals found in both fly and bottom ash when batteries, used lubricating oil and other metal-containing wastes are burned. Fine particulates are the very small particles found in smoke created by incomplete combustion and can cause respiratory irritation in humans and wildlife.

Dioxins and furans are pollutants that have drawn much attention in recent years because they have been linked to certain types of cancers, liver problems, impairment of the immune, endocrine and reproductive systems and effects on the fetal nervous system. These pollutants persist in the environment for long periods of time, bioaccumulate in plants and animals, result predominantly from human activity and have been identified for ‘virtual elimination’ in Canada under the federal Toxic Substances Management Policy. The incineration of solid waste accounts for almost 25% of the dioxin and furan emissions in Canada each year. They are formed in trace amounts by *de novo* synthesis during the low temperature burning of waste containing organic compounds and chlorine (i.e. chlorinated plastic, PVC pipe, marine driftwood).

The most effective way to reduce or minimize the release of pollutants is to segregate the waste before burning and achieve sufficiently high temperature, holding time and turbulence in the burn chamber. Open burning produces more smoke and pollutants, including dioxins and furans, than does an incinerator capable of achieving complete combustion.

2.3 Burning and Incineration Methods

The burning and incineration method used is a major factor in determining what type of waste can be safely and effectively disposed of. The methods commonly used in Nunavut include open burning on the ground, unmodified burn barrels and various mechanical incineration systems. Other useful methods include the use of burn boxes and modified burn barrels. Each method is discussed separately in the following sections.

2.3.1 Open Burning

Open burning means the burning of waste where limited or no control of the combustion process can be exercised by the operator. This method includes burning solid waste directly on the open ground or in burn boxes or burn barrels and often does not achieve the temperatures or holding time needed for complete combustion of the waste to occur. This results in the formation of potentially hazardous pollutants and ash, which are likely to impact nearby land and water. Food waste that is not completely burned through open burning can also be a powerful attractant for animals.

The various open burning methods can also present a risk of uncontrolled vegetation and tundra fires through the release of hot sparks or embers. The level of fire risk depends upon the type of open burning used, its location, the skill of the operator and the environmental conditions that exist at the time (i.e. dryness of the surrounding vegetation, wind).

The open burning of solid waste remains a common practice in Nunavut. It is the policy of the Department of Environment to eliminate or minimize open burning of mixed solid waste to the extent practicable and to encourage more acceptable methods of disposal and incineration.

Open Burning on the Ground

Open burning on the ground involves burning solid waste that has been piled directly on the surface of the ground or placed in a small open pit. Many large and small communities and camp operators in Nunavut continue to practice open burning on the ground as a means of reducing the volume of solid waste that must ultimately be disposed of. In general, open burning on the ground results in the incomplete combustion of waste and the release of various harmful pollutants to the air, can cause vegetation or tundra fires through the uncontrolled release of hot sparks and embers, and is actively discouraged by the Nunavut Department of Environment as a method for disposing of unsegregated or mixed solid waste.

Figure 1 – Open Burning on the Ground
Photo courtesy of Aboriginal Affairs and Northern Development Canada

Burn Boxes

There are two basic types of burn boxes. The *enclosed burn box* is constructed using heavy sheets of steel or other metal while the *open burn box* is constructed using expanded metal grating. The latter type is commonly referred to as a *burn cage*. These devices are not commercially-available in Nunavut, but can be constructed using locally available materials. For example, the enclosed metal burn box shown in Figure 2 is made from a dump truck bed and steel plating.

Figure 2 – Enclosed Metal Burn Box
Photo courtesy of Alaska Department of Environmental Conservation

Burn boxes are considered a modification of open burning. Combustion air is provided passively using a natural draft making electricity unnecessary. Burn boxes are single chambered units. Waste is raised off the bottom of the box by placing it on grates inside the unit. Unburned bottom ash falls through the grate during burning making removal easier once a sufficient amount has accumulated. Combustion air in enclosed burn boxes is typically provided by cutting holes near the bottom of the box allowing for better mixing with the burning waste.

Open burn boxes, or burn cages, are an improvement over enclosed burn boxes as the waste is exposed to natural drafts through the metal grating on all surfaces including the bottom. This enables air to better mix with burning waste and promotes more efficient combustion throughout the burning period. Both types of burn boxes are constructed with hinged tops to enable easier loading and cleaning.

Unlike open burning on the ground, burn boxes help to contain the burning waste within a specific location reducing the risk of fire spreading to other disposal areas or surrounding tundra, while still enabling moderate amounts of solid waste to be burned.

Figure 3 – Open Metal Burn Box
Photo courtesy of Alaska Department of Environmental Conservation

Burn Barrels

There are two basic types of burn barrels – the unmodified burn barrel and modified burn barrel.

The *unmodified burn barrel* is normally a 45 gallon, or 205 litre, metal fuel or oil drum with the top removed. These devices typically operate at a low temperature resulting in incomplete combustion of the waste and production of large volumes of smoke and fly ash.

A *modified burn barrel* is a 45 gallon metal fuel or oil drum that has been affixed with devices or features which result in higher burn temperatures, better mixing of the air and a longer holding time. These modifications include a 'metal mesh basket' insert or grate designed to suspend the burning waste. Evenly spaced vents or holes cut above the bottom of the barrel supply combustion air. These features provide for enhanced passive under-fire ventilation and promote better contact between the waste being burned and incoming air. The basket insert is topped with a hinged lid and a chimney port for attachment of an exhaust pipe or stack. The lid helps to increase heat retention and holding time inside the barrel while also allowing for easier loading and mixing of the waste. The removable mesh basket enables access to the unburned bottom ash.

Figure 4 – Modified Burn Barrel

Modified burn barrels can be built using commonly available materials. They can either be pre-built locally or transported to the site for assembly. Detailed construction plans are provided in Appendix 2.

Although modified burn barrels are designed to create an advantage over open burning on the ground, burn boxes and unmodified burn barrels through achieving higher burn temperatures and increased turbulence and holding time, incomplete combustion of waste and the release of pollutants to the atmosphere are still likely. In fact, emissions testing by Environment Canada on a modified burn barrel in April 2011 suggest that these devices do not provide any improvement over open burning on the ground in terms of emissions quality, particularly if wet food waste is added to the waste mixture. Other common problems include easily overfilling the unit and loading waste that should not be burned (refer to section 3.2). Wet or frozen masses of waste are particularly difficult to burn and the resulting partly burned food waste may still attract animals. The proper operation of modified burn barrels is critical to achieving the most efficient burn possible. Basic operating instructions are provided in section 4.1.

Burn barrels are capable of burning only small volumes of solid waste. Like burn boxes, they reduce the risk of fire spreading to vegetation and tundra by containing the burning waste to a specific location.

2.3.2 Incineration

Solid waste incinerators are engineered systems that are capable of routinely achieving burn temperatures in excess of 1000^{o}C and a holding time of at least one second. Properly designed and operated incinerators are able to effectively and safely destroy a wide range of waste. Only incinerators designed for burning mixed municipal solid waste are discussed in the guideline. The incineration of

hazardous and biomedical waste and sewage sludge requires specific equipment, operational controls and training that are beyond the scope of the current document.

There are four basic types of incinerators. They vary based upon the number of burn chambers they have, the amount of air provided to each chamber and how waste is fed into the primary burn chamber.

Dual-Chamber Starved Air System	The primary burn chamber receives less air than is needed to achieve full combustion. Gases from this incomplete combustion then pass into a second burn chamber where sufficient air is injected and complete combustion is achieved.
Single Chamber Excess Air System	More than a sufficient amount of air (as much as 50% more than the amount of air needed) is injected into the single burn chamber to achieve complete combustion of the waste.
Continuous Feed Incinerator	An incineration process that is in a continuous burn cycle. A continuous feed incinerator operates without interruption throughout the operating hours of the facility by having waste continually added to the primary burn chamber.
Batch Feed Incinerator	An incineration process that is not in a continuous or mass burning cycle. A batch feed incinerator is charged with a discrete quantity or single load of waste at the beginning of the burn cycle.

Batch feed dual-chamber controlled air incinerators currently operate at several remote industrial locations in northern Canada and Alaska. Although they are generally considered to have the highest qualities of all the incinerators and open burning methods mentioned, they must be designed for the type and quantity of waste to be burned. Too little heat and holding time will not allow waste to burn properly; too much heat will damage the incinerator.

Figure 5 illustrates the design of a typical batch feed dual-chamber controlled air incinerator. The main features of this type of incinerator are:

- Batch operation allows greater control of temperature and air throughout the burn process.
- Air turbulence can be reduced in the primary chamber so fewer particulates are released into the air from the stack.
- Although a wide range of wastes can be destroyed, waste may have to be segregated and remixed in order to achieve a uniform heating value close to the design point of the incinerator.
- Externally supplied fuel and electricity are needed for the burners and forced air ventilation.
- A properly operating dual-chamber controlled air system will reduce problems with animal attraction as the production of bottom and fly ash and smoke is minimized.

Section 2.3.2 is intended to provide the reader with a brief introduction to incinerators. It is not intended to provide information suitable for the design, selection or operation of an incineration system. Any person considering the purchase of an incineration system should first consult the system's manufacturer or other qualified persons with expertise in the incineration of solid waste.

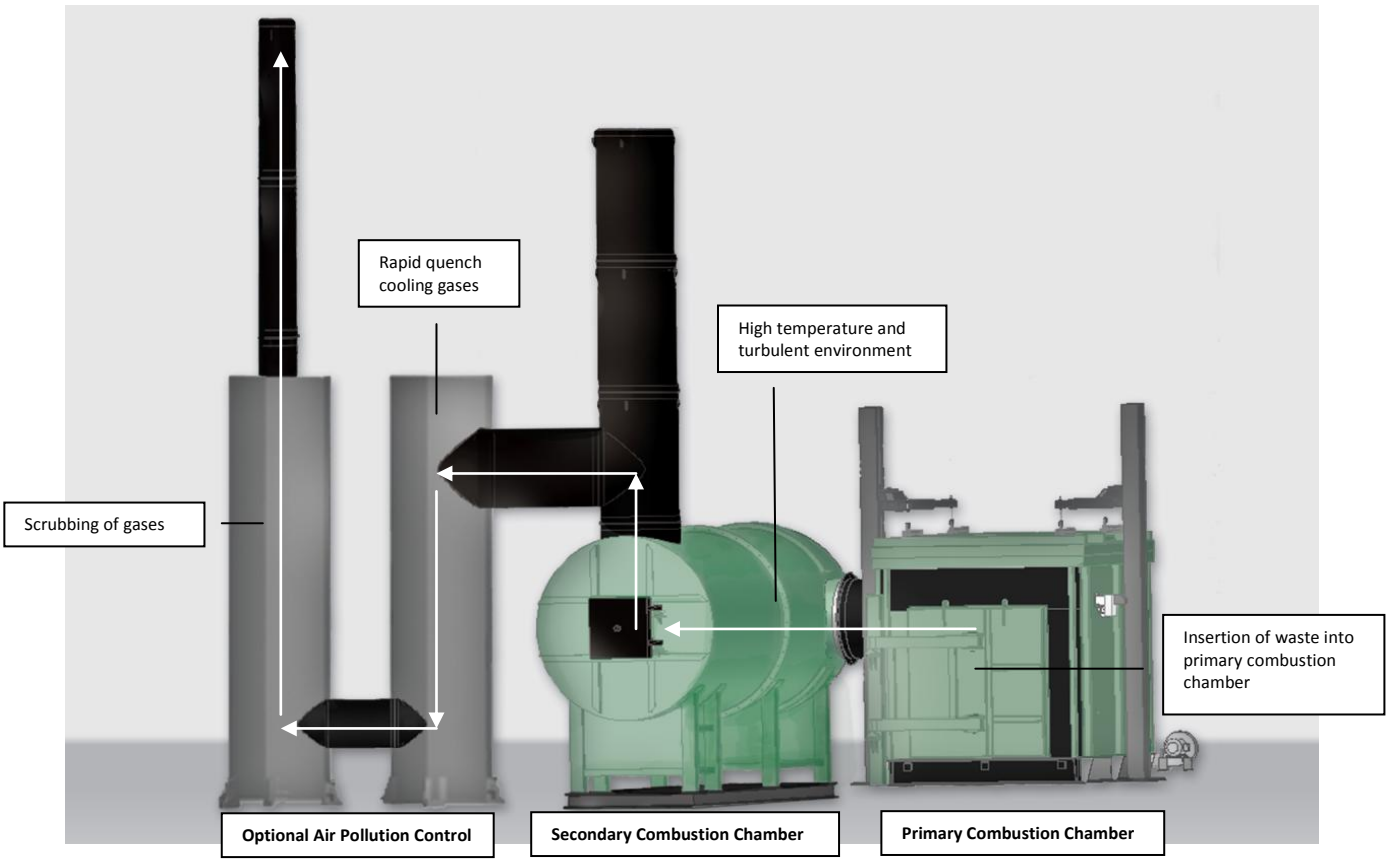

Figure 5 – Typical Batch Feed Dual-Chamber Controlled Air Incinerator with Optional Air Pollution Controls
Illustration courtesy of Eco Waste Solutions

2.4 Environmental Standards

2.4.1 Air Emissions

Air emission standards establish limits on the amount of contaminants that can be released into the atmosphere. These standards are expressed as a concentration in the exhaust gases leaving the stack and are capable of being achieved using generally available incineration technology and waste diversion practices. The following emission standards[1] 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, respectively. Similar standards for the open burning of solid waste have not been established.

[1] Stack concentrations are always corrected to 11% oxygen content for reporting purposes.

Table 1. Air Emission Standards for Solid Waste Incinerators

Parameter	Numeric Standard	Explanation
Dioxins and Furans	80 pg I-TEQ/cubic metre	Unit of measure is picograms of International Toxicity Equivalents per cubic metre of air
Mercury	20 µg/Rcubic metre	Unit of measure is micrograms per Reference cubic metre (the volume of gas adjusted to 25°C and 101.3 kilopascals)

Opacity is the degree to which the exhaust gases reduce the transmission of light and obscure the view of any object in the background. It is expressed as a percentage representing the extent to which an object viewed through the gases is obscured. Although not an emission standard, opacity provides an indication of the general performance of the incinerator during normal operation[2]. Opacity in the incinerator stack should not exceed 5%. While it is not anticipated that opacity levels would exceed 1% to 2% under normal operation, values greater than 5% indicate the incinerator is not performing properly and additional performance evaluation and adjustment is required.

Less than 5% Opacity | 20%-30% Opacity | 90%-100% Opacity

Figure 6 - Examples of Smoke Opacity Ratings
The opacity ratings are estimates and are provided for illustrative purposes only
Centre and right photos courtesy of GNWT Department of Environment and Natural Resources

2.4.2 Bottom Ash

The *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* establishes criteria for determining whether process residuals[3] are suitable for disposal in landfill sites in Nunavut. For the purpose of this Guideline, process residuals include bottom ash from industrial and commercial incinerators. The Toxicity Characteristic Leaching Procedure Test method 1311 (US EPA) is the preferred method to analyze the residuals as this test is designed to simulate the processes a material would be subjected to if placed in a landfill.

Refer to the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* for additional information on the management of process residuals.

[2] The time during which optimum designed temperature is maintained in the burn chamber, and excludes 'startup' and 'cool down' operations.
[3] Process residuals are the solid, semi-solid or sludge waste resulting from industrial operations.

Best Management Practices

Best management practices are methods and techniques that have been shown to be effective in preventing or reducing pollution. They include policies, prohibitions of practices, maintenance and monitoring procedures and other practices adopted by the responsible party. Implementing best management practices together with using best available technology is an effective means of reducing costs, reducing pollution and reducing a parties' legal liabilities.

3.1 Waste Management Planning

The generator of a waste is responsible for its safe management from cradle-to-grave. Using raw materials efficiently and reducing the amount of waste generated is the most important step in waste management planning. For example, through improved waste management planning, it may be possible to reduce or eliminate the need to burn or incinerate waste altogether. Undertaking a waste audit will help to identify the type and amount of waste being generated, the costs of current management options and examine opportunities for better managing the waste. This information will also enable the generator to implement a waste management regime that is tailored to its own unique needs, location and circumstances.

Even with improved waste reduction measures in place there will be waste generated. Waste by its nature is usually a mixture of different unwanted materials. The segregation and diversion of different types of waste is an effective way to reduce the amount of waste requiring costly handling, storage, treatment and disposal. Segregation also enables the reuse of certain types of waste for a different purpose. Reuse activities may be undertaken either on-site or off-site.

