Mary River Project

Attachment 5: Waste Management Plan for Construction, Operation, and Closure

Appendix 10D-4

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ABBREVIATIONS

Baffinland	:	Baffinland Iron Mines Corporation
CCME	:	Canadian Council of Ministers of the Environment
EHS	:	Environmental, Health and Safety
EIS	:	Environmental impact statement
EPCM	:	Engineering, Procurement, and Construction Management
EPP	:	Environmental Protection Plan
ERCB	:	Energy Resources Conservation Board
IIBA	:	Inuit Impacts Benefits Agreement
the Project	:	Mary River Project
NIRB	:	Nunavut Impact Review Board
NWB	:	Nunavut Water Board
NWT	:	Northwest Territories
QIA	:	Qikiqtani Inuit Association
TDG	:	Transportation of Dangerous Goods
VEC	:	Valued Ecosystem Components
WMP	:	Waste Management Plan

Section 1: Introduction

Baffinland Iron Mines Corporation is committed to taking all 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. One of the first steps towards achieving these goals is the preparation of this Waste Management Plan for Construction, Operation and Closure (WMP). The WMP establishes the roles and responsibilities of employees, contractors and other site personnel as well as protocols for handling, storing and disposing of all solid wastes generated onsite. The intent is to afford a high degree of control over the waste generation and to minimize the adverse environmental effects associated with waste generation.

The basis of a sound waste management program lies in the three R's: reduction, recovery, reuse and recycling of wastes. The main objectives of this WMP are:

- the creation of a framework for the proper handling and disposal of wastes
- the minimization of potentially adverse impacts on the environment
- compliance with all regulatory requirements for waste management.

Waste generation follows the "Cradle to Grave" principle. It is the primary responsibility of all personnel to implement the plan as outlined, in accordance with their contractual and legal obligations, under the supervision of the Project Manager or Site Manager as assisted by the Site Environmental Coordinator (SEC). Exaggerating

This WMP applies to the Construction, Operation and Closure Phase of the Mary River Project at all project sites. This plan will be reviewed on an annual basis and updated as necessary to accommodate any deficiencies, inadequacies or potential improvements that are identified.

1.1 Purpose

The aim of the Waste Management Plan is to implement a sound waste minimization program that will focus upon the principles of Reduction / Recovery / Reuse / Recycling. The residual waste generated by the Project activities will then be disposed of in a landfill/landfarm, incinerated or shipped off-site to southern Canada for final disposal, treatment, or recycling.

This Waste Management Plan deals with wastes generated by the Mary River Project including, among others, inert and hazardous solid wastes, i.e., solids, semi-solid and sludge, used oils, contaminated fuel, and antifreeze, used chemical products, biomedical waste and spills clean-up materials. The management of sewage effluent and sludge from the sewage treatment plants is the subject of the Waste Water Management Plan.

The Waste Management Plan presents the various disposal methods, the types and expected quantities of waste produced and the ultimate disposal of the waste stream. The Plan also defines the roles and responsibilities, specific requirements, and monitoring controls for managing solid and hazardous wastes generated by the Project. It also presents the strategy for adaptive management and continuous improvement.

In order to handle, storage, transport and treat / dispose the wastes generated during the construction, operation and closure phase of the Project, several treatment or disposal facilities must be built on-site to ensure that the waste management is being conducted in a safe, efficient and environmental-compliant manner. The infrastructure deemed necessary to manage the wastes appropriately are:

- Two long term waste management facilities at the Mine Site and Steensby Port
- Two long term landfills and landfarm's at the Mine Site and Steensby Port
- Temporary landfarm, incinerator, hazardous / medical waste storage facility and waste oil treatment/recovery facility at Milne Port
- Temporary incinerator and waste storage areas at Mine Site, Steensby Port and Rail Camps for use only during construction

All Project activities are regulated and will be performed according to the law and regulations applicable to the Project and procedures developed.

The Waste Management Plan (WMP) presented in this document establishes a management strategy for all the wastes generated during the construction, operation, closure and reclamation of the Project.

1.2 Definitions

Project	:	All necessary tasks and work from construction, operation, closure and reclamation phase, during the lifespan of the Project, on the Site.
Site	:	All of the areas occupied by the Project facilities (permanent or temporary) during the construction, operation, closure and reclamation phase of the Project.
Contractor	:	A person or business which provides goods, material, equipment, personnel, and/or services to Baffinland Iron Mines Corporation under terms specified in a contract.
Waste	:	All residual material (hazardous, non-hazardous or Putrescible) generated during the construction, operation, closure and reclamation phase of the Project.
Hazardous Waste	:	All kind of wastes generated during the lifespan of the Project and that present a threat to the human health or the environment because they posses one or more of the following characteristics: corrosive, reactive, explosive, toxic, inflammable, or biologically infectious.
Non-Hazardous Waste	:	All kind of wastes generated during the lifespan of the Project and that do not present a threat to human health or the environment.
Putrescible Wastes	:	All kind of wastes generated during the lifespan of the Project and that are degraded very rapidly, i.e., plants, food scraps or animal remains.

1.3 Regulatory Requirements

A number of Acts and Regulations provide specific requirements for the management of the different types of waste generated at the Mary River Project. They are:

- Territorial Lands Act 1985;
- Territorial Land Use Regulations;
- Nunavut Waters and Nunavut Surface Rights Tribunal Act 2002;
- Canadian Environmental Protection Act;
- Transportation of Dangerous Goods Act and Regulations;
- Safety Act, Occupational Health and Safety Regulations;
- Work Site Hazardous Materials Information Systems Regulations;
- Export and Import of Hazardous Waste Regulations;
- Spill Contingency Planning and Reporting Regulations;
- National Fire Code;
- Public Health Act;
- Explosives Act;
- Fisheries Act;
- Metal Mining Effluent Regulations; and
- Petroleum Refining Liquid Effluent Regulation.

Due to the complexities and the number of acts and regulations involved, the Government of Nunavut has published a number of Guidelines to assist the generators of waste in the development and an effective waste management plan for their specific sites. These guidelines are listed as references in Section 9.

The Project will be subject to a Type 'A' Water License. Conditions regarding aspects of waste disposal as outlined in this Plan will be specified by the water license and will likely include:

- Annual inspection of earthworks by a geotechnical engineer during summer months
- Submission of landfill expansion design documents to NWB 60 days prior to construction
- Any required updates to the Landfill Operations and Maintenance Plan
- Submission of a revised Environmental Monitoring Plan;
- Waste disposal areas must be a minimum of 30 m from the ordinary high water mark of any water body such that quality, quantity or flow of water is not impaired, unless authorized by the NWB
- Prior to the removal and transfer of waste, a declaration of authorization must be obtained from the Hamlet of Pond Inlet which clearly indicates the authorization to allow the deposit of solid waste in the Hamlet's NWB licensed solid waste facility
- records must be maintained of waste (including hazardous waste, waste oil, and non-combustible waste) that is backhauled and records must be maintained confirming proper disposal/fate of backhauled waste;
- food waste, paper waste, and wood products must be incinerated using an incinerator capable of meeting Canada Wide Standards for Dioxins and Furans, and Mercury.

1.4 Relationship to Other Management Plans

This plan is based on the concepts and principles found in Appendix 10A-1 EHS Management System Framework Standard and 10A-2 Hazard Identification and Risk Assessment Standard. The plan should be reviewed in concert with the following additional plans that have been prepared for the EIS:

- Environmental Protection Plan;
- Surface Water and Aquatic Ecosystem Management Plan;
- Wastewater Management Plan;
- Preliminary Mine Closure and Reclamation Plan;
- Air & Noise Management Plan;
- Emergency Response and Spill Contingency Plan;
- Explosives Management Plan;
- Terrestrial Wildlife Management Plan; and
- Hazardous Materials and Hazardous Waste Management Plan.

1.5 Baffinland's Commitments

Baffinland provides adequate resources to implement and maintain the EHS Management System including the necessary human, material and financial resources. Baffinland's Sustainable Development Policy is presented in Section 2.