Treatment and disposal is the last step in effective waste management and should be undertaken only after all other practical reduction and reuse options have been examined. A wide variety of treatment and disposal options exist and each must be examined before deciding on a final method, regardless of whether waste is to be treated and disposed of on-site or off-site. If burning and incineration is the method of choice, equipment must be designed and sized accordingly to accommodate the type and quantity of waste being produced. As described in the following section, open burning is capable of safely destroying a limited number of types of waste. While incinerators are capable of safely destroying a wider range of waste, many types of waste must still be diverted. Because of this, on-site segregation remains a critical component of any waste management plan.

Overall, the following principles should be used to guide responsible solid waste management planning:

- Know your waste by conducting a waste audit.
- Reduce the amount of solid waste produced by implementing strategic purchasing policies that focus on the substitution or reduction of purchased products as well as product design, composition and durability.
- Reuse waste where different purposes can be identified.
- Segregate and divert mixed waste streams enabling waste to be reused or recycled, thereby reducing the amount of waste to be disposed of.
- All practical disposal methods should be examined. Burning and incineration of waste should be considered only where other practical methods do not exist.

- If burning and incineration is used, the equipment chosen should be designed and sized to accommodate the waste produced, minimize fire hazard and result in the complete combustion of the waste.

3.2 Wastes That Can be Burned or Incinerated

Complete combustion converts waste into inert bottom ash with minimal creation of smoke, fly ash and hazardous gases. Several factors influence this process including the heating value, wetness and chemical composition of the waste itself, operating conditions in the burn chamber (i.e. temperature, holding time and turbulence) and operator skill.

The method used is important in determining what can safely be burned. Certain wastes can only be incinerated using equipment that has been specifically designed and equipped with sufficient air pollution controls and that achieve specific air emission standards. For example, waste containing chlorinated compounds (i.e. chlorinated solvents and plastics, PVC piping, wood treated with pentachlorophenol or PCB-amended paint, marine driftwood) must be separated from other waste as their burning will result in the *de novo* creation and emission of various dioxin and furan compounds. Waste containing mercury (i.e. batteries, thermostats and fluorescent light bulbs) and other heavy metals (i.e. lead acid batteries, wood treated with lead paint) should not be burned as the mercury and heavy metals will not be destroyed. Other waste that should not be burned unless using specially designed incinerators include used lubricating oil, hydrocarbon contaminated soil, biomedical waste, sewage sludge or any other waste specifically prohibited by the Department of Environment.

Table 2 provides a listing of common wastes that can be burned and those that require special consideration and treatment. Note that open burning and incineration are identified as separate columns in the table and that different restrictions apply depending upon which method is used. In general, more restrictions apply to the various methods of open burning because of the incomplete combustion achieved. Fewer restrictions apply to incineration because of the operator's ability to control the combustion process.

Non-combustible materials such as metal and glass do not burn and will rob heat away from waste that can be destroyed by burning. Combustible waste should always be separated from non-combustible waste before being loaded into the burn chamber.

3.3 Keeping Waste Dry

Typical mixed garbage has a moisture content of less than 20% while the moisture content of food wastes can range up to 80%. Anything that can be done to reduce the moisture of waste burned will decrease the amount of smoke produced and increase the completeness of combustion. Waste should be covered or stored inside sheds or other secure buildings to keep rain and snow out of the waste. This will also lessen the opportunity for wildlife to access the waste. If wet waste must be burned, the wet waste should be mixed or layered with dry waste to reduce the overall moisture content of the waste burned. Mixing or layering waste in this manner is particularly important when loading wet solid waste into a burn box or modified burn barrel.

Table 2. Waste That Can be Burned or Incinerated

Waste Type	Method	
	Open Burning[4]	Dual-Chamber Incinerator
Paper products	✓	✓
Paperboard packing including boxboard and cardboard	✓	✓
Untreated wood including lumber and plywood	✓	✓
Food waste		✓
Food packaging		✓
Natural fiber textiles	✓	✓
Plastic and Styrofoam except plastic containing chlorine[5]		✓
Painted wood except wood painted with lead or PCB-amended paint		✓
Wood treated with creosote or tar oil		✓
Hydrocarbon spill absorbents		✓
Animal carcasses except those affected by disease-causing agents		✓

The following waste requires special consideration. It is not to be burned or incinerated unless the equipment used has sufficient air pollution controls, meets specific air emission standards and has been specifically designed to safely incinerate the waste product.

Hydrocarbon contaminated soil
Radioactive waste including smoke detectors
Organic compounds containing chlorine including plastics, solvents, PVC piping and marine driftwood
Pesticides
Items containing mercury, lead or other heavy metals including paint, computer equipment and fluorescent bulbs
Batteries
Explosives
Pressurized cans, cylinders or other containers that may explode when heated
Synthetic fiber textiles
Biomedical waste and animal carcasses affected by disease-causing agents
Wood treated with pentachlorophenol, inorganic preservatives, lead paint or PCB-amended paint
Sewage sludge
Rubber tires
Used lubricating oil
Waste fuel except limited quantities used solely as a starting fuel
Construction and demolition waste including roofing materials, electrical wire and insulation

3.4 Locating the Facility

Distance from sensitive areas (i.e. camp, work site, drinking water supply) and prevailing wind direction are important factors to consider when locating any facility that burns waste. The facility should be kept

[4] Includes open burning on the ground and the use of burn boxes, unmodified burn barrels and modified burn barrels.
[5] Chlorinated plastic materials are identified by the number "3" associated with the mobius loop symbol.

at least 100 metres from any surface water body. Although the objective is to minimize pollutants being released to the air, the site should be selected so that any resulting emissions are adequately dispersed. This includes locating the structure or facility away from areas or features that may trap smoke close to the ground (i.e. located in a valley). Avoid burning waste if people will be living or working within the plume of smoke. The facility should be located on stable and level ground. A gravel, rocky outcrop or other area free of combustible materials and vegetation should be chosen to avoid accidently starting a vegetation or tundra fire.

3.5 Maximizing Combustion Efficiency

More smoke and other pollutants are released into the air during the 'start-up' and 'cool down' phases of the burn cycle than during the 'full burn phase' when high temperatures are maintained. Low temperature smoldering fires should be avoided. Burn only dry feedstock and periodically add additional waste to the fire in order to maintain high burn temperatures until all waste has been destroyed. If waste is to be open burned on the ground, the use of deep or steep-walled 'pits' should be avoided as this will prevent the necessary turbulent mixing of oxygen with the burnable gases.

Desired operating temperature should be achieved as quickly as possible when operating any burning or incineration device. A rapid 'start-up' can be achieved by first loosely loading dry paper, paperboard packing and untreated wood into the bottom of the device. Dry, loosely loaded material will ignite more quickly and burn more evenly than a wet, tightly packed load. Wet waste should only be added after the fire is actively burning. Overfilling the burn chamber will prevent the turbulent mixing of burnable gases and oxygen, and should be avoided.

Modern batch feed incinerators are designed with primary and auxiliary burners to achieve and maintain the necessary high burn temperatures. Additional waste should only be added to these incinerators once the 'cool down' phase has been completed and it is safe to do so.

3.6 Ash Management

The management of bottom ash and other unburned residue is an integral part of sound waste management and the ash will need to be disposed of. Extreme care must be exercised when handling ash because of its physical (i.e. glass, nails) and chemical hazards. Use closed or covered containers when moving or transporting bottom ash from the burning device or incinerator to the approved disposal site. This will minimize physical contact with the ash and the release of fine ash particles to the environment.

Avoid handling bottom ash until it is completely cool. Hot ash and embers can cause painful skin burns and should never be buried or landfilled as they could cause unburned waste in the disposal area to catch fire.

Bottom ash from the open burning of paper, paperboard packing, untreated wood waste and natural fiber textiles is suitable for burial in a designated pit or municipal landfill. Because incinerators can be used to destroy a wide variety of waste and the subsequent ash may contain a wide variety of toxic residues, bottom ash from an incinerator is suitable for burial only where it meets the criteria set out in Table 1 of the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities*. Waste originating from outside a municipality and meeting the criteria may be deposited in municipal landfills only with the consent of the local government. Any bottom ash

not meeting the criteria set out in the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* is considered to be a hazardous waste. This ash is not suitable for landfilling and its management must comply with the *Environmental Guideline for the General Management of Hazardous Waste*.

3.7 Monitoring and Record Keeping

Burn boxes, burn barrels and incinerators should be inspected for signs of damage, corrosion or other physical defects before each burn cycle. Repairs must be completed before the equipment is used again to ensure the health and safety of the operator, nearby people and the environment.

The various open burning methods tend to produce large quantities of smoke. Burning dry waste, high burn temperatures and sufficient air mixing with the burnable gases will reduce, but not eliminate, the amount of smoke and other pollutants that are generated. Large quantities of dark smoke indicate problems and inefficiencies with the combustion process and the generation of pollutants. Keep records of when, how much and what waste was burned, how the waste was loaded into the burning device or incinerator, the amount of smoke and bottom ash generated, how the fire was started and any other information that would help remind the operator of what worked well, and what didn't. These records would also assist the operator, Department of Environment and other regulatory agencies if complaints of nuisance smoke were to be received.

The operation of incinerators should be monitored using on-line instruments capable of continuously measuring the combustion process and stack emissions. The most basic measurement associated with the combustion process is temperature in both the primary and secondary burn chambers. Temperature readings outside of the normal range can warn the operator that the system is not working properly. In-stack monitoring provides the operator with additional information on the combustion process and on pollutants that may be released to the environment. A continuous opacity or particulate monitor should be installed in the incinerator stack to monitor emissions quantity. Additional combustion chamber and in-stack sampling and monitoring may be required depending upon the type and quantity of waste being incinerated. Each process and in-stack monitor should be equipped with visible and audible alarms to warn operators of poor incinerator operation. Refer to section 4.2 for additional information on incinerator monitoring requirements.

Written records should be kept by incinerator operators of what waste is burned, when and how much. Other record keeping requirements for incinerators may include:

- Operating data including readings from the process and emissions monitoring instruments.
- Weather conditions (i.e. air temperature and wind speed) at the time the incinerator is being operated.
- Repairs and maintenance performed on the incinerator and monitoring instruments.
- Major changes in operation.
- Quantity, condition and disposal location of the collected bottom ash.
- Operator training.

Records should be maintained on-site throughout the operational life of the facility and be made available to Inspectors and other regulatory officials upon request.

3.8 Operator Training

The cornerstone of ensuring proper and safe operation of any equipment is adequate operator training. Facility owners must ensure qualified operators are available and have been properly trained to operate the equipment under both normal and emergency conditions. This will help to ensure the continued operation and maintenance of the equipment and facility, protection of the environment and the continued health and safety of the operator and nearby people. In particular, operators of incinerators should be trained in the following areas:

- Physical and mechanical features of the equipment and facility.
- Operation and trouble-shooting procedures.
- Environmental and safety concerns related to operation of the facility.
- Spill and fire emergency response procedures.
- Emergency and accident reporting procedures including use of the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130.

Every incinerator manufacturer has its own approach to designing and building incinerators. Operators should be qualified and trained to safely operate the specific make and model of incinerator they are expected to operate.

The Application of Open Burning and Incineration

The Department of Environment does not promote or endorse the burning and incineration of solid waste. This method of waste management should be implemented only after the owner or operator has made all reasonable and determined efforts to implement sound waste management planning and practices. Opportunities to reduce or eliminate the need for burning and incineration through changes in purchasing practices, reuse, recycling, segregation and diversion, and other changes or emission control upgrades that would result in emission reductions, must be reviewed periodically and implemented where practical. Refer to section 3 for additional information on best management practices.

This section provides guidance on the application of open burning and incineration of solid waste. In addition to the guidance and direction provided through the Guideline, the burning and incineration of solid waste may also be controlled through permits and licenses issued by Nunavut's co-management boards, Aboriginal Affairs and Northern Development Canada and other regulatory agencies. These permits and licenses must be complied with at all times.

4.1 Open Burning

Open burning is the burning of solid waste where limited or no control over the combustion process can be exercised by the operator. For the purposes of the Guideline, open burning includes burning waste that has been piled on the surface of the ground or placed in small open pits, or the use of a burn box, unmodified burn barrel or modified burn barrel. Open burning does not include the destruction of waste using a commercial or manufactured incinerator.

The open burning of unsegregated, or mixed, solid waste must not occur under any circumstances. Today's household, institutional, commercial and industrial garbage contains many materials which, when burned at low temperature, can result in the release of high levels of particulates, acid gases, heavy metals, carbon monoxide, dioxins, furans and other chemicals, some of which may cause cancer. The only solid wastes that may be disposed of through open burning are paper products, paperboard packing, untreated wood waste and natural fiber textiles (i.e. cotton, wool). Refer to section 3.2 for further information on what waste can and cannot be burned.

The open burning of solid waste remains a hazardous practice from a fire prevention and environmental management perspective. **Open burning on the ground** should not take place within a municipality without first obtaining authority to do so from the local community government. It should never occur at a municipal or industrial landfill because of the proximity of other combustible wastes within the working landfill. Where permission has been obtained and paper, paperboard packing, untreated wood waste and natural fiber textiles are open burned on the ground or in a small open pit, the activity must be attended and carefully monitored by a responsible adult at all times.

The preferred alternative to open burning on the ground is the use of an **enclosed burn box or burn cage**. These devices should be used when burning a moderate to large quantity of paper, paperboard packing, untreated wood waste and natural fiber textiles. They are designed to contain the waste while it is burning and reduce the likelihood of sparks or burning embers igniting adjacent vegetation and other combustible materials. When using a burn box or cage at a municipal or industrial landfill, extreme caution must be taken to ensure other areas of the working landfill are not ignited. Their

proper operation includes loading the device with dry waste to about half its capacity before igniting the fire. Additional or wet waste can be added in small batches so as not to dampen the fire once the fire has developed into a good flame and it is safe to do so.

The following general conditions should be met whenever open burning on the ground or burning using an enclosed burn box or burn cage takes place:

- Only paper, paperboard packing, untreated wood waste and natural fiber textiles are burned.
- The waste is burned in a controlled manner and at a site which is separate from combustible vegetation and other materials.
- Burning takes place only on days when winds are light and blowing away from people.
- Waste is burned in manageable volumes so the fire does not get out of control.
- The fire is started, attended and monitored at all times by authorized and qualified personnel.
- The waste is kept dry or covered to the extent practicable prior to burning.
- Where applicable, authority is first obtained from the municipality or other regulatory agencies.

Modified or unmodified burn barrels should only be used to burn small quantities of paper, paperboard packing, untreated wood waste and natural fiber textiles at remote locations such as traditional camps and field camps. Food and food packaging waste, which make up a significant portion of kitchen garbage produced at these camps, should not be burned. These wastes should be segregated daily and stored in wildlife-proof containers for frequent removal to an approved disposal site.

It is important that burn barrels are properly constructed and operated to ensure safety of the operator and the environment. Appendix 2 provides detailed construction drawings for a modified burn barrel. The Department of Environment will consider other designs if they provide an equivalent level of environmental protection.

Below are some easy-to-do actions to ensure unmodified and modified burn barrels are operated safely and waste is burned to the greatest extent possible[6].

When locating and constructing a burn barrel:

- Locate the burn barrel in a place predominantly downwind of the camp site or burn only on days when the wind is light and blowing away from the camp.
- Ensure the burn barrel is located on gravel, rocky outcrop or other area free of combustible materials and vegetation to avoid accidently starting a tundra fire.
- Ensure the detailed plans provided in Appendix 2 are carefully followed when constructing a modified burn barrel. The 'exhaust gas to combustion air' ratio is particularly important to achieving the maximum burn rate. A 2:1 ratio of exhaust stack to air intake area consisting of a 6-inch exhaust port and three 2-inch air intake holes positioned equidistantly around the bottom of the barrel a few inches up from the base is preferred.

[6] Testing of a modified burn barrel was performed by Environment Canada's Air Quality Research Division in April 2011 at the request of Nunavut's Department of Environment. Ten trial burns were completed prior to emissions testing in order to optimize and standardize barrel design and operational procedures. Following the trial burns, four test runs were performed and air emission samples collected for analysis. Results of the emission testing program will be available from Nunavut's Department of Environment. This list of recommended practices reflects the operational observations and measurements made during the testing program.

When operating a burn barrel:

- Inspect the barrel for any signs of leakage, corrosion or other physical defects before each burn cycle. Any necessary repairs must be completed before the equipment is used.
- Burn only dry waste. If wet waste must be burned, mix or batch the waste with other waste that has a low moisture content and high heating value (i.e. dry wood). This will help ensure the slow-burning wet waste is completely burned.
- Burn only paper, paperboard packing, untreated wood waste and natural fiber textiles. Food and food packaging waste should not be burned. Burning non-combustible waste (i.e. metal and glass) will rob the fire of valuable heat and should also be avoided. Food and food packaging, non-combustible and other waste that cannot be burned should be segregated and removed from the site for disposal on a regular basis.
- Do not overfill or densely pack waste into the burn barrel as air will be prevented from properly mixing with the waste. This will result in a smouldering, low temperature burn and smoke.
- Layering wet or slow burning waste with dry fast burning waste will help ensure more complete combustion of all waste.
- The burn barrel should not be used unless a responsible adult is available to monitor and watch over it until the fire has completely cooled.
- When using a modified burn barrel, the exhaust port on the 'metal basket insert' should be aligned between two of the 2-inch air intake holes in order to avoid short-circuiting of the combustion air directly through to the stack. Also, the spark arrest screen should be cleaned following each burn to ensure the stack does not become blocked with soot and other debris. If the barrel lid begins to 'puff' during a burn, inspect the screen to ensure it is not obstructing the flow of exhaust gases.

Care must be taken by the operator at all times to avoid skin contact with hot surfaces and avoid breathing smoke and other exhaust gases.

Written records of open burning should be kept by the operator. These record what was burned, when and how much, how waste was loaded into the device, how the fire was started, its location, weather conditions at the time and any other information that may help remind the operator of what worked well, and what didn't. These records are to be made available for review upon request by an Inspector.

Bottom ash from the open burning of paper, paperboard packing, untreated wood waste and natural fiber textiles is suitable for burial in a designated pit or municipal landfill site. Consent to use a municipal landfill should first be obtained from the local government. Bottom ash must be completely cooled before it can be safely handled and disposed of. Refer to section 3.6 for further information.

4.2 Incineration

Incinerators differ from the simpler methods of open burning as the operator has a higher degree of control over the burning process. The resulting higher temperatures, longer holding times and greater turbulence lead to more complete combustion of the waste. Although a wider range of wastes can be destroyed using high temperature single or dual-chambered incinerators, determined efforts should still be taken to reduce the quantity and type of waste generated and to implement other changes which would result in reductions in air emissions. Refer to section 3 for further information proper waste management practices and a listing of what waste can and cannot be incinerated.

The incinerator manufacturer's operating instructions must be followed at all times to ensure designed temperature, holding time and turbulence conditions are achieved and to avoid damage to the facility. When operating during winter months, additional care must be taken because cold air introduced into the primary and secondary chambers may make it difficult for normal operating temperatures to be achieved. Operators must be properly trained and qualified to operate the equipment under both normal and emergency conditions. Owners are strongly encouraged to consult system manufacturers or other qualified persons with expertise before purchasing an incinerator. Additional guidance on the selection of incinerator technologies and their operational requirements can be obtained by referring to Environment Canada's *Technical Document for Batch Waste Incineration*.

The installation and operation of monitoring and control systems is critical for the proper and safe operation of any incinerator. The design, installation, certification and operation of continuous emissions monitoring systems (CEMS) should comply with the principles described in Environment Canada's *Protocols and Performance Specifications for Continuous Monitoring of Gaseous Emissions from Thermal Power Generation*. While the document is written for power generation facilities, the principles apply equally well to other types of facilities and continuous emissions monitoring systems. For incinerators operating in Nunavut, key operational parameters must be monitored at all times using on-line instruments capable of continuously measuring the combustion process and stack emissions quality. These instruments should be equipped with visible and audible alarms and be on-line whenever the incinerator is in operation, including 'start-up' and 'cool down' phases. Table 3 lists the monitoring and control system requirements.

Table 3. Incinerator Monitoring and Control System Requirements

System Description	Quantity of Waste to be Burned[7]	
	Less than 26 Tonnes per Year	Greater than 26 Tonnes per Year
Weight and composition of feedstock waste on a batch basis	✓	✓
Temperature in the primary and secondary combustion chambers	✓	✓
Opacity in the stack[8]	✓	✓
Initial Certificate of Operation[9]		✓

While not a specific requirement of the Guideline, additional one-time or continuous emissions monitoring may be required depending upon the type and quantity of waste to be incinerated. Examples include monitoring oxygen and carbon monoxide in the undiluted gases exiting the combustion chamber, such as a secondary chamber of a conventional dual-stage incinerator. Annual or periodic stack sampling for hydrogen chloride, dioxins and furans may also be required where the feedstock includes a significant quantity of organic materials that contain chlorine (i.e. chlorinated solvents and plastics, PVC piping, marine driftwood). The reader is encouraged to contact Nunavut's Department of Environment for guidance on additional emissions monitoring requirements.

[7] The CCME Canada-Wide Standard for Dioxins and Furans Emissions from Waste Incinerators and Coastal Pulp and Paper Boilers (2001) established a criterion of 26 tonnes per year to distinguish between a 'small facility' and 'large facility' incinerator.
[8] An acceptable alternative to monitoring opacity is to continuously monitor particulate matter in the stack.
[9] An initial Certificate of Operation includes satisfactory confirmation based on manufacturers' or third-party testing and certification that the unit is capable of complying with the requirements contained in the Guideline when operated in accordance with the manufacturer's recommendations and with minimal requirement for operator attention. The Certificate is to be provided to the Nunavut Department of Environment before the incinerator is placed into routine operational service.

Monitoring and control data should be recorded each time a burn cycle is completed. Records are to be maintained for the operational life of the incinerator and made available for review upon request by an Inspector. Refer to section 3.7 for additional information on monitoring and record keeping.

Bottom ash and other solid residue collected from the incinerator is suitable for burial where it meets the criteria set out in Table 1 of the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* or in accordance with land use permits and water licenses issued by Nunavut's co-management boards and Aboriginal Affairs and Northern Development Canada. Where bottom ash meets the criteria and is to be disposed of into a municipal landfill, the quantity transported off-site must be recorded and the consent of the local municipal government first be obtained. Bottom ash not meeting the criteria set out in the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* is considered to be a hazardous waste and must be managed in accordance with the *Environmental Guideline for the General Management of Hazardous Waste*.

Conclusion

This is a general introduction to the practice of burning and incinerating solid waste. It is not intended to promote or endorse the practice but to provide the reader with information on the risks, hazards and best management practices associated with this activity. It also provides specific guidance on the application of burning and incinerating solid waste should this practice be undertaken by municipalities and operators of traditional, field and commercial camps.

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

For additional information on the management of solid waste, or to obtain a complete listing of available guidelines, contact the Department of Environment at:

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

Phone: (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.

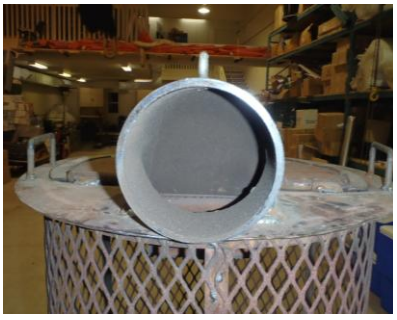
(2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the 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 – MODIFIED BURN BARREL DESIGN AND SPECIFICATIONS

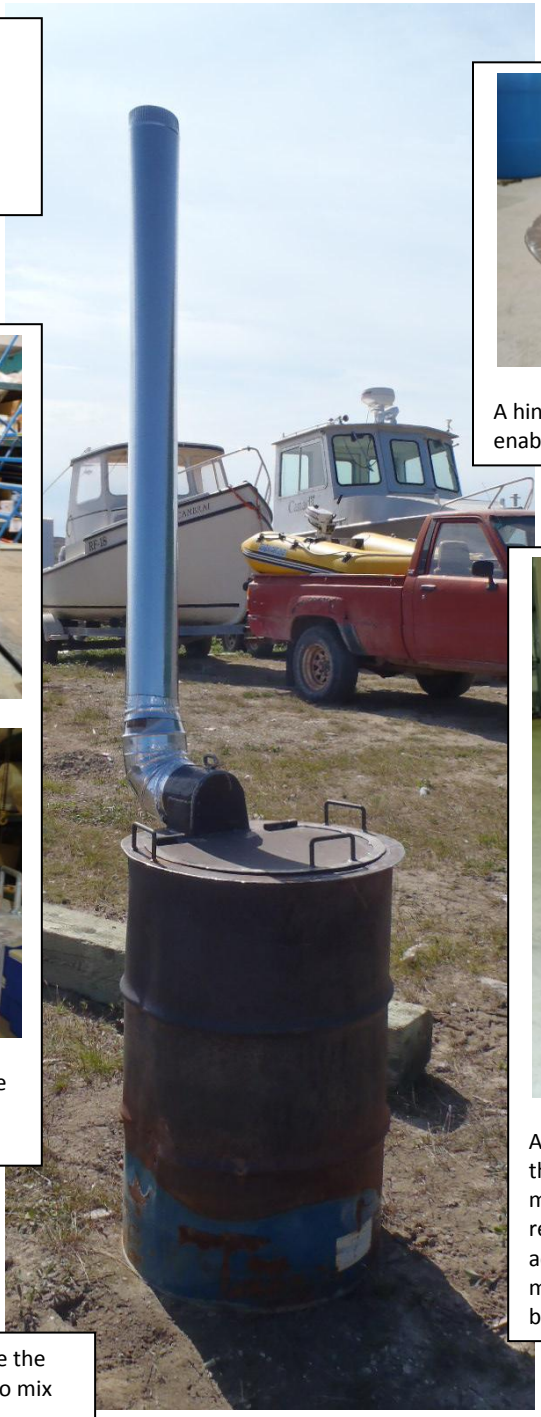
A modified burn barrel is typically constructed from a 45 gallon metal fuel or oil drum. The modifications result in greater heat generation and retention, better mixing of the waste with incoming air and longer holding time inside the barrel. Together, these modifications result in more complete combustion of the solid waste than does open burning on the ground or in a pit.

Placing a metal screen over the top of the exhaust pipe may be required to prevent sparks and hot ash from escaping. Care should be taken to ensure the screen does not become blocked with soot.

A hinged top helps to capture heat and enables easy loading and mixing of waste.

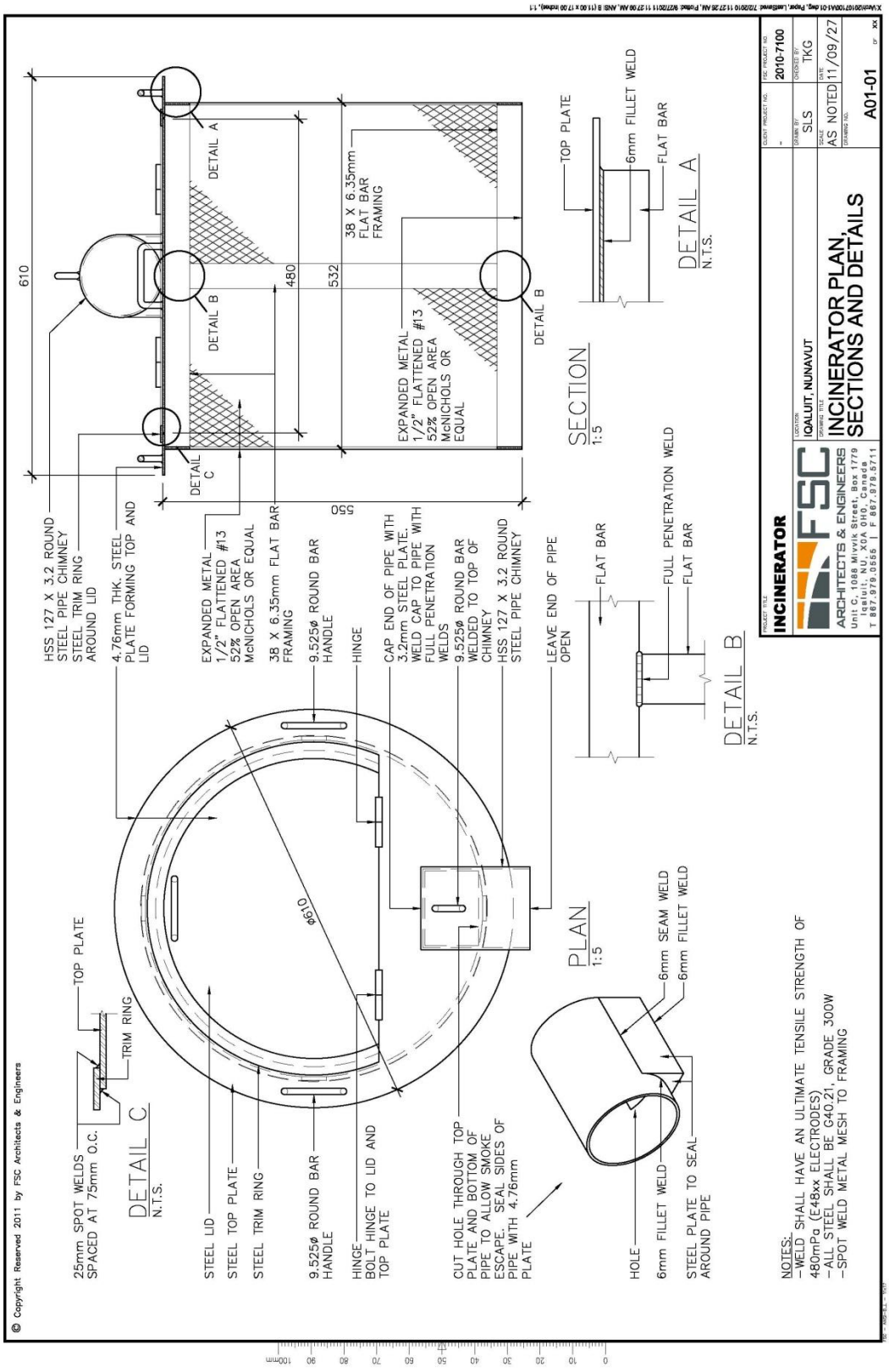


A stove pipe attached to the top of the barrel allows smoke to escape and creates an effective draft.



A metal basket or grate suspends the burning waste and enables mixing with the incoming air. The removable basket also enables access to any unburned ash that may collect in the bottom of the barrel.

Evenly spaced vents or holes cut above the bottom of the barrel enable fresh air to mix with waste inside the metal basket.