1.6 Update of This Management Plan

The Waste Management Plan is a "living document". It will be regularly updated on the basis of management reviews (as outlined in Section 8), incident investigations, regulatory changes or other Project related changes.

Section 2: Sustainable Development Policy

At Baffinland Iron Mines Corporation, we are committed to conducting all aspects of our business in accordance with the principles of sustainable corporate responsibility and always with the needs of future generations in mind. Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and to create authentic relationships. We expect each and every employee, contractor, and visitor to demonstrate a personal commitment to this policy through their actions. We will communicate the Sustainable Corporate Policy to the public, all employees and contractors and it will be reviewed and revised as necessary on an annual basis.

These four pillars form the foundation of our corporate responsibility strategy:

- Health and Safety
- Environment
- Investing in our Communities and People
- Transparent Governance

1.0 HEALTH AND SAFETY

- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness from the very earliest of planning stages. Why? Because our people are our greatest asset. Nothing is as important as their health and safety.
- 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 and awareness. We allow our workers and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- We employ a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- We apply the principles of pollution prevention 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 pioneering new processes and more sustainable practices.
- We understand the importance of closure planning. We ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts.

3.0 INVESTING IN OUR COMMUNITIES AND PEOPLE

- We respect human rights and the dignity of others. We honour and respect the unique culture, values and traditions of the Inuit people.

- We contribute to the social, cultural and economic development of sustainable communities adjacent to our operations.
- 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.

4.0 TRANSPARENT GOVERNANCE

- We will take steps to understand, evaluate and manage risks on a continuing basis, including those that impact the environment, employees, contractors, local communities, customers and shareholders.
- We 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 environmental, safety, health, socio-economic commitments and set annual targets and objectives.
- We conduct all activities in compliance with the highest applicable legal requirements and internal standards
- We strive to employ our shareholder's capital effectively and efficiently. We demonstrate honesty and integrity by applying the highest standards of ethical conduct.

Tom Paddon
President and Chief Executive Officer
September 2011

Section 3: Targeted VEC's

Waste will be generated throughout the life cycle of the project. To ensure that wastes are handled, stored and managed in a safe and environmentally acceptable manner, Baffinland will apply best practices for its waste management activities.

Inadequate handling, storage and elimination of waste could impact the following valued ecosystem components (VECs):

- Soils (spills & contamination)
- Water quality (contamination of runoff)
- Fish and fish habitat
- Permafrost
- Vegetation (uptake of contaminants or loss of vegetation)
- Birds (exposure and ingestion of contaminants)
- Terrestrial wildlife (exposure and ingestion of contaminants)
- Human health (exposure and ingestion of contaminants).

Section 4: Waste Management Approach

The aim of the Waste Management Plan is to implement a sound waste minimization program that will focus upon the principles out lined in Appendix 10A-1 EHS Management System Framework Standard. The remaining waste will then be disposed of in a non-hazardous landfill, incinerated or shipped off-site for final disposal / treatment or recycling.

4.1 Waste Identification

A summary of the types of waste expected to be generated by the Project, and disposal method, are presented below. Operations and Maintenance procedures will be developed for each waste to be managed. This information will be summarized in manuals and training will be provided as required. For the majority of long term infrastructure, the facilities used in construction will be the same ones used during the operations phase.

Table 4.1 presents an overview of the types of waste generated by the Mary River Project and the general disposal method for each type of waste. **Table 4.2**, **Table 4.3**, and **Table 4.4** presents the expected quantities of waste generated for the construction and operation phases respectively.

4.2 Waste Management Methods

Wastes remaining after application of the waste minimization techniques will be managed in a practical and environmentally responsible manner utilized methods appropriate for each waste type generated. The following methods will be applied at the site:

- Waste sorting at all generation points
- Incineration of non-hazardous combustible wastes
- Open burning in a regulated burn pit of untreated wood and cardboard
- Landfilling of inert non-combustible wastes
- Temporary storage and off-site shipping of hazardous and recyclable waste materials
- On-site treatment for contaminated soil and oily water from hydrocarbon spills in a landfarm.