INCINERATOR PLAN, SECTIONS AND DETAILS
A01-01
IQALUIT, NUNAVUT
AS NOTED
11/09/27
2010-7100
SLS
TKG
FSC ARCHITECTS & ENGINEERS
Unit C, 1088 Mivvik Street, Box 1779
Iqaluit, NU, X0A 0H0, Canada
T 867.979.0566 | F 867.979.5711
INCINERATOR
610
480
532
550
DETAIL A
DETAIL B
DETAIL C
38 X 6.35mm FLAT BAR FRAMING
EXPANDED METAL 1/2" FLATTENED #13 52% OPEN AREA McNICHOLS OR EQUAL
HSS 127 X 3.2 ROUND STEEL PIPE CHIMNEY
STEEL TRIM RING AROUND LID
4.76mm THK. STEEL PLATE FORMING TOP AND LID
9.525ø ROUND BAR HANDLE
HINGE
CAP END OF PIPE WITH 3.2mm STEEL PLATE. WELD CAP TO PIPE WITH FULL PENETRATION WELDS
9.525ø ROUND BAR WELDED TO TOP OF CHIMNEY
LEAVE END OF PIPE OPEN
SECTION
1:5
TOP PLATE
6mm FILLET WELD
FLAT BAR
FULL PENETRATION WELD
DETAIL A
N.T.S.
DETAIL B
N.T.S.
ø610
PLAN
1:5
6mm SEAM WELD
6mm FILLET WELD
HOLE
6mm FILLET WELD
STEEL PLATE TO SEAL AROUND PIPE
25mm SPOT WELDS SPACED AT 75mm O.C.
TOP PLATE
TRIM RING
DETAIL C
N.T.S.
STEEL LID
STEEL TOP PLATE
STEEL TRIM RING
9.525ø ROUND BAR HANDLE
HINGE
BOLT HINGE TO LID AND TOP PLATE
CUT HOLE THROUGH TOP PLATE AND BOTTOM OF PIPE TO ALLOW SMOKE ESCAPE. SEAL SIDES OF PIPE WITH 4.76mm PLATE
NOTES:
-WELD SHALL HAVE AN ULTIMATE TENSILE STRENGTH OF 480mPa (E48xx ELECTRODES)
-ALL STEEL SHALL BE G40.21, GRADE 300W
-SPOT WELD METAL MESH TO FRAMING
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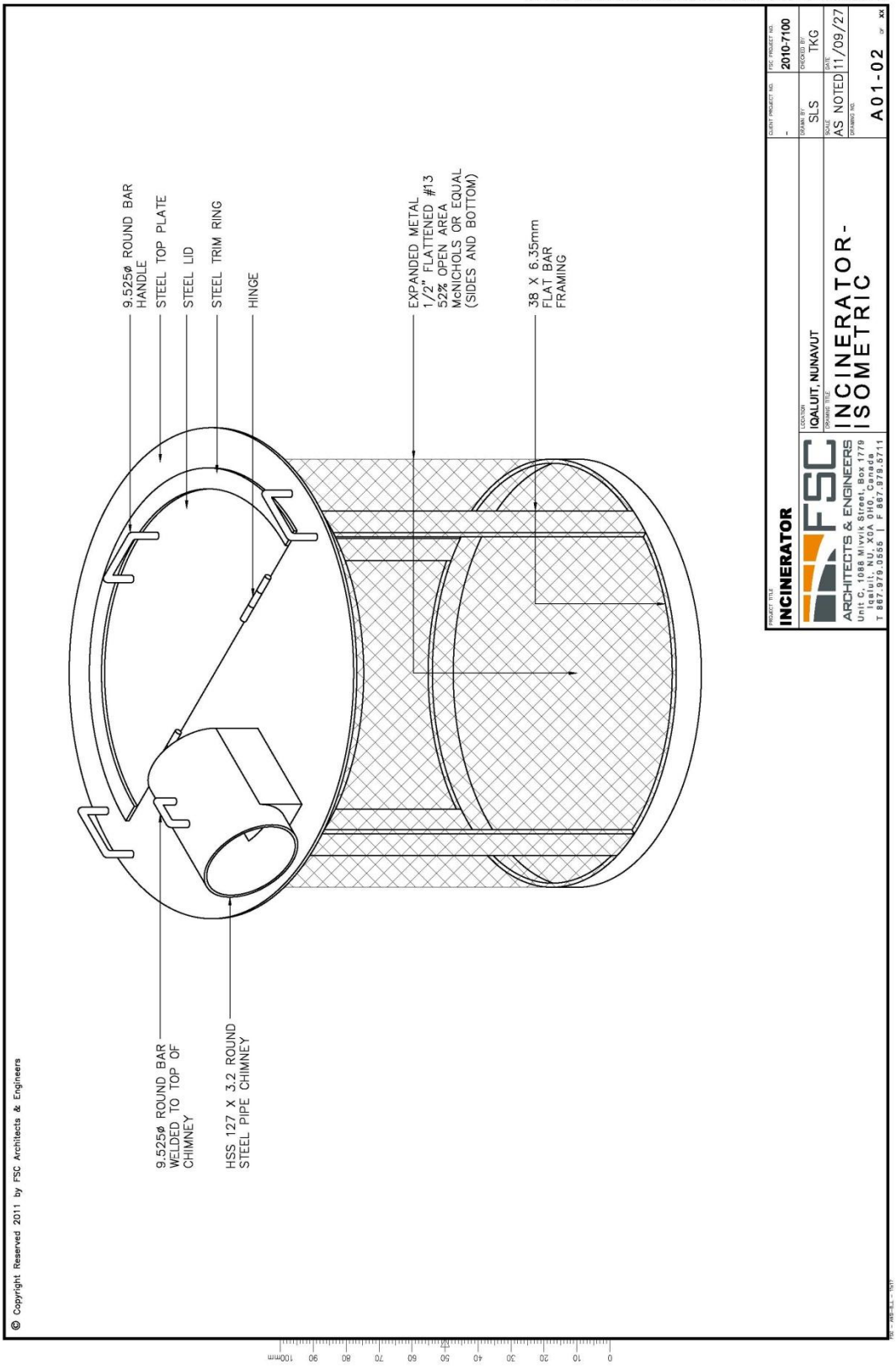
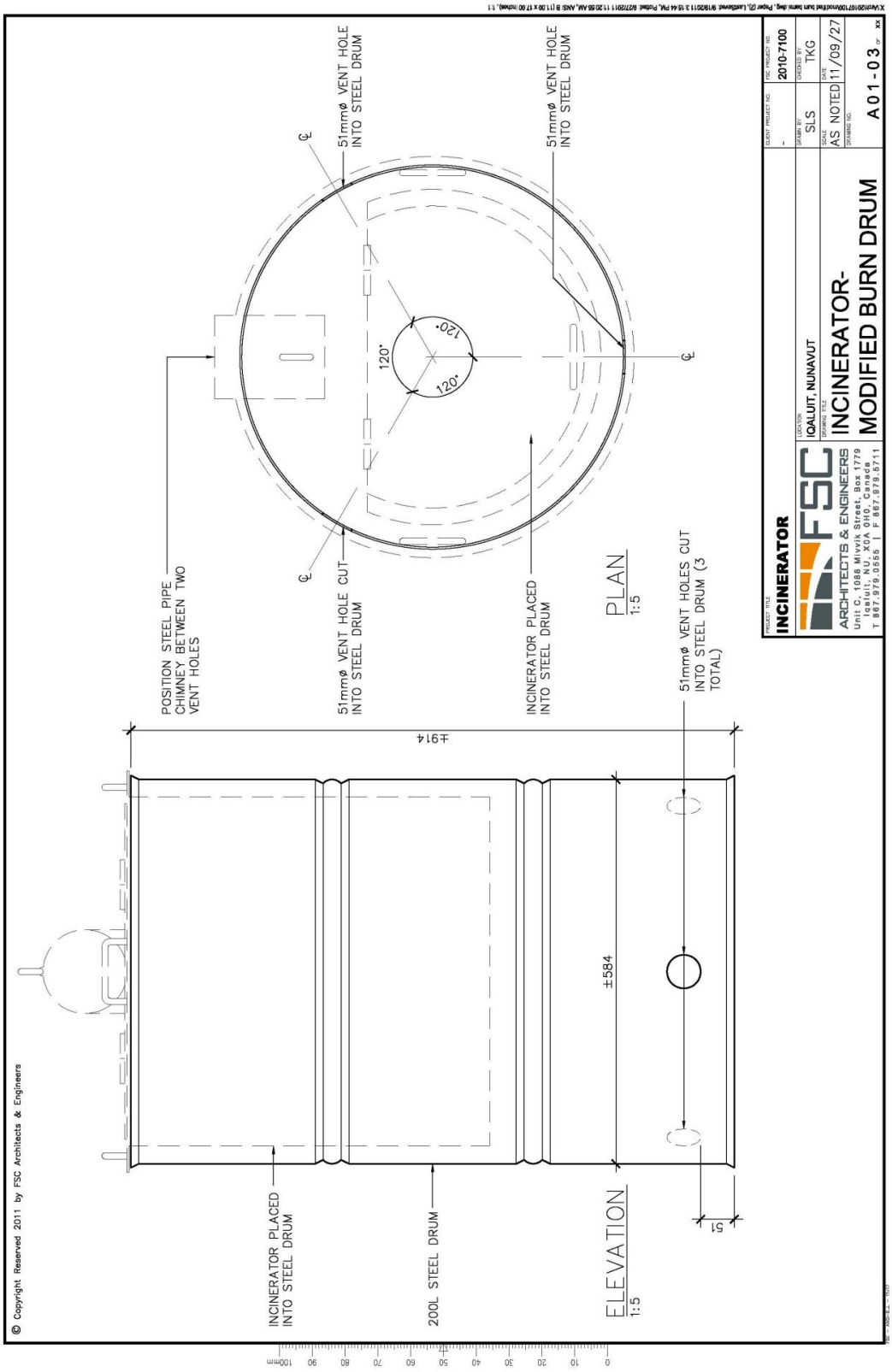

9.525ø ROUND BAR HANDLE
STEEL TOP PLATE
STEEL LID
STEEL TRIM RING
HINGE
EXPANDED METAL 1/2" FLATTENED #13 52% OPEN AREA McNICHOLS OR EQUAL (SIDES AND BOTTOM)
38 X 6.35mm FLAT BAR FRAMING
9.525ø ROUND BAR WELDED TO TOP OF CHIMNEY
HSS 127 X 3.2 ROUND STEEL PIPE CHIMNEY
© Copyright Reserved 2011 by FSC Architects & Engineers
INCINERATOR
IQALUIT, NUNAVUT
INCINERATOR-ISOMETRIC
ARCHITECTS & ENGINEERS
Unit C, 1088 Mivvik Street, Box 1779
Iqaluit, NU X0A 0H0, Canada
T 867.979.0555 | F 867.979.0711
2010-7100
SLS
TKG
AS NOTED
11/09/27
A01-02


INCINERATOR
IQALUIT, NUNAVUT
INCINERATOR-
MODIFIED BURN DRUM
ARCHITECTS & ENGINEERS
2010-7100
SLS
TKG
AS NOTED
11/09/27
A01-03
51mmø VENT HOLE INTO STEEL DRUM
51mmø VENT HOLE INTO STEEL DRUM
POSITION STEEL PIPE CHIMNEY BETWEEN TWO VENT HOLES
51mmø VENT HOLE CUT INTO STEEL DRUM
INCINERATOR PLACED INTO STEEL DRUM
51mmø VENT HOLES CUT INTO STEEL DRUM (3 TOTAL)
120°
120°
120°
PLAN
1:5
±914
±584
INCINERATOR PLACED INTO STEEL DRUM
200L STEEL DRUM
ELEVATION
1:5
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Appendix H
Incinerator Ash Sampling Procedure

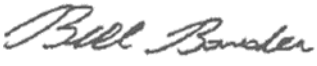
Baffinland Iron Mines Corporation

Incinerator Ash Sampling Procedure

BAF-PH1-830-PRO-0006

Rev 0

Prepared By: Katherine Babin
Department: Environment
Title: Environmental Coordinator
Date: January 24, 2017
Signature: 

Approved By: William Bowden
Department: Environment
Title: Environmental Superintendent
Date: January 24, 2017
Signature: 

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
01/24/17	0	KB 	WB 	Use

TABLE OF CONTENTS

1 PURPOSE AND SCOPE

Baffinland Iron Mines Corporation is committed to taking the necessary steps to ensure that the collection, handling, storage, transportation and disposal of wastes generated during the construction, operation and closure of the Mary River Project is conducted in a safe, efficient and environmentally compliant manner.

The purpose of this procedure is to provide a set of requirements for the safe and consistent sampling of incinerator ash at the Mary River Project. The proper disposal incineration of waste is one of a number of elements of the Mary River Project source segregation and waste management program.

This document is designed to provide a set of operational standards that can be used to track, sample, analyse, and prepare for disposal of incinerator ash in an environmentally responsible and accountable manner. This document is designed for the Environment Department and Site Services, to complement the existing Incinerator Operation Procedure document # BAF-PH1-320-PRO-0002, for Site Services.

2 REQUIRMENTS

2.1 REGULATIONS

Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities. Department of Environment of the Government of Nunavut (2011).

The Environmental Guideline for Industrial Waste Discharges establishes criteria for determining whether process residuals are suitable for disposal in landfill sites in Nunavut. For the purpose of this document, process residuals are ash produced from the ECO M2TN, EWS Mobile Incinerator. The Toxicity Characteristic Leaching Procedure (TCLP), per United States Environmental Protection Agency (USEPA) Test Method 1311, is the preferred method to analyse the residuals.

Water License NO: 2AM–MRY1325 – Amendment No. 1", Nunavut Water Board (2015).

Nunavut Mine Health and Safety Act and Regulations

Commercial Lease No.: Q13C301

2.2 HAZARDS AND ADDITIONAL PPE REQUIREMENTS

2.2.1 HAZARDS

- Inhalation of ash and dust particles
- Skin and eye irritation from ash and dust particles
- Hazardous materials (chemicals, sharp objects, poisonous substances)
- High temperatures of ash

- Encounters with wildlife (Wildlife attractants)

2.2.2 Personal Protective Equipment (PPE)

- Standard PPE as per Baffinland requirements
- Paper face mask or full face respirator (if required)
- Latex / nitrile gloves

2.3 General Safety Instructions

- Use a spade or long stemmed ladle when sampling ash drums to minimize interaction with the ash.
- Position yourself upwind when sampling so that ash and dust when stirred up does not irritate your eyes, skin and lungs.
- Ensure ash has had adequate time to cool before proceeding with sampling

2.4 Required Equipment

2.4.1 Site Services

- Two large bins for ash disposal
- Two Buckets/ Barrels that coincide with ash bins for sample composite

2.4.2 Environment

- Spade or metal ladle for scooping ash
- Two 250 ml soils jars with labels
- New 'sampling in progress' signs
- Metal stake or signpost
- Most recent ash sample ID numbers
- Notebook and Pen

2.5 Training/ or Qualifications Requirements

Any persons who may be engaging in any part of the ash sampling procedure should read and understand this document and any relevant documents such as the Incinerator Operation Procedure document # BAF-PH1-320-PRO-0002 Rev. 1.

3 DEFINITIONS

COC: Chain of Custody

MSC: Mine Site Complex

PSC: Port Site Complex

TCLP: Toxicity Characteristic Leaching Procedure, per United States Environmental Protection Agency (USEPA) Test Method 1311, is the preferred method to analyse process residuals. The procedure analyses the composition of moisture, Mercury (Hg), Silver (Ag), Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Selenium (Se), and Zinc (Zn). This analysis is intended to simulate the processes a material would be subjected to if placed in a landfill.

4 RESPONSIBILITIES

Incinerator ash from the MSC and PSC incinerators should be sampled and disposed of in compliance with the Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (2011).

The following roles and responsibilities shall be assigned to sample ash in a proper and safe manner. Site Services Superintendents/Supervisors and Environmental Superintendents/ Coordinators are responsible for ensuring that all personnel are fully trained and competent to meet the expectations of this procedure.

4.1 SITE SERVICES SUPERVISOR

The Site Services Supervisor is responsible for:

- Read, Understand and follow this procedure.
- Supervising the incinerator operator in the safe execution of this procedure.
- Ensuring that Incinerator Operators are knowledgeable in the operation of the Incinerator (Refer to # BAF-PH1-320-PRO-0002 Rev. 1.) in order to ensure a representative ash composite can be sampled.
- Understanding the commitments made by Baffinland Iron Mines to regulatory bodies, with regards to incinerator operation, monitoring and recording requirements.
- Communicating with environment staff as to when the ash bin is reaching capacity and needs to be sampled.

4.2 INCINERATOR OPERATOR

The Incinerator operator, under the supervision of the Site Services Supervisor, is responsible for:

- Understanding and following this Procedure.
- Ensuring that no hazardous waste is loaded into the incinerator.
- Ensure that all steps outlined in section 5.1 are followed to ensure the ash sampling process runs smoothly and there are no delays due to the need for resampling.

4.3 Environment Department

4.3.1 Environmental Coordinator

Under the supervision of the Environmental Superintendent, the Environmental Coordinator at the MSC or PSC will ensure that this procedure for sampling ash is implemented correctly by Environmental staff. The Environmental Coordinator will monitor and audit this procedure periodically or perform the Environmental procedures (5.2) as required.

4.3.2 Environmental Staff

Under the supervision of the Environmental Coordinator at the MSC or PSC, environmental staff will be responsible for adhering to and following this procedure properly to track, sample and analyse, and prepare disposal of incinerator ash. Specifically, environmental staff will:

- Read, fully understand and adhere to this procedure.
- Wear proper PPE when performing sampling procedures.
- Refer to section 5.2 Ash Sampling Procedure for step by step instructions.

5 PROTOCOL

The following protocols should be followed to ensure safe and uniform labelling, sampling, logging and disposal of all incinerator generated ash.

5.1 Site Services Incinerator Operator Procedure

The following steps are available as a stand-alone checklist in Appendix 1. The Incinerator operator, under the supervision of the Site Services Supervisor, is responsible for following the steps:

1. When each burn is complete, one shovel full of ash shall be put into the barrel/bucket that matches the ash bin that is currently being filled (Bin 1 with barrel 1, Bin 2 with barrel 2). The rest of the ash shall be placed in the bin.
2. Only one bin shall be filled at a time with ash.
3. When one bin is full, site services personnel will communicate with their supervisor so that the environment department can be notified.
4. Once the Environment department has sampled a bin, a sign will be erected directing personnel to stop filling the bin with ash. No more ash is to be placed in this bin.
5. Move full ash bin out of the way to avoid confusion. Ash should remain indoors (except if cooling down)
6. While one bin is being sampled, operators can begin filling the other bin using the same procedure. Ensure that the correct sample barrel is being used.
7. Do not dump any ash in the landfill until written direction has been given by the environment department.

5.2 Environment Department Required Documents and Procedures

5.2.1 Incinerator Operation Data Download

A designated computer will be maintained with the required software to download the incinerator operation data on a periodic basis or as internal incinerator data storage requirements dictate. This downloaded data should be uploaded onto the File Server.

5.2.2 Ash tracking Log

The ash tracking log is located on the environment server and should be updated after every sampling session. The ash tracking log is designed to prevent incorrect data entry and flag sample guideline exceedances for TCLP analysis.

- Upon sampling the user will input Bin ID, sample date, barrel contents, and degree of combustion.
- After sample analysis the user will input analysis date, analyte composition values, Lab Report ID, Lab COC Number, and Lab Sample ID.
- After site services has been notified the date of disposal will be added to the ash sampling log. Environment staff should visually confirm that this has been done before entering this into the log.

5.2.3 Labelling

All samples will be labelled with a predetermined 8 digit ID composed of sample location, substance, and numerical indicator. Refer to the ash sampling log for most recent sample ID. The sampling date, time and names of samplers should also be recorded.

Sample ID example: MS-ASH-001, MP-ASH-001

The sampling date, bin number and ash ID should all be included on the “sampling in progress” sign to avoid confusion and streamline ash disposal procedures.

5.2.4 Ash Sampling Procedure

When the ash bin is full, site services supervisor will contact the environment department to sample the full ash bin. The following steps are required

1. Required PPE should be worn during sampling (2.2.2)
2. Required sampling equipment should be located (2.4.2)
3. Before sampling, check the incinerator ash log for current ID number
4. A visual inspection should be conducted for ash barrel hazards, contents and degree of combustion (5.4.1)
5. Fill in a new “Sampling In Progress Sign” with correct information and place sign INSIDE of ash bin.
6. Sample ash from barrel/bucket that coincides with full ash bin.
7. A long stemmed ladle or spade should be used to stir up the composite bucket and obtain 500 ml of representative ash.

8. Two 250mL wide mouthed glass sample jar should be labeled and filled in entirety.
9. Moisture and non-combusted bulky waste in the sample should be avoided when possible.
10. Update the ash tracking log with all required information so cross shifts can follow up.
11. Fill out and send all required documentation including COC, shipping request and assist ALS lab if needed. Samples should be sent off for TCLP analysis the week of sampling, if possible
12. Ensure site services supervisor is notified when results are received. Ensure there is clear written communication given on whether the ash can be taken to the landfill. Follow up with site services to ensure ash is disposed of, including ash from the composite sample drum.

5.2.5 Visual Inspection

All ash generated will be visually inspected for freshly deposited unacceptable waste contents and degree of combustion prior to sampling. All unacceptable materials should be documented in a notebook and added to the ash tracking log and removed from the bin and disposed of correctly. Site Services should be notified. Possible unacceptable materials include:

- Incompletely burned food waste
- Aerosol Cans
- Batteries
- All other unacceptable incinerator waste

The degree of combustion should be documented. Whitish, grey, fall apart ash indicates complete combustion. Ash that is dark and/or wet, characterised by distinct structures indicates incomplete combustion. The presence of noticeable cardboard, plastic and rubber all indicate incomplete combustion.

5.3 Documentation and Dissemination

After TCLP sample results are received from the lab, the ash tracking log should be updated. The Environmental Coordinator should be notified, who will inform Site Services how to dispose of the sampled bin. It is important to follow up that disposal has been completed, and all sampling in progress signs removed so that a new sampling cycle can commence with no confusion.

6 REFERENCES AND RECORDS

Baffinland, (2014). EPP: BAF-PH1-830-P16-0008 Rev 1 Environmental Protection Plan. Baffinland Iron Mines: Revised August 30, 2016

Baffinland, (2014). Waste Management Plan. Baffinland Iron Mines: # BAF-PH1-830-P16-0028 Rev 4 March 7, 2016. EBA, (2013).

Incinerator Ash Drum Sampling Report. EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company: March 27, 2013

Baffinland, (2014). Baffinland Incinerator Operation Procedure. Baffinland Iron Mines: # BAF-PH1-320-PRO-0002 Rev 1 March 10, 2016.

Water License No: 2AM–MRY1325 – Amendment No. 1", Nunavut Water Board (2015).

Appendix A

Incinerator Operator Checklist

INCINERATOR OPERATOR CHECKLIST

When each burn cycle is complete, the Site Services Incinerator Operator should complete the following steps to ensure that ash can be sampled successfully.

- ☐ When each burn is complete, one scoop full of ash shall be put into the barrel/bucket that matches the ash bin that is being filled **(Bin 1 with barrel 1, Bin 2 with barrel 2).** The rest of the ash shall be placed in the bin.

- ☐ Only one bin shall be filled at a time with ash.

- ☐ When one bin is full, site services personnel will tell their supervisor so that the environment department can be notified.

- ☐ Once the Environment department has sampled a bin, a sign will be put up directing personnel to stop filling the bin with ash. No more ash is to be placed in this bin.

- ☐ Move full ash bin out of the way to avoid confusion. Ash should remain indoors (except if cooling down).

- ☐ While one bin is being sampled by environment, operators can begin filling the other bin using the same procedure. Ensure that the correct sample barrel is being used.

- ☐ Do not dump any ash in the landfill until written direction has been given by the environment department.

Appendix I
On Site Tire Disposal Procedure

Baffinland Iron Mines Corporation

On Site Current Tire Disposal Procedure

BAF-PH1-300-PRO-0020

Rev 0

Prepared By: Katherine Babin
Department: Environment
Title: Environmental Coordinator
Date: March 20, 2017
Signature:

Approved By: William Bowden
Department: Environment
Title: Environmental Superintendent
Date: March 20, 2017
Signature:

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
03/20/17	0	KB	WB	Use

TABLE OF CONTENTS

1 PURPOSE AND SCOPE

Baffinland Iron Mines Corporation is committed to taking the necessary steps to ensure that the collection, handling, storage, transportation and disposal of wastes generated during the construction, operation and closure of the Mary River Project is conducted in a safe, efficient and environmentally compliant manner.

The purpose of this procedure is to provide a set of guidelines for the safe disposal of newly generated scrap tires in an environmentally-acceptable manner at the Mary River Project. Used tires are a significant waste stream in mining operations. Project used tires are to be either stockpiled in seacans or designated areas for shipment off-site or re-used for various applications. Tire re-use on site will be evaluated on a case by case basis to ensure it is done in an environmentally friendly and safe manner.

This procedure deals specifically with all newly generated scrap tires from this point onwards. Historic tire piles are a separate issue and options to deal with them are currently being investigated.

2 REQUIREMENTS

2.1 HAZARDS AND PPE REQUIREMENTS

2.1.1 HAZARDS

There are numerous hazards associated with the tire management. They include:

- Fire
- Leachate
- Potential fuel spills
- Overloading seacans
- Seacan structural instability
- Injury to personnel due to improper tire handling technique

2.1.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Wear Standard P.P.E. - Safety glasses, hard hat with reflective tape, safety boots, reflective vest, clothing in good condition, gloves or mitts in good condition and hearing protection if required.

2.1.3 Safety and Environmental Equipment

- 20lb Fire Extinguisher
- Sea cans of proper structural integrity
- Spill kits
- Radio Communication
- A spotter (second person) if required

2.2 Training and/ or Qualifications

Any persons who may be handling of tires at Baffinland will need to be signed off that they have read and understand this procedure.

General Safety Instructions:

- Follow the steps necessary to safely dispose of tires in seacans.
- Ensure that when stacking tires in seacans, they are stable and in no danger of falling on top of personnel.
- A fire prevention and emergency plan should be posted at designated areas.
- If tires are being stored in blocks (e.g. tires greater than 44") the procedure outlined in section5.3 must be followed.

3 DEFINITIONS

MS: Mine Site

PS: Port Site

Designated area: Area deemed appropriate by Environmental and Surface Works Superintendent to stock pile tires awaiting back haul.

4 RESPONSIBILITIES

The following roles have specific accountabilities that must be met to ensure the Mine Site and Port Site operate in conformance with this procedure. The following roles and responsibilities shall be followed to safely and successfully dispose of tires at the project.

4.1 MS/PS Maintenance Supervisor

The MP/MS Maintenance Supervisors are responsible for ensuring that all relevant employees and contractors are trained and competent to meet the expectations of this policy. Specifically, they are responsible for:

- Implementing this procedure and ensuring that the operators and or tire technicians are knowledgeable and working in a safe manner.
- Overseeing the overall tire disposal activities to ensure that practices are in conformance with the guidelines stated in this procedure.
- Understanding the commitments made by Baffinland Iron Mines to regulatory bodies, with regards to tire disposal.
- Providing Personal Protective Equipment required for a safe working environment and the protection of workers.

4.2 MS/PS Site Services Supervisor

The Site Services Supervisor is responsible for ensuring this procedure is followed by all relevant operators. Specifically, the Site Services Supervisor shall:

- Supervise equipment operators in the safe execution of this procedure.
- Organize seacan movement around the Mine Site and Port Site
- Ensure designated areas are in conformance with guidelines outlined in Section 5.3
- Understanding the commitments made by Baffinland Iron Mines to regulatory bodies, with regards to tire disposal.
- Ensure seacans are removed from Fountain Tire work areas in a timely manner if applicable, and that the full sea cans are replaced immediately with an empty sea can.

4.3 Surface Works Operator

The equipment operator, under the general supervision of the Site Services Supervisor, is responsible for properly transporting and storing seacans that are being used for tire disposal. The operator will inspect seacans to ensure structural integrity and deliver seacans to the designated areas at the Mine Site and Port Site.

4.4 Fountain Tire OTR Tire Technicians

Fountain Tire technicians will place appropriate tires into the seacans in the designated areas for back haul or stack them according to the protocol outlined in Section 5.3. Specifically, they are responsible for:

- Understanding and following this Procedure, including:
  - Orderly stacking or placement of tires for storage.
  - Ensuring proper technique for stacking tires is used. If available, equipment (loader, skid steer) should be used to stack tires.
  - Reporting problems with tire piles to Maintenance and Site Services

- Keeping track of the number of tires in each sea can
- Wearing the proper PPE when working

4.5 Environment Department

The Environment Department is responsible for executing the following tasks:

- Auditing tire management operations to ensure that practices are in conformance with the guidelines as set out in Baffinland's Tire Management SOP.
- Inspecting tire blocks to ensure they are adhering to the protocol outlined in Section 5.2.
- Direction in a case by case basis in options that increase site sustainability practices if used tires can be re-used on site. This includes but is not limited to the re use of tires for ballast along containment berms, barriers and along the tote and mine haul road.

4.6 Health and Safety Department/ Mine Rescue Team

The Health and Safety Department is responsible for developing and implementing a fire safety plan for existing and new tire piles and tire storage areas. This plan is to ensure that emergency situations (e.g. tire fires) can be dealt with if they were to occur.

4.7 Port and Logistics

The Port and Logistics department is responsible for ensuring the seacans containing tires designated for backhaul are inventoried, included on the manifest and are loaded onto the sealift.

5 PROCEDURE

5.1 Tire Disposal in Seacans

Newly generated scrap tires should be sorted by Fountain Tire technicians according to tire diameter. Tires should not be left to accumulate around the Fountain Tire shop, but should be brought to the designated storage area in a timely manner.

Tires measuring 44 inches and less will preferably be stacked inside designated seacans in an orderly fashion. Skid steers and forklifts should be used when available, but stacking tires manually may be required. If seacans are not available, <44" tires will be stacked in the designated area using the procedure highlighted in section 5.3, while still being separated from tires >44".

The following steps shall be followed by all personnel involved in handling and disposing of tires:

- Seacans will be placed by site services in the designated area for tire disposal use.
  - In Milne Port, a seacan will be placed in the Fountain Tire work area, north of the shop.

- At the Mine site, due to lack of space the seacans will be placed at the waste sorting building, north of the Incinerator.

- Once a seacan is full, Fountain Tire Technicians will contact site services supervisor to remove the full seacan and bring a new acceptable empty seacan back. Site services will stock pile waste tire seacans awaiting back haul in the B1 pad in Milne and waste management building laydown at the Mine Site.
- It is estimated that approximately 80 tires will fit in a 20 foot seacan and 160 in a 40 foot seacan but quantities may be less depending on stacking safety constraints.

5.2 Safe Tire Disposal in Seacans

Personnel handling tires for disposal in seacans must do so in a safe manner. Mechanical assistance (forklift, skid steed) or a second person shall be used when needed to load tires in seacans. Tires should be stacked in a neat and orderly way so as to allow the maximum number of tires to fit in a seacan. The number of tires in each seacan must be kept track of and recorded. See photo 2 in Appendix A for visual representation tires stacked in seacans.

5.3 Tire Stockpiles in Designated Areas

Tires greater than 44 inches will be stacked in piles in pre-determined locations. In Milne this is at the old Anmar shop area and at the Mine Site it is in the waste management building laydown. See Appendix B for maps of the areas in Mary River and Milne Port

Tires are to be stockpiled in a designated area in a way to limit the risk of a fire and easy access for back haul during the open water season. The designated area will have minimal drainage to limit the risk of leachate entering any water body. Below is a list of stock pile requirements at each designated area:

- Tires must be stored in blocks with a maximum base area of 1000 m^2 and a maximum height of 3 m.
- The distance between each block must be 6 m with a minimum distance of 15 m between a block and a building.
- Tires must be stored a distance greater than 6 metres from roads and emergency vehicles must be able to approach to a minimum distance of 60 m.

See Appendix B for a map of the designated areas at the Mine Site and Milne Port.

5.4 Re-use of Tires on Site

Investigation on a case by case basis if tires can be re-used on site in an environmentally safe manner will be undertaken. This includes but is not limited to the re use of tires for ballast along

containment berms and for barriers along the tote and mine haul road. The re-use of tires on site is not to be undertaken unless approval has been given by the Environment Department.

5.5 FINAL DISPOSAL OF SITE TIRES

Tires that are backhauled offsite for disposal will be delivered to an accredited tire recycle and disposal facility in southern Canada to be processed or an alternative identified tire disposal or re-use source

6 HISTORIC TIRE PILE

There are several options that are currently being investigated to deal with the existing used tire piles on site:

- There is the potential to acquire a tire shredder for on-site use to effectively reduce the volume of tires needed to be backhauled. If a tire shredder was to be acquired, an update to this procedure would occur. A tire shredder has the potential for a volume reduction of 50%.
- Tires will either be backhauled on the on regularscheduled jets or summer cargo sealifts for final disposal.

7 REFERENCES AND RECORDS

Nunavut Mine Health and Safety Act and Regulations Canadian Standards Association

Baffinland Iron Mines Corporation Mary River Project Waste Management Plan for Construction, Operation and Closure, dated April 19, 2013

Commercial Lease No.: Q13C301

Environment Quality Act– Used Tire Storage. Quebec Government. 2016

BAF-PH1-830-P16-0028 r4 – Baffinland Waste Management Plan

Appendix A

Photo of tires stockpiled in seacans properly

Photo 1 – Tires stacked inside a sea can using a forklift, numbered for easy tracking.

Photo 2 – Fountain tire employee manually stacking tires in a seacan.

Appendix B

Maps of seacan locations for used tire disposal

Figure 1: Location of seacan for tire disposal at the Mine Site (North of the incinerator building)

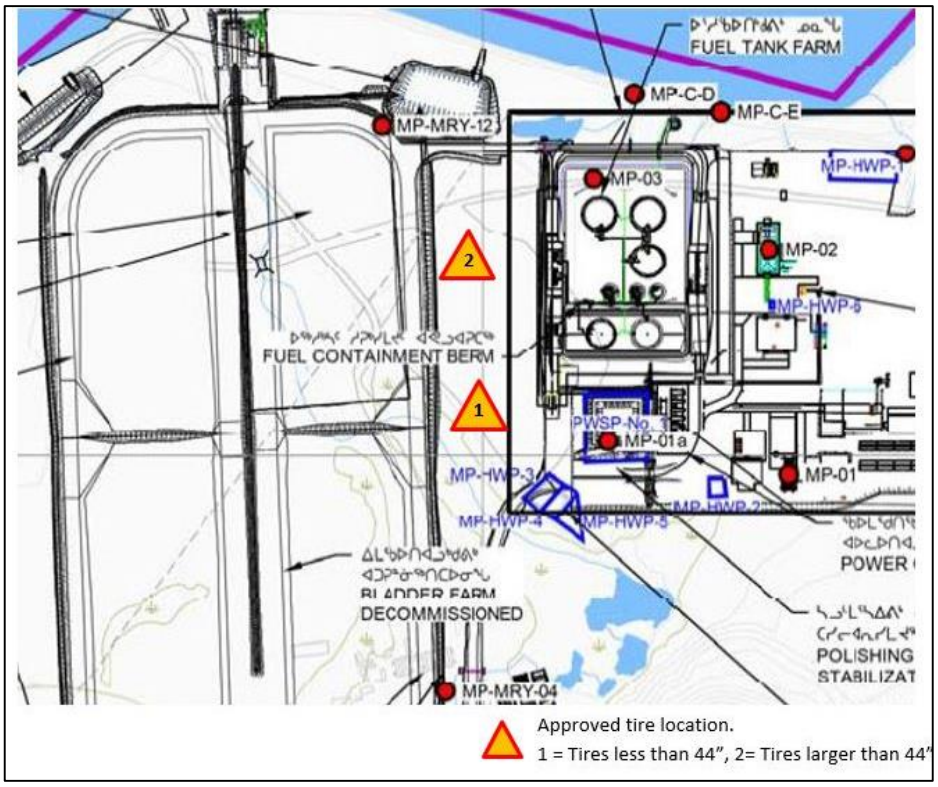


Figure 2: Location of approved tire disposal areas in Milne Port (North of Fountain Tire shop).
Area 1 for sea cans, area 2 for tire piles.