Table 4.1: Waste Type and General Disposal Methods

Source	Waste Description	Waste Type	General Disposal Method
Offices	Computers and other electronic wastes, fluorescent lights	Recycle	Off-site recycling or disposal
	Waste paper	Combustible/ non-hazardous	Incineration
Wastewater treatment facility	Biological sludge (dried solids)	Combustible/ non-hazardous	Incineration / Landfilling
Maintenance complex	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, tires, rubber, plastic	Inert	Inert landfill
Laboratory	Chemical laboratory wastes, toxic substances	Hazardous	Off-site recycling or disposal
Domestic waste from construction camp, accommodation facility and kitchens/canteens	Accommodation facility garbage, food wastes	Combustible/ non-hazardous	Incineration
Inert waste from construction sites and materials from operations	Treated wood, plastics, cement, sand, used construction materials, metal, pipes, glass, insulation, etc.	Inert	Landfill
	Untreated wood / cardboard	Combustible/ non-hazardous	Incineration / open burning
Medical facility	Biomedical wastes	Hazardous	Biomedical off-site disposal
Incinerator	Ash (placed in closed drums)	Inert	Inert Landfill (if non-hazardous)
Fuel spill	Hydrocarbon-contaminated soil	-	On-site treatment using landfarm facility
Fuel spill	Hydrocarbon-contaminated snow/water/ice	-	On-site treatment and reuse of product if practical

Table 4.2: Waste Quantities

Non-Hazardous Solid Waste Generation Estimate										
Project Phase and Location	Time Period	On Site Personnel [1]	Total Waste Generated (excluding sludge and ash)[2]	Incineration Waste			Inert Landfill Waste			
				Waste Stream - Suitable for Incineration	Sewage Sludge Cakes [6]	Total Waste Incinerated	Waste Stream - Suitable for Landfill	Inert Wastes[6]	Ash[7][9]	Total
			(tonnes)					(m^3)		
CONSTRUCTION PHASE[3]										
Mine Site Camp	Daily (avg)	1200	6.72	2.24	0.44	2.68	4.48	11.20	0.67	11.87
	Annual	1200	2453	818	162.1	980	1635	4088	245	4333
	Total[7] (4 years)		9811	3270	648.2	3919	6541	16352	980	17332
Steensby Port Camp	Daily (avg)	600	3.36	1.12	0.22	1.34	2.24	5.60	0.34	5.94
	Annual	600	1226	409	81.0	490	818	2044	122	2166
	Total[7] (4 years)		4906	1635	324.1	1959	3270	8176	490	8666
Milne Port Camp	Daily (avg)	165	0.92	0.31	0.06	0.37	0.62	1.54	0.09	1.63
	Annual	165	337	112	22.3	135	225	562	34	596
	Total[7] (4 years)		1349	450	89.1	539	899	2248	135	2383
Rail Camp (Ravn River)[8]	Daily (avg)	200	1.12	0.37	0.07	0.45	0.75	1.87	0.11	1.98
	Annual	200	409	136	27.0	163	273	681	41	722
	Total[7] (4 years)		1635	545	108.0	653	1090	2725	163	2889
Rail Camp (Mid Rail)[8]	Daily (avg)	200	1.12	0.37	0.07	0.45	0.75	1.87	0.11	1.98
	Annual	200	409	136	27.0	163	273	681	41	722
	Total[7] (4 years)		1635	545	108.0	653	1090	2725	163	2889
Rail Camp (North Cockburn)[9]	Daily (avg)	200	1.12	0.37	0.07	0.45	0.75	1.87	0.11	1.98
	Annual	200	409	136	27.0	163	273	681	41	722
	Total[7] (4 years)		1635	545	108.0	653	1090	2725	163	2889

Non-Hazardous Solid Waste Generation Estimate										
Project Phase and Location	Time Period	On Site Personnel [1]	Total Waste Generated (excluding sludge and ash)[2]	Incineration Waste			Inert Landfill Waste			
				Waste Stream - Suitable for Incineration	Sewage Sludge Cakes [6]	Total Waste Incinerated	Waste Stream - Suitable for Landfill	Inert Wastes[6]	Ash[7][9]	Total
			(tonnes)					(m^3)		
Rail Camp (South Cockburn)[9]	Daily (avg)	300	1.68	0.56	0.11	0.67	1.12	2.80	0.17	2.97
	Annual	300	613	204	40.5	245	409	1022	61	1083
	Total[7] (4 years)		2453	818	162.1	980	1635	4088	245	4333
Construction Total			**20971**	**6990**	**1386**	**8376**	**13981**	**34952**	**2094**	**37046**
OPERATION PHASE(4)										
Mine Site Camp	Daily (avg)	475	2.66	1.33	0.18	1.51	1.33	3.33	1.51	4.83
	Annual	475	971	485	64.1	550	485	1214	550	1763
	Total[7] (20 years)		19418	9709	1283.0	10992	9709	24273	10992	35264
Steensby Port Camp	Daily (avg)	175	0.98	0.49	0.06	0.55	0.49	1.23	0.55	1.78
	Annual	175	358	179	23.6	202	179	447	202	650
	Total[7] (20 years)		7154	3577	472.7	4050	3577	8943	4050	12992
Operation Total			**26572**	**13286**	**1756**	**15042**	**13286**	**33215**	**15042**	**48257**

[1] Maximum populations were assumed to be carried year round to be conservative
[2] Disposal Rate of 5.6 kg/day - Cold Region Utilities Monograph, 3rd edition, pg 14-16 1996
[3] Assumed 1/3 of waste stream is suitable for incineration, 2/3 suitable for landfill during construction phase due to high amounts of packaging waste during construction
[4] Assume 1/2 of waste stream is suitable for incineration, 1/2 suitable for landfill during operation phase as per Meadowbank Landfill Management Plan, 2008
[5] Estimated sewage sludge production at 0.37 kg/person/day based on Draft EIS Appendix 10D-3, Seprotech specification
[6] Estimated waste density was assumed as 0.4 tonnes/m^3 for moderately compacted solid waste - AMEC Earth & Environmental. Victor Diamond Mine Project Comprehensive Study. Waste Management Addendum Jan 18 2005
[7] Estimated ash density was assumed as 1.0 tonnes/m^3 - AMEC Earth & Environmental. Victor Diamond Mine Project Comprehensive Study. Waste Management Addendum Jan 18 2005
[8] Assume all waste suitable for landfill goes to Mine site
[9] Assume all waste suitable for landfill goes to Steensby Port
[9] Assume 95% volume reduction, 200 kg/m^3 density for non-compacted waste

Table 4.3: Estimated Domestic Solid Non Hazardous Waste [1]

Waste	Waste Description	Disposal Method	Est. Total Annual Production (tonnes)
Construction Phase			
Organic	Kitchens	Incinerator	6172
Paper	Packaging/Offices	Incinerator/On-site landfill	1769
Plastic	Offices/Camps	Incinerator[2]/On-site landfill	1265
Cardboard	Packaging/Camps	Incinerator	1347
Cloth	Camps	Incinerator	410
Multi-Material	Packaging/Camps	Incinerator/On-site landfill	293
Metal	Packaging	On-site landfill	176
Glass	Camps	On-site landfill	164
Wood	Packaging	Incinerator	117
Operation Phase			
Organic	Kitchens	Incinerator	7002
Paper	Packaging/Offices	Incinerator/On-site landfill	2006
Plastic	Offices/Camps	Incinerator[3]/On-site landfill	1435
Cardboard	Packaging/Camps	Incinerator	1528
Cloth	Camps	Incinerator	465
Multi-Material	Packaging/Camps	Incinerator/On-site landfill	332
Metal	Packaging	On-site landfill	199
Glass	Camps	On-site landfill	186
Wood	Packaging	Incinerator	133

[1] Composition based in part on 2011 Mary River Waste Audit results (Aug 27 - Aug 29), Assume 50% of waste generated to be domestic

[2] Poly-chlorinated plastics will be sorted out of waste stream and sent to landfill and will not be incinerated

Table 4.4: Estimated Hazardous Waste [1]