Appendix J
Landfarm OMM Manual

Baffinland Iron Mines Corporation

Landfarm Operation Maintenance and Monitoring Manual

BAF-PH1-320-T07-0005

Rev 0

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

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Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
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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.

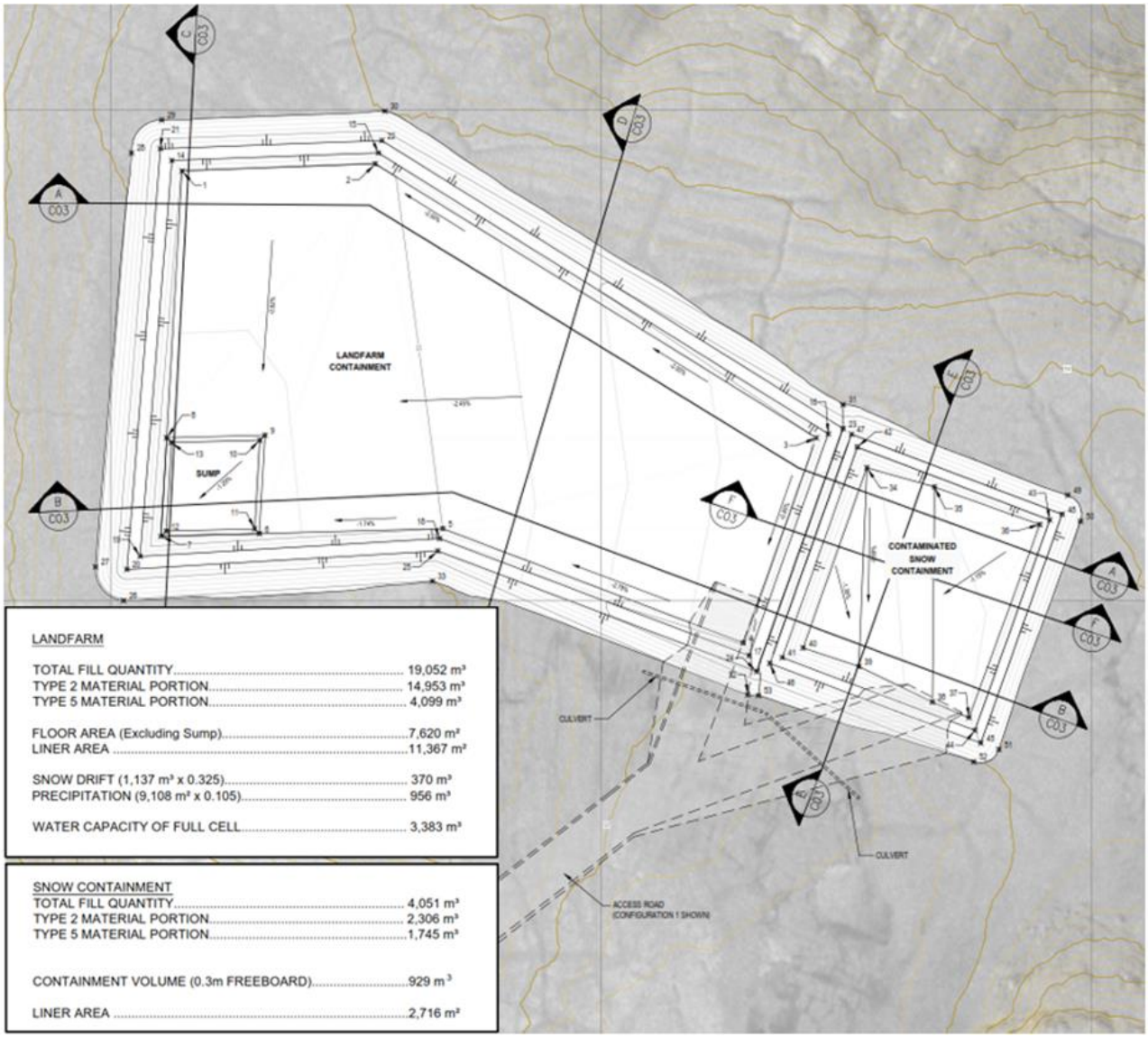

Figure 1 – Landfarm and Contaminated Snow Containment Facility

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.

Appendix K
Landfill OM Manual

Baffinland Iron Mines Corporation

Landfill Maintenance and Operation Manual

BAF-PH1-320-T07-0004

Rev 0

Prepared By: Jim Millard
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Date: March 17, 2015
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Department: Site Services
Title: Site Services - Manager
Date: March 17, 2015
Signature:

DOCUMENT REVISION RECORD

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TABLE OF CONTENTS

1 PURPOSE AND SCOPE

The purpose of this procedure is to ensure that non-hazardous solid wastes are disposed of in compliance with all environmental permits, licences, and authorizations, and in an efficient and safe manner.

This procedure applies to the handling, storage and disposal of all non-hazardous solid industrial waste at the Mine Site Landfill.

This procedure does not apply to hazardous and liquid industrial wastes, hauled sewage or domestic waste. Refer to Baffinland's Waste Sorting Guidelines (BAF-PH1-830-P25-0001) which clearly differentiates landfill waste from non-hazardous putrescible wastes and hazardous wastes.

This manual has been designed to be used both as a field reference document as well as a training manual for classroom and self-instruction purposes. Every employee with accountabilities and responsibilities as required by this procedure is expected to be familiar with its use at the site. This manual contains the basic knowledge regarding personnel responsibilities, safety practices, and the overall operations of the landfill. Appendix C focuses on Landfill Work Instructions and has been formatted to provide supervisors and their employees with a user-friendly method for training and implementation.

2 REQUIREMENTS

2.1 HAZARDS AND ADDITIONAL PPE (PERSONAL PROTECTIVE EQUIPMENT)

2.1.1 HAZARDS

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

- Mobile equipment dangers and spills
- Flying objects (i.e. debris, broken glass)
- Dust and small particles

2.1.2 PPE

- Wear Standard PPE - Safety glasses, hard hat, safety boots and reflective vest.[1]

2.1.3 SAFETY AND ENVIRONMENTAL EQUIPMENT

- Spill kits
- Radio Communication

2.2 TRAINING/ QUALIFICATIONS AND CERTIFICATIONS

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

Any operator who may be working at the landfill 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 Mine Site landfill is operated in compliance with this procedure. The following roles and responsibilities of the various employees who work at the Landfill site are described below.

3.1 SITE SERVICES MANAGER/SUPERINTENDENT

a. The Site Services Manager, or the Site Services Superintendent during the Manager's absence, is accountable for the overall operation of the landfill. Specifically, he/she shall:
b. Organize, oversee and administer the operation of the landfill in accordance with regulatory requirements and applicable procedures.
c. Plan and coordinate the most efficient use of landfill areas to conserve landfill space.
d. Help develop, implement and enforce landfill specific safety regulations.
e. Meet routinely with the Site Services Supervisors to maintain proper control of the site and to determine what, if any, problems exist or may be anticipated. Consider the following:
    i. Operational issues;
    ii. Regulatory Requirements;
    iii. Equipment issues;
    iv. Special operating instructions – e.g. inclement weather, special waste, emergencies.
f. Schedule routine work as required – e.g. drainage channel cleaning, landfill surface repairs and litter control, etc.
g. Ensure that the need for any special operating conditions have been planned for in advance – e.g. identification of features with stakes in advance of winter and the ground freezing.
h. Coordinate a biannual summer earthworks inspection which shall be conducted by a geotechnical engineer.
i. Schedule the quarterly survey requirements for volume calculations.

3.2 SITE SERVICES SUPERVISOR (MINE SITE)

The Site Services Supervisor, under the general supervision of the Site Services Manager/Superintendent, is responsible for supervising waste disposal and associated activities at the Mine Site Landfill in accordance with this procedure. Specifically, the Site Services Supervisor shall:

a. Regularly brief the Site Services Manager/Superintendent on the status of routine operations and any special problems.
b. Implement and enforce the landfill safety regulations and operating procedures.

c. Check grades and contours to ensure that refuse placement and compaction conforms to engineered specifications and designs.
d. Maintain thorough, accurate and detailed records of landfill operations, and other related matters.Respond to incidents and inquiries promptly to ensure the landfill is operated in compliance with this procedure.
e. Instruct all crews on critical landfill procedures and areas of concern and monitor progress.

3.3 Mine Site Landfill Operator/ Labourer

The Landfill Operator/Labourer, under the general supervision of Site Services Supervisor, is responsible for executing the following tasks at the landfill. 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 landfill operations according to this procedure.
c. Maintain a level landfill base at the working face dumping area,
d. Ensure the landfill is maintained free of windblown litter and that litter fences are appropriately placed and in good condition
e. Employees are to report all violations of site user rules (Appendix B) to their supervisors for further action and incident reporting.

3.4 Environment Department Personnel

The Environment Department will conduct weekly inspections of the Mine Site Landfill. In addition to conducting weekly inspections, Environment personnel shall:

a. Support Site Services by providing guidance on what types of solid wastes are permitted at the Mine Site Landfill.
b. Notify the Site Services Superintendent and/or Supervisor when non-compliance conditions are observed so that corrective action will be taken on a timely basis.
c. Ensure that all contractors and Baffinland employees are familiar with Baffinland's waste sorting guidelines.

4 DEFINITIONS

Waste Management System: A waste management system includes all facilities, equipment and operations for the collection, handling, transportation, storage, processing and disposal of waste.

Landfill Site: Controlled site where no hazardous wastes are accepted and only specific wastes as outlined in the Mine Site Landfill approval permit are accepted. At landfill sites, the waste is regularly compacted and covered.

Mine Site Landfill: For the purpose of this document, the Mine Site Landfill has been constructed as a Non-Hazardous Solid Waste Landfill facility.

Non-Hazardous Solid Waste: The wastes generated during the lifespan of the Project that do not present a threat to human health or the environment.

Hazardous Waste: Material that, given its quantity, concentration and composition or its corrosive, inflammable, reactive, toxic, infectious or radioactive characteristics, presents a real or potential danger to human health, safety and public well-being or poses a danger to the environment if it is not stored, treated, transported, eliminated, used or otherwise managed. Hazardous Waste are not permitted to be disposed of in the Landfill.

Domestic Waste: Domestic waste includes waste such as office paper, lunchroom supplies, washroom supplies, food waste and containers contaminated with food. Domestic waste can be considered all bagged and boxed waste originating from offices, kitchens and camps, generally suitable for disposal in the incinerator. Domestic waste are not permitted to be disposed of in the Landfill as these wastes may be an attractant to wildlife.

Empty Container: Clean, empty containers that did not previously contain hazardous material, food or compressed gas.

5 LANDFILL OPERATIONS

The Mine Site non-hazardous solid waste landfill's operation and maintenance are based on the Guidelines for the Planning, Design and Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories (the Guidelines) to ensure both the protection of the environment and the health and safety of individuals. The estimated remaining capacity of the current landfill design is approximately 5,000 m3 of waste and cover material. If additional capacity is required in the future an extension to the current design will be designed and developed.

5.1 CLASSIFICATION OF WASTE

5.1.1 ACCEPTABLE WASTES AT THE LANDFILL

Non-hazardous solid wastes acceptable for disposal at the Mine Site Landfill include the following products:

- Treated wood products[2] – e.g. plywood, painted wood, etc.
- Clean plastics
- Cardboard
- Bulky waste such as heavy equipment, trucks, snowmobiles and appliances. These items will be drained of all fluids (oil, fuel, hydraulic fuel; ozone depleting substances must be removed by a licensed technician) prior to disposal.

[2] Clean untreated wood that can't be reused should be diverted to the designated Burn Area. Please refer to BAF-PH1-300-PRO-0001 Open Burning of Untreated Wood, Cardboard and Paper Products Procedure for clean untreated wood management.

- Concrete
- Glass
- Metal
- Non-toxic incinerator ash
- Empty containers (as defined in this procedure)

5.1.2 Hazardous Material and Other Unacceptable Wastes at the Landfill

Hazardous waste, liquid waste and food waste are NOT accepted at the Mine Site Landfill. They include the following:

- Liquid wastes – e.g. sewage, grey water
- Food waste and other domestic wastes
- Radio-nuclides (Radioactive waste)
- Batteries
- Infectious or medical waste
- Electronic waste – e.g. TVs, computer CRTs (screens) and computer hard drives
- All material regulated by the Transportation of Dangerous Goods Act
- All material requiring a Material Safety Data Sheet (MSDS)
- Chemicals – e.g. paint, solvents, acids, cleaning products, insecticides, etc.
- Any petroleum product – e.g. gasoline, diesel, jet A, waste oil, etc.
- Propane tanks
- All pressurized gas cylinders and aerosol cans
- Fuel drums (205 liter barrels) or other materials/containers previously containing fuel or other hydrocarbons
- Friable asbestos
- All heavy metals such as Beryllium, Cadmium, Mercury, etc.
- Scrap tires

The above list is not all inclusive. For unusual or hard to segregate waste types – e.g. multi-material waste, please contact the Environmental Department.

5.2 Landfill Waste Cell Construction

Due to the presence of permafrost, the area method will be used to place waste in the landfill. Waste will be deposited on the ground, worked with appropriate heavy equipment, and packed against a constructed berm. Construction of the berm will be advanced with the advancing face of the landfill. The waste cell is the basic building block of the landfill. It is composed of several layers of solid waste compacted on a slope by heavy equipment and enclosed on all sides by soil. The general placement of waste will progress down-slope from the southeast rear berm wall towards the northwest end of the site. Basic instructions for constructing waste cells with acceptable materials at the Mine Site Landfill are described below in Figure 1.

5.2.1 Control of Working Face

The working face is the portion of the uncompleted cell on which additional waste is spread and compacted. The optimal working face width varies depending on the number of vehicles bringing wastes to the site and the equipment available for spreading and compacting. It should be wide enough to prevent a backlog of trucks; however, the width should not be so wide as to be impractical to operate or to expose an undue amount of refuse to the wind. The face width should be reduced by compacting and covering portions of the face as soon as a section of the cell meets the grade design. Ideally, for control of the waste exposure to wind, the width of the face should not exceed 12 m at any time.

5.2.2 Equipment Movement

Solid waste should be dumped at the toe of the working face by the collection trucks and pushed up the slope. For safety reasons, keep a minimum of 3 m separation between vehicles. The unloading area is to be maintained level and clear of waste materials.

5.2.3 Spreading Waste on a Slope

To maximize compaction, and to provide an optimal weight distribution of the dozer, the waste should be spread up an approximate 3:1 slope in 0.3 – 0.6 m layers. Fill in any holes that develop in the face with loose waste.

5.2.4 Using Grade Stakes

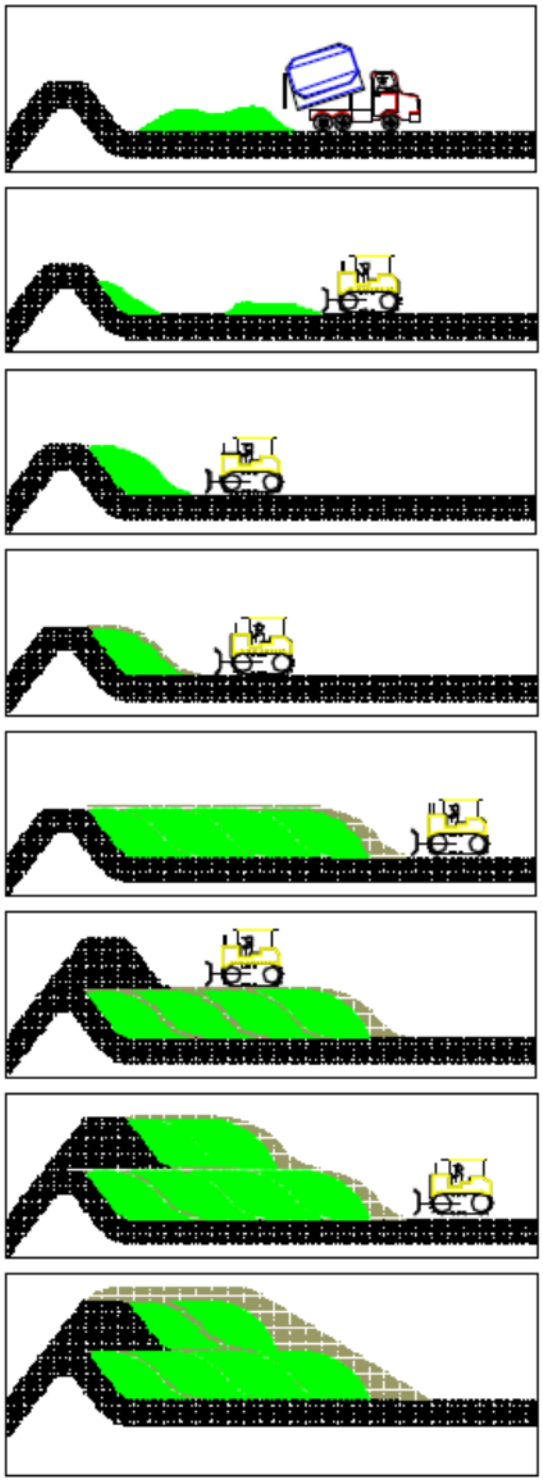
If necessary, use grade stakes to aid operators in keeping the slope of the final top fill surface at a grade of 0.5%, the slope of the cell face 3:1 and the grade of the landfill base to 0.5%, approximately.