Waste	Waste Description	Disposal Method	Est. Total Annual Production (tonnes)
Construction Phase			
Waste oils and fluids	Maintenance	Shipped off Site	133
Batteries	Maintenance	Shipped off Site	13
Spent activated carbon	Domestic	Shipped off Site	13
Aerosol containers	Misc.	Shipped off Site	8
Empty compressed gas cylinders	Misc.	Shipped off Site	minimal
Kitchen grease	Kitchen	Shipped off Site	57
Crushed drums / plastic pails	Misc.	Shipped off Site	26
Spoiled CaCl	Drilling	Shipped off Site	4
Operation Phase			
Waste oils and fluids	Maintenance	Shipped off Site	76
Batteries	Maintenance	Shipped off Site	7
Spent activated carbon	Domestic	Shipped off Site	8
Aerosol containers	Misc.	Shipped off Site	5
Empty compressed gas cylinders	Misc.	Shipped off Site	minimal
Kitchen grease	Kitchen	Shipped off Site	33
Crushed drums / plastic pails	Misc.	Shipped off Site	15
Spoiled CaCl	Drilling	Shipped off Site	3
Contaminated Soils or Snow to Landfarm during all phases (m^3)[2]			
Soils contaminated with Hydrocarbon	Fuel spill	On-site treatment (landfarm)	8400
Water/ice/snow contaminated with HC	Fuel spill	On-site treatment (landfarm)	25200

1 Composition based on Canutuec Hazardous Waste Shipment Manifest from Mary River Project 2011

2 Assume 350 m^3 of contaminated soil 1/4 of the year, Landfarm Design and Management Plan, Meadowbank Mine (Golder, 2007)

3 Assume 350 m^3 of contaminated snow/ice 3/4 of the year, Landfarm Design and Management Plan, Meadowbank Mine (Golder, 2007)

4.3 Waste Flow

Visual representations of waste flows are presented in Annex as block flow diagrams. Waste streams are described and their respective storage and treatment paths are demonstrated. Diagrams are provided for construction and operation phase for the Mine Site and Steensby Port. Diagrams are provided for construction phase for Milne Port, Mid-Rail Rail Camp, Ravn River Rail Camp and Cockburn Lake Rail Camp.

4.3.1 Generation Points

Waste will be sorted and collected at all major generation points at each project site (Mary River, Steensby Port, Milne Port, and Rail Camps) according to the Mary River Project Waste Sorting Guidelines (Annex 6). Disposal will occur in appropriately labelled receptacles based on disposal methods and waste sorting guidelines. This will ensure waste types are disposed of in the correct methods as outlined in table 4.1. Waste will be stored indoors or in secure wildlife proof receptacles prior to collection.

4.3.2 Waste Collection

Waste will be collected from generation points on a daily basis by a waste collection vehicle(s) and taken the appropriate waste handling facility for treatment and/or final disposal as shown in Annex 1. Waste will be collected by personnel trained in waste handling guidelines and personnel will use visual inspection to ensure waste types are taken to the appropriate treatment or disposal location.

4.3.3 Temporary Waste Sorting and Processing Facilities (during Construction Phase only)

Temporary waste management facilities will be constructed at all sites (Mary River, Steensby Port, Milne Port, Ravn River Rail Camp, Mid Rail Rail Camp and South Cockburn Lake Rail Camp for use only during the construction phase. These facilities will consist of:

- A secure central depot where waste generated across the site will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for transportation to disposal site as per Block Flow Diagrams in Annex 1
- All wildlife attracting wastes such as organics, sewage waste or petroleum based chemicals will be stored animal proof containers inside a secured area that will be monitored

As much as possible and practical, the various waste streams will be sorted at the source according to the Mary River Project Waste Sorting Guideline (Annex 6)

4.3.4 Permanent Waste Sorting and Processing Facilities

Permanent waste management facilities will be constructed at Steensby Port and the Mine Site. These facilities will consist of a heated all season building and adjacent laydown areas that provide the following capabilities, functions and / or facilities:

- A central depot where waste generated across the site will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for sealift or reuse on site
- The waste management facility has a poured concrete floor with large doors for transferring waste in and out plus an adjacent office for the waste management technician
- Waste oil storage tank adjacent to facility with waste oil filtering process inside and temporary storage for filtered or unfiltered oil
    - The filtered waste oil will be used for waste oil burners used to heat select facilities on site which include the waste management facility itself, truck warming shed, etc. Waste oil can also be blended into fuel for certain operations.
- Oil filter draining and crushing facility
- Drum crushing machine
- Strapping and plastic wrap capabilities
- Label making capabilities.

As much as possible and practical, the various waste streams will be sorted at the source according to the Mary River Project Waste Sorting Guideline (Annex 6).

All food waste and other animal attractants (greases, glycol based antifreeze) will be stored inside of the facility prior to incineration to avoid the attraction of wildlife.

Table 4.5: Mary River Project Waste Management Facility Summary

Location	Facility Type	Components	Function
Milne Port	Temporary - Waste Management Facility	• Secured laydown area • Heated building • Incinerator • secure hazardous waste storage area • Used tire storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
Milne Port	Landfarm	• Landfarm facility	See Annex 5.
Mine Site	Temporary - Waste Management Facility	• Secured laydown area • Secure hazardous waste storage area and containers • Animal proof containers for storage of animal attracting waste	A secure central depot where waste generated across the site will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for transportation to disposal or treatment locations
Mine Site	Landfarm	• Landfarm facility	See Annex 5.
Mine Site	Landfill	• Licensed Landfill facility • Access road • Used tire storage area	Disposal of inert, non-combustible waste and non-hazardous wastes.
Mine Site	Permanent - Waste Management Facility	• Secured area, • heated building, • incinerator, • secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
Steensby Port	Temporary - Waste Management Facility	• Secured area, • Secure hazardous waste storage area • Animal proof containers for storage of animal attracting waste	A secure central depot where waste generated across the site will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for transportation to disposal or treatment locations.
Steensby Port	Landfarm	• Landfarm facility	See Annex 5.
Steensby Port	Landfill	• Licensed Landfill Facility • Access road • Used tire storage area	Disposal of inert, non-combustible waste and non-hazardous wastes.
Steensby Port	Permanent - Waste Management Facility	• Secured area, • Heated building, • Incinerator, • Secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
Ravn River Rail Camp	Temporary - Waste Management Facility	• Secured area, • Incinerator, • secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed,

Location	Facility Type	Components	Function
			packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
Mid Rail Rail Camp	Temporary - Waste Management Facility	• Secured area, • Incinerator, • secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
North Cockburn Lake Rail Camp	Temporary - Waste Management Facility	• Secured area, • Incinerator, • secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.
South Cockburn Lake Rail Camp	Temporary - Waste Management Facility	• Secured area, • Incinerator, • secure hazardous waste storage area	A central depot where hazardous waste and waste suitable for incineration generated across the site will be managed properly processed, packaged, labelled, inventoried, and treated and/or stored for disposal on site or off site as appropriate.

4.4 Waste Handling and Minimization by Category

The Waste Management Plan is designed to ensure that a sound waste management program which focuses on the principles of reduction/recovery/reuse/recycling is implemented. The following are examples the Mary River Project will undertake to minimize the amount of waste being generated on Project sites and ensure proper handling.

4.4.1 Vegetation less than 80 mm Diameter, Grubbed Material and Soil

There will be a need during and at the completion of construction for revegetation of disturbed areas, which will typically have little or no topsoil after disturbance. Non-salvageable timber along with shrubs and other small woody plants shall be chipped and mixed in with the grubbed material to be used on an ongoing basis as soil cover and to stabilize disturbed slopes. Material will be stockpiled, for use when restoring the major areas, including the temporary camp sites and laydown areas. Stockpile(s) will be located to avoid drainage into the stockpile and to collect any seepage from the stockpile for analysis and treatment if necessary. Any such material not required for site restoration can be used in the landfill as final cover material.

4.4.2 Other Spoils Removed During Excavation

Every effort will be made during the design to balance the cut and fill requirements. However most of the fill area has requirements for stability of materials that will preclude the use of some of the excavated materials. Such materials will be disposed of in one of the designated Disposal Sites or used in other applications as much as possible.