5.2.5 Waste Compaction

A high degree of compaction extends the fill life, reduces cover material and long-term land requirements, reduces litter problems, and results in other beneficial effects. Good compaction is achieved by operating up and down the working face between 3 and 5 times on 0.3 - 0.6 m layers of waste until no further compaction occurs. The top deck of the cell must also be compacted by running across the top, keeping it as level as possible. This will typically occur once per week or in combination with collection frequency and nature of the waste.

5.2.6 Cell Completion

Cover soil will be placed over exposed compacted waste cells or portions of waste cells. A minimum of 0.3 m of cover shall be placed over the deck and 0.1 m over the slope of the cell. Use no more fill than necessary. When the cell is completed, no waste should be visible.



1. Build berm, 2 m high. Dump garbage near the berm. The maximum width of the working exposed face used for dumping should be as small as practical and not exceed 12 m.

2. Drive over the garbage 3 to 5 times with a dozer or other equipment as appropriate. Work the garbage up the berm a little at a time to pack it. Do this daily when material is deposited in the landfill.

3. Alternate between dumping and packing garbage until packed garbage is 2 m high, approximately.

4. When garbage at the working face is 3 m wide, cover garbage with 0.3 m of granular material over the deck of the cell and 0.1 m between cells to complete a partial cell, approximately. Repeat steps 1 - 3 across the width of the landfill until a cell is completed.

5. Repeat steps 1 to 4 until site is full. Then cover all garbage with about 0.3 m of granular material. Pack and add more granular material until top is level.

6. Build new 2 m berm on top of cells.

7. Repeat steps 1 to 5.

8. To close out site, put 0.6 m of granular material on cells then pack with bulldozer so that water runs off.

Figure 1. Waste Cell Construction for Mine Site Area Method Landfill

5.3 Cover Soil

5.3.1 Excavation

Excavation of soil for cover material shall only be made from designated "borrow" areas. Working cover stockpiles are to be placed within the perimeter of the approved landfill pad where they will be accessible to the working face. However, they are not to be located where they may block truck travel or filling operations.

5.3.2 Placement of Final Cell Cover

Use of soil for intermediate and final cover should be placed in the following manner:

a. When using a dozer, push cover soil up the slope and feather it out as evenly as possible. Do not permit the tracks of the equipment to spin as you traverse the compacted slope. This action will tear up the waste and it may be necessary to compact the waste again in order to reapply the cover material.
b. When a cell or portion of a cell has reached the final planned grade and width, a final cover of compacted soil should be placed. A minimum of 0.3 m of cover shall be placed over the deck and 0.1 m over the slope of the cell. Use no more fill than necessary.

5.4 Hard-to-Handle Wastes

Certain wastes acceptable at the Mine Site Landfill require special handling. The following are basic methods to be used when managing hard-to-handle waste.

5.4.1 Bulky Waste

a. **Crushable Items:** Such items (e.g. furniture and appliances) should be dumped at the toe of the working face if traffic permits. Use the dozer to crush the item on solid ground, and then push it to the toe of the working face. Fill in any holes with regular waste.
b. **Demolition Debris:** Spread out bulkier pieces of concrete, lumber, and other debris evenly at the toe of the working face. Place regular wastes on top of the demolition wastes.
c. **Long Items:** Long, awkward items, such as pipe, rolls of paper and plastic should be dumped at the toe of the face, placed parallel to the working face, and covered with regular waste. The dozer should be driven over these items slowly to prevent overturning.
d. **Large Metal Wastes:** Metal wastes, such as pipes, rolls of cable, and wires should be placed directly at its position of disposal and covered by household or demolition wastes (bridged). This will prevent unnecessary machine damage and shutdown.

5.4.2 Low Density Wastes

Waste types such as synthetic fibers, loose plastic film or foam, and rubber and plastic scraps or shavings, require special handling. These materials present problems because they rebound after being run over by the dozer. Spread the lightweight material into 1 to 2 foot deep layers, and then cover it with regular waste, compacting as usual at base of cell. These wastes should be compacted until the operator can no

longer detect that the surface of the waste layer is being depressed more than it is rebounding. The weight of the regular waste tends to keep the low-density material down.

5.4.3 Powdery Wastes

Wastes such as sawdust and ash also require special handling. These wastes are problems because they are stirred up by the equipment and blown by wind. Once in the air, they may be harmful to personnel if they are inhaled or contact the skin. Personnel not working in enclosed cabs should wear protective clothing and respirators if dust becomes airborne. Some powdery wastes may be wetted down with water from a water truck and then covered immediately with soil or regular refuse. This procedure will help reduce blowing and dusting of the powdery waste. If water is not available, cover the powdery wastes with soil or refuse to reduce blowing and dusting of the waste.

5.5 Maintenance of Completed Cells

5.5.1 Inspection of Completed Areas

As per the Nunavut Water Board Type A Water Licence No: 2AM-MRY1325 Part D Section 19, biannual summer inspection of the landfill earthworks (e.g. berm walls and completed cell) will be completed for signs of cracks and depressions due to settlement. Cracks and settlement will be filled and compacted back to the original grade.

5.5.2 Groundwater Protection System

Due to the permafrost in the area, no groundwater protection system is required.

5.5.3 Surface Water Flow and Quality

Flowing surface water will be prevented from entering the landfill site by the construction of a berm along the upper end of the site (i.e. the berm constructed above for waste placement) and berms along the sides of the site. The landfill site area will be graded 0.5% to promote drainage away from the landfill and prevent pooling of water within the landfill or against the berms.

Appropriate erosion and sediment control measures will be implemented as required through the use of silt fences, etc. Temporary sediment control measures will be used during all construction activities at the site. See the Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026) for further details on surface water flow and quality.

5.5.4 Landfill Gas Assessment

Landfill gas is not expected as the deposited waste will be non-hazardous, non-organic and inert. Also, all hazardous chemicals will be diverted from the landfill waste stream and backhauled during the sealift for proper disposal at a licensed facility in Southern Canada. Therefore a landfill gas collection system will not be installed.

5.5.5 Leachate Characteristics

Leachate is not expected as the waste to be deposited in the landfill will be relatively dry, inert and non-hazardous. Therefore no leachate collection system has been included in the design. In addition, a perimeter berm will be constructed surrounding the landfill site. This will redirect surface runoff originating upstream of the landfill site, thereby minimizing the amount of water which might infiltrate the deposited waste.

5.6 Traffic Control and Unloading of Waste

5.6.1 Traffic Flow

Traffic should be kept moving at a safe, steady rate to avoid backlogs and congestion near the working face. Drivers are to back up to the toe of the slope before he/she starts to dump. The driver is to pull straight away slowly from the slope while he/she is dumping.

5.6.2 Aids to Traffic Control

Directional signs, pylons and barricades may be used to help with traffic control and directing trucks to unload the waste at the base of the cell. Ensure proper signage and barricades are in the required locations at the beginning of each day. Relocate signs and barricades as required at the end of each day so that they will be in place and ready for the next day's operation.

5.6.3 Separation of Vehicles

Due to the risk of dump trucks and trailers overturning, only one vehicle is to be unloaded at the face at a time, this includes vehicles being unloaded by hand.

5.6.4 Load-on-Fire Procedures

Loads-on-fire are wastes that are either on fire or that are smouldering or smoking within a vehicle or when deposited at the working face. In the event of Loads-on-fire, site personnel are to call Code 1 immediately (Appendix C).

5.6.5 Prevention of Scavenging

Scavenging by employees, visitors and local people travelling through is not permitted. Scavenging in a waste pile is a safety hazard with a high risk of injury and is strictly prohibited.

5.6.6 Site User Rules

Landfill staff should know all site user rules and watch for violations. User rules (Appendix B) and wastes acceptable for disposal in the landfill (Appendix A) are to be posted at the entrance to the landfill and at the working face. All violation of landfill user rules shall be recorded by landfill staff and reported to the Site Services Supervisor.

5.6.7 Emergency Procedures

Site personnel shall be familiar with proper emergency procedures and are expected to know their role in all possible emergency situations. Refer to the Emergency Work Instructions in Appendix C of this manual for more details.

5.7 Landfill On-Site Roadways

5.7.1 Road Construction

On-site access roads for transporting waste to the working face and landfill maintenance shall only be constructed under the approval of the Environmental Manager and according to engineered design specifications.

5.7.2 Road Maintenance

a. **Maintenance of Gravel Roadways:** Roadways that are made in native or filled soil and are heavily travelled require routine maintenance. These roads should be graded and re-compacted as required to re-establish proper road grades.
b. **Filling of Areas Where Settlement Occurs:** When all-weather roads are constructed on the tundra, settlement of the filled area may cause cracks to form in a road or cause the slope of a road to change. Cracks should be filled with material that is compatible with the roadbed. The area of a sloped road where the slope has changed drastically should be built-up with material compatible with the roadway until the desired elevation is achieved.
c. **Maintenance of Drainage Culverts:** All drainage culverts should be kept free of obstructions and debris. All drainage crossings should be identified with staking prior to the winter so that they can be found and opened in advance of freshet. Prior to the onset of freshet, all drainage culverts shall be opened and ready to accept water flow.

5.8 Preparation for Weather Conditions Affecting Landfill Operation

Wind and white out conditions caused by storms during the winter and spring freshet may have an impact on landfill operations. The following precautions shall be followed.

5.8.1 Wind

In preparation for wind storms, the working face shall be compacted and covered as practical to reduce the width of the exposed face. Litter fences should be installed prior to windy weather and relocated as required.

5.8.2 White Out Conditions Caused by Winter Storms

Under severe white out conditions caused by some winter storms, the Site Services Manager/Superintendent may declare the landfill temporarily closed if conditions at the landfill cannot be made safe to operate.

5.8.3 Freshet

Prior to the spring melt of freshet the Site Services Supervisor will take the following precautions to minimize the impact of the water flow from freshet:

a. Ensure all culverts are cleared prior to freshet.
b. Remove all excess snow from the landfill pad and completed cell slope to minimize water accumulation on the pad.
c. Install silt fencing or other control devices if required on drainage that contains silt as a result of landfill erosion.

5.9 Inspection, Environmental Monitoring and Reporting

5.9.1 Routine Inspections

Routine visual inspections will be completed every week on the Mine Site Landfill Inspection form (See the Environmental Protection Plan BAF-PH1-830-P16-0008 section 3.7) by the Environment Department for various components of the landfill, including:

- General site area
- Litter control
- Storm water runoff control
- Vector attractants
- Wildlife observations
- Wildlife signs

5.9.2 Environmental Monitoring

In addition to weekly inspections, the Environment Department will conduct surface water monitoring on a seasonal basis for compliance monitoring purposes.

5.9.2.1 Water Sampling

As per the Nunavut Water Board Type A Water Licence No: 2AM-MRY1325 Part F Section 22, seepage sampling will be undertaken during the open water season at two locations downstream of the landfill. Sampling parameters will include: pH, alkalinity, conductivity, total dissolved solids (TDS), total suspended solids (TSS), phenols, nutrients, anions, total organic carbon (TOC), dissolved organic carbon (DOC), total metals, total petroleum hydrocarbons, oil & grease, and trace Arsenic and Mercury. An appropriate number of samples (approximately 10% of the total number of samples) will be collected for Quality Assurance / Quality Control.

Water sampling will continue to be undertaken in the receiving water (Sheardown Lake) as part of routine affects monitoring. Groundwater monitoring is not required as the landfill is underlain by permafrost and any runoff or seepage daylights upstream of the current monitoring locations. In consideration that the landfill is situated in a permafrost area with little to no groundwater present. Thus, impacts to groundwater are not expected.

5.9.2.2 Ground Temperature Monitoring

It is expected that the permafrost active layer will progress into the landfill waste and cover material. Therefore, ground temperatures are not expected to increase due to the presence of the landfill or the types of non-hazardous waste disposed in the landfill.

During regular landfill inspections, signs of ground warming will be monitored by watching for indicators such as soil creep, settling and slumping, and areas of melted snow, for example.

5.9.3 Reporting

Annual reporting regarding the landfill will be incorporated into the Annual QIA and Nunavut Water Board Annual Report. The report will consist of information such as:

- Total volume of waste deposited in the landfill site during the previous calendar year
- Progression of the landfill site development, indicating the landfill site location currently in use, and any areas that have been closed
- Monitoring results
- Photographs as required

5.9.4 Summary of Monitoring and Reporting

Monitoring/Reporting	Frequency	Department Responsible	QA/QC
Overall Site Inspection (runoff, waste composition, litter control and placement, wildlife signs)	Weekly	Environment	Management review of records to confirm proper site operation
Volume Deposited in Landfill	Quarterly	Site Services	Management review of records to confirm proper site operation
Materials Composition of Waste	Whenever deposition occurs	Site Services	Management review of records to confirm proper site operation
Surface Water (Seepage) Sampling Downstream of Landfill	During Open Water Season	Environment	Routine QA/QC Sampling (equivalent to 10% of samples taken)
Earthworks Inspection (berm settlement, ground temperature warming, erosion, cracks, etc.)	Biannually during the summer	Site Services (Geotechnical Engineer Consultant)	Management review of report to confirm proper site operation
Landfill Report - incorporated into Annual QIA and Nunavut Water Board Annual Report	Annual	Environment	n/a

6 REFERENCES AND RECORDS

- Nunavut Mine Health and Safety Act and Regulations
- Canadian Standards Association
- Nunavut Water Board Type A Water Licence No: 2AM-MRY1325
- Commercial Lease No.: Q13C301
- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011)
- Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026)
- Environmental Protection Plan (BAF-PH1-830-P16-0008, Section 3.7)
- Waste Sorting Guidelines (BAF-PH1-830-P25-0001)
- Open Burning of Untreated Wood, Cardboard and Paper Products Procedure (BAF-PH1-300-PRO-0001)

Appendix A
Potential Pollutant Sources and Best Management Practices Summary Table

Area	Activity	Pollutant Source	Pollutant	Best Management Practices
Landfill	General landfill operations	Soil Erosion	Sediment	- Maintain design slopes - Repair all berm and cover areas experiencing settling or erosion - No cuts permitted into the tundra during landfill construction or operation - Silt fences installed at any drainage site experiencing sedimentation due to soil erosion
Landfill	Fueling of heavy equipment	Diesel fuel	Diesel fuel	- Fueling is completed in accordance with the Baffinland fueling procedure. - Personnel are trained on the procedure for fueling
Landfill	Unloading waste at landfill	Improper segregation or direction of non-permitted wasted	Hazardous waste or non-permitted waste	- Following Baffinland's Waste Sorting Guidelines - The inspection of all landfill waste prior to unloading/disposal, as outlined in this manual.
Landfill	Unloading waste at landfill	Hazardous material spill	Hazardous waste	- Following the Baffinland Spill Contingency Plan when responding to spills

Landfill & Surrounding Area	General landfill operations	Landfill working face	Litter	- Landfill operations manual contain best management practices including:
				  - Minimizing active working face
				  - Compaction & cover plan
				  - Use of litter fences

Appendix B
Mine Site Non-Hazardous Solid Waste Landfill User Rules

1. **RESTRICTED ACCESS – ONLY SITE SERVICES PERSONNEL ARE ALLOWED TO ENTER THE LANDFILL FACILITY.**
2. **All waste is to be inspected prior to dumping – Contact the Site Services Supervisor for pickup and inspection.**
3. **No liquid or hazardous waste is accepted at this landfill.**
4. **Vehicles shall follow posted speed limits and directions to the unloading area - Unloading in other areas is strictly prohibited.**
5. **Dump waste immediately behind the vehicle as close to the toe of the working face as possible.**
6. **No Unloading by Rapid Acceleration or Deceleration.**
7. **No scavenging is permitted.**
8. **No open fires or the burning of waste is allowed at the landfill.**
9. **All spills are to be stopped if safe to do so, and immediately reported to the Site Services Supervisor/Environment Department.**
10. **PPE is required to be worn at landfill area.**

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.

Appendix C
Mine Site Landfill Work Instructions

Appendix C focuses on work instructions. Specific work instructions concerning landfill operations and emergencies have been documented in order to establish standard policies and practices for Site Services personnel working at the Mine Site Landfill. These topics will be reviewed periodically at routine safety meetings, which will allow operators to keep up-to-date on any changes in standard operations. Site Services personnel are expected to be familiar and comply with the work instructions relating to their areas of responsibility.

1. General Site Maintenance

Landfills require general maintenance throughout the year in order to keep them orderly and clean. Much of this maintenance is in anticipation of permit requirements and seasonal weather changes.

a. Access roads are to be maintained and graded to eliminate ruts, cracks and settling.
b. Maintain drainage, keep road culverts and landfill drainage free of debris.
c. Define a critical landfill perimeter and mark perimeter with stakes and/or signs prior to winter to facilitate identification.

2. Dust Control

Place dusty loads at the toe of the face and cover as quickly as possible.

Benefit of Compliance to Instruction:

- Compliance with operating permit
- Cleaner, safer work environment
- Reduced impact on surrounding environment

3. Litter Control

The control of litter is an essential part of our permit conditions and readily evident to all who drive by or onto the landfill. In an effort to maintain compliance with our permit and reduce the amount of time and effort required for this task, the following procedures are to be followed:

Prevention of Litter at Working Face:

a. Minimize the length of the working face to reduce the size of the face exposed to wind. The maximum length of the exposed cell face should not exceed 12 meters at any time.
b. Keep waste well confined at the working face to reduce the amount of waste susceptible to wind.
c. Deposit waste at the toe of the face and spread it upward.
d. Cover the compacted waste as soon as possible to minimize blowing litter.

Control with Litter Fences:

a. Position fences near the working face as wind and fill operations change.
b. Move or lengthen semi-permanent litter fences that are strung around the area to conform to filling operations and prevent migration of litter off site.

Litter Pickup:

a. Personnel are to pick any litter off the fences to prevent the fence from being clogged and subject to overturning by the wind.
b. Promptly pick up any litter not trapped by the fences to prevent off-site migration.

Litter in Heavy Wind Conditions:

a. Install litter fences prior to windy weather and relocate as required.
b. If lightweight material cannot be contained within the site, place intermediate cover over the waste to prevent it from blowing.

Benefit of Compliance to Instruction:

- Compliance with operating permit
- Reduction in amount of litter migrating out of the landfill area
- Minimize impact to surrounding environment
- Reduce the amount of time dedicated to picking up litter

4. Vector Control

Vectors (any wildlife that carry diseases) are generally not present at a properly operated and maintained non-hazardous solid waste landfill (no domestic waste). The provisions of source segregation and waste inspection at the landfill prior to unloading waste will safeguard against vector problems. Well-compacted wastes and cover material will effectively prevent vectors from becoming attracted and burrowing into waste materials. The following are basic guidelines to ensure proper vector control on site:

a. All waste is to be inspected at the landfill prior to unloading at the working face to confirm no domestic or food waste is present.
b. Maintain a narrow working face and cover all un-worked areas to minimize animal foraging at the site.
c. Cover waste on all unused slopes.
d. Ensure good compaction of the cover material to discourage animals from burrowing through it.
e. Keep equipment, storage and leisure areas free of debris and food waste to prevent vectors from establishing residence in or near areas where employees and contractors work.

Benefit of Compliance to Instruction:

- Protects the health and safety of employees
- Eliminates potential exposure pathways of disease to employees
- Reduces risk of contact with vectors and scavengers
- Maintains compliance with operating permit

5. Building and Equipment Fires

In the event of a fire, site personnel are to call Code 1 immediately

6. Fire in Load

“Fire in load” refers to a load of waste within a vehicle that is either on fire and/or smoldering or smoking prior to discharge to the landfill. In the event of Loads-on-fire, site personnel are to call Code 1 immediately.

7. Subsurface Landfill Fires

Warning signs may include:

- Smoke and/or heat waves emanating from cracks and/or fissures;
- Localized settlement (sinkholes up to several meters in diameter);
- The odor of burning plastic/refuse may be present

BEWARE! The surrounding area may not be stable. The rapid decomposition of refuse by combustion may have created large voids underground.

Safety Procedures

1. If an area is suspected of having an underground fire, call a Code 1 and take control of the scene by blocking access to the landfill area until Mine Rescue Team personnel arrive onsite. Ensure all personnel near the suspected landfill fire are notified and/or vacated as necessary.
2. Try to stay upwind of any smoke and not breathe the fumes, if any.
3. The Mine Rescue Team Lead will evaluate the conditions and develop a plan to safely deal with the fire (Note: Pumping water into the ground may not stop the smoldering and will not prevent future fires. Smothering with dirt is the preferred option).
4. Notify the Baffinland Environment department to evaluate the incident and confirm the repair plan is in compliance with permits.
5. Once the fire is extinguished and the situation secured, look for other cracks and/or depressions in the area and schedule their repair. (They could be the source of air that allowed the fire to start originally).
6. Complete repairs to the landfill structure. Note completion of work in site log along with fire location for future reference.

Appendix L
Open Burning Procedure

Baffinland Iron Mines Corporation

OPEN BURNING OF UNTREATED WOOD, CARDBOARD AND PAPER PRODUCTS PROCEDURE

BAF-PH1-300-PRO-0001

Rev 1

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1.0 PURPOSE AND SCOPE

The purpose of this procedure is to provide a set of operational requirements for the safe controlled burning of untreated clean wood waste and cardboard in an environmentally acceptable manner at the Mary River Project. The open burning of untreated wood waste is one of a number of elements of the Mary River Project source segregation and waste management program.

2.0 REQUIREMENTS

2.1 HAZARDS/ PERSONAL PROTECTIVE EQUIPMENT (PPE)/ SPECIAL EQUIPMENT

2.1.1 HAZARDS

There are numerous specific hazards associated with the management of open burning. They include:

- Puncture or slivers from handling broken wood or wood containing nails & screws
- Smoke inhalation from working in the smoke plume of the fire
- Burns from direct contact with the flames or indirect burns from clothing coming in to contact with flame
- Burns or fire from handling embers (un-combusted wood) in the ash

2.1.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Wear Standard P.P.E. - Safety glasses, hard hat with reflective tape, safety boots, reflective vest, clothing in good condition, gloves or mitts in good condition
- Do not wear loose flammable clothing such as an unbuttoned work shirt when working around the burn container

2.1.3 SAFETY EQUIPMENT REQUIREMENTS

- Skid Steer/Bob Cat will be used to stockpile the clean wood and cardboard in the burn container
- A spade or shovel should be used to turn over & inspect the residual ash

2.2 PERMITS/ TRAINING AND/OR QUALIFICATION REQUIREMENTS

Any person who may be burning untreated wood at a Baffinland work site shall complete the documented training in this procedure and demonstrate their understanding of the hazards and controls. Verification of training will be kept by the Training Department.

3.0 RESPONSIBILITIES

The following roles have specific accountabilities that must be met to ensure the **Mine Site Complex (MSC)** and **Port Site Complex (PSC)** clean wood waste open burnings are operated in compliance with this procedure and its permit. The following roles and responsibilities shall be followed to safely and successfully operate the open burns. Area Superintendents/Supervisors are responsible for ensuring that all personnel are fully trained and competent to meet the expectations of this procedure.

3.1 MSC/PSC Manager or his Designate

The Site Services Manager or designate is accountable for the overall operation of the open burning. Specifically, he or she shall:

- Organize, oversee and administer the operation of the burn in accordance with current permits, regulations and this procedure
- Evaluate the burn permit requirements and monitor and direct the wood and cardboard waste open burn activities

3.2 MSC/PSC Site Services Supervisor

The Site Services Supervisor, under general supervision of the Site Services Manager or designate, is responsible for supervising the operation of the open burning in accordance with this procedure. Specifically, the Site Services Supervisor shall:

- Supervise the Open Burn Operator in the safe execution of this procedure
- Inspect the burn container residual ash to ensure it contains no hot embers prior to transport to the landfill

3.3 Site Services Operator

The Site Services Operator, under the general supervision of the Site Services Supervisor is responsible for executing the following tasks at the burn container. Specifically, the Operator shall:

- Work in conjunction with the Site Services Supervisor in executing this procedure. Conduct the burn in compliance with this procedure.
- Know how to respond appropriately to all emergencies described in this procedure.
- Complete report forms as required. The approximate quantity and general types of waste (based on visual estimation of volume to nearest cubic meter) will be noted on a form to be filled out daily whenever open burning occurs. The completed forms are to be submitted to the Environment Department on a monthly basis.

3.4 Environmental Manager or Designate

The Environmental Manager or Designate will issue the approval to open burn (Open Burn Permit) for a specified period and will work with Site Services Manager, Supervisors, and Operators to ensure that the open burn activities are comply with applicable environmental permits and in accordance with directives provided by responsible regulators and agencies. Environmental monitors, under the direction of the Environmental Manager or Designate will conduct periodic inspections of the designated open burn areas and operations to ensure compliance with permits and this SOP. If environmental non-compliances are identified, the Open Burn Permit can be revoked and a request for specified corrective actions to be implemented. The quantity and types of waste being open burned are summarized and reported in the Annual NWB and QIA Reports submitted by March 31 of each year.

4.0 DEFINITIONS

MSC:	Mine Site Complex
PSC:	Port Site Complex
SOP:	Standard Operating Procedure
Open Burning:	Burning of any material or substance in the ambient air in an open topped burn container.
Permit:	A paper or electronic form that documents the approval of open burning at one of the two approved open burn sites. This permit will cover a specified period when open burning would be allowed under the conditions specified in this SOP.
Clean Untreated Wood Waste:	Clean untreated wood waste includes wood or timber, not suitable for recycling or reuse that is substantially free of glue, petroleum-based materials, other chemicals, or contains other non -wood products.
Cardboard, Paper Products and Other Packaging:	Clean paper products and paperboard packing material including boxboard and cardboard, as well as natural fibre textiles (i.e. cotton, wool).

5.0 PROTOCOL

5.1 SOURCE SEGREGATION AND WASTE MANAGEMENT PROGRAMS

It is Baffinland's policy to minimize material and packaging purchased and shipped to Mary River to reduce the amount of waste produced at the site, reuse and recycle waste, and maximize diversion from the landfill.

The Mary River source separation program consists of a series of ongoing activities to separate reusable and recyclable waste materials from other wastes at the point of origin. The purpose of the source separation program is to separate the waste into its material categories as well as from other wastes so that wastes that can be reused or recycled, are diverted from the landfill. The execution of the source segregation program at the Mary River Project serves to:

- Ensure hazardous material is segregated, packaged and shipped to licensed facilities in the South
- Promote the diversion of waste away from the non-hazardous solid waste landfill
- Direct domestic kitchen, office and camp waste to incinerators
- Reduce, reuse and recycle wood products to the extent practicable
- Divert non-reusable/non-recyclable clean wood waste and cardboard from the non-hazardous solid waste landfill for open burning

5.2 CLEAN WOOD AND CARDBOARD OPEN BURNING OPERATIONS

Open burning shall strictly be operated in an open top sea container. This shall help to prevent waste and ash from blowing around and allow easy removal and disposal of ash.

5.2.1 Open Burning Container Locations And Access Control

There are only two approved open burn locations at the Mary River Project. Both sites are signed and as identified at the following locations:

- MSC: N 71° 19’ 56.4” W 79° 24’ 33.2”
- PSC: N 71° 52' 30.571" W 80° 53' 27.874"

The burn area will be restricted access. Gates must be kept closed and locked when the burn area is not occupied by trained operators. The burn area locations are located a distance greater than 30 metres from any water body and are far enough from camp facilities to prevent impact to personnel from airborne emissions. Signage at gate needs to be in place and maintained to be visible upon approach.

5.2.2 Acceptable Clean Wood Waste

Acceptable clean wood waste **permitted** for open burning includes the following products that are not suitable for re-use or recycling:

- Lumber
- Timber
- Pallets
- Paper products & paperboard packaging

Non-clean wood wastes are **not permitted** for open burning. This includes the following wood products:

- Treated or painted wood
- Plywood
- Petroleum-based materials
- Materials contaminated with petroleum or petroleum derivatives
- Petroleum products used as accelerants
- Plastics, electrical wire, Styrofoam or asbestos

5.2.3 Open Burn Permit

Prior to ignition of the wood pile the Open Burn Operator shall ensure that all conditions of this SOP are met that the Burn Permit for the dedicated burn locations is in good standing.

Open burning shall occur only with a permit that is current and in good standing and that covers the period required. In the event of non-compliance of this SOP or in the event of an environmental or safety infraction, the permit may be revoked for a specified period of time until corrective action is implemented to the satisfaction of the Site Services and Environmental Managers. The Open Burn Permit is provided by the Environmental Manager or his designate and will be valid for a set period of time.

5.2.4 Weather Conditions

Mild to moderate winds provide for the best smoke dispersal. Extreme winds create a potential uncontrollable fire condition. Ignition of waste pile is not permitted in winds greater than 20 km/h.

The burn shall be temporarily stopped if the burn has the potential to:

- Create a condition in which a fire hazard is created or a condition in which the open burning can cause a fire to spread beyond its initial area
- Cause air pollution that creates a health hazard, a public nuisance or directly impacts wildlife

To ensure a “hot burn” is maintained to create an efficient burn, start the fire during dry conditions (i.e. Not during wet, rain conditions).

5.2.5 Open Burn Supervision

The designated MSC/PSC Manager is responsible for ensuring the conditions as required by this procedure are complied with.

5.2.6 Burning Guidelines

The wood will be kept as dry as possible before burning.

The primary goal in operating the open burn pit is to maintain a “hot burn” to create an efficient burn. To that end, the burning shall be managed as follows:

- The size of the burn pile will be contained within the container using consistent/constant feed rates to avoid over feeding and damping the fire.
- A “hot burn” should be maintained to create an efficient burn using consistent/constant feed rates to avoid over-feeding and damping the fire.
- Construct piles loosely, with spaces to allow adequate oxygen to reach the burning material. Create a “heart” of fine, flammable paper or fine wood waste and light it down low on the side the wind is coming from.
- Construct piles in a dome or teepee shape that allows heat to build so that flames can be maintained, and the wood can be consumed rapidly. Flat, sprawling piles rarely burn well.
- Make sure your pile is clean, the arch enemy of a good burn pile is dirt.
- The Open Burn Operator shall monitor the pile to make sure it burns hot and clean.

5.2.7 Ignition

The only authorized methods for igniting the wood waste in the open burning container are:

- Propane burners provide a safe ignition. All propane bottles are to be stored in the vehicle when not immediately being used for ignition and are to be disposed of in an authorized recycling container for pressurized or hazardous material.
- Paper and matches can be used as a safe method of ignition.

No fuel or other petroleum-based product or other chemical is permitted as an accelerant.

5.2.8 Extinguishing Requirements

Fires will be extinguished under the following conditions:

- When any condition as required by this procedure is not met
- To ensure smouldering of material does not persist upon completion of the open burn

5.2.9 Disposal Of Open Burn Ash

All residual waste and ash will be collected and disposed of in the MSP approved non-hazardous material solid waste landfill or a designated area approved by the Inspector. The following conditions must be met prior loading and transport of the ash to the landfill:

- Upon completion of the open burn and subsequent extinguishing, ash will be allowed to cool for 48 hours
- Fill shall be mixed with the ash in the burn container to confirm the ash is extinguished and to prevent loss of ash during transport to the landfill
- ALL ash and debris in the vicinity of the burn container shall be cleaned up prior to subsequent burns

5.2.10 Open Burn Areas

- The gates which control access to the open burn areas shall remain locked at all times when the area is not in use or is unattended and only authorized personnel shall have access to the area
- Signage shall be clearly posted at the open burn locations in both English and Inuktitut and shall include but is not limited to the SOP for Open Burning, the general Waste Segregation Guidelines as well as the Waste Segregation Guidelines for Open Burning

6.0 REFERENCES AND RECORDS

- *Nunavut Mine Health and Safety Act* and Regulations
- Canadian Standards Association
- Nunavut Water Board Type A Water Licence No: 2AM-MRY1325
- Commercial Lease No.: Q13C301
- Baffinland Iron Mines Corporation Mary River Project Waste Management Plan for Construction, Operation and Closure, dated April 19, 2013
- Waste Sorting Guidelines
- Waste Sorting Guidelines - Open Burning
- Form for recording approximate volumes and types of wastes to be open burned