4.4.3 Nonhazardous Waste Materials Generated During Construction Operations

A large amount of material will be generated during the construction operation, including packing materials, containers, temporary supports and general construction debris, used tools and pieces of construction material.

It is anticipated that some of the contractors generating this waste will carry out their own salvage of economically worthwhile recyclables, particularly ferrous metals and copper, where a ready market exists. Typically tires, where the casings are sound, are retreaded for ongoing use, reducing the materials requiring final disposal.

In some cases large amounts of a single waste product will be produced, that can be readily source separated. Specific items identified at this time include:

- Timber **-** generated by unpacking, and from the disposal of temporary supports. Where possible shipments will be bought in on pallets that can be returned for reuse, thereby reducing the waste generated. Where timber waste consists of clean timber of useable size it will be stacked and made available for reuse. Timber that is not reusable will be disposed of via open burning. Note that chemically treated timber shall be separated and, if it cannot be reused, shall be disposed of as a hazardous waste, and shipped off-site.

- Polyethylene film - Film is used in large quantities to wrap and hence protect equipment. It is anticipated that substantial amounts will be generated by unpacking equipment. Opportunities for recycling this material will be explored and if practical the film will be baled and shipped for reuse.

- Steel and other scrap metal waste shall be kept separate from the other solid waste produced during construction. Separation of steel and scrap metal from other solid waste shall be the responsibility of site personnel handling the materials. If economically worthwhile steel and other scrap metal waste will be shipped off site for recycling.

- Recyclable materials shall be placed in appropriate recycling bins or on pads by site personnel. Containers shall be clearly marked and have signage reminding all workers of what is recyclable and what is not. Recycling bins shall be placed alongside garbage bins to promote recycling habits.
- All other nonhazardous waste material will be separated at source into categories, based on potential for recycling, such as metal containers, water bottles, corrugated board, and the need for segregation for final disposal, such as tire casings.
- During the course of the project, opportunities will be explored to expand the list of recyclables, particularly for wastes generated in large quantities. Recyclable materials shall be placed in appropriate recycling bins by site personnel. Containers shall be clearly marked and have signage reminding all workers of what is recyclable and what is not. Recycling bins shall be placed alongside garbage bins to promote recycling habits.
- All sites will be provided with, at fixed locations, separate containers/areas for each type of waste to be separated, and dispose of to a recycling facility off site, hazardous waste facility off-site, landfill, or incinerator. The containers will be located in convenient locations to encourage utilization, and will be protected by fencing, to catch any wind blow generated during transfer of waste to the containers.
- Each contractor will be responsible for bringing all of the waste collected on their site to the provided waste containers.

- In locations where organic (food) waste will be generated, a separate container will be provided for this waste, secure against animal access. These organic waste containers will be emptied each day, and the waste will be treated using incineration.

4.4.4 Unset Concrete and Concrete Wash Water from Mixing and Transportation of Concrete

During the major works, concrete will be provided from a batching plant located at the construction laydown area. Waste concrete will arise from off-spec mixes, residual concrete at the end of a pour, and from wash down of the 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 and decant; and analysis, and if necessary pH adjustment, prior to discharge will occur.

All fresh concrete and concrete product waste to be disposed of onsite shall be disposed of in the concrete waste pond. No concrete truck shall be cleaned anywhere else onsite. Waste hardened concrete will be either used as fill or disposed of in one of the onsite landfills.

4.4.5 Camp Site Waste

During peak of construction camps will provide housing for up to 2900 of personnel across the project and provide meals and other domestic support facilities. Wastes generated from this operation will be similar to normal residential domestic garbage, with a higher percentage of organic (food) wastes.

The operation of the camp site will be by a contractor, who will have responsibility for the management, including source separation and disposal, of all waste generated on site. Recyclables will be consolidated and disposed of to the Contractor supplied containers, and the remaining waste transported and disposed of to as per Annex1 by the Camp Contractor, using appropriate vehicles, equipped to stop any loss of either liquid or wind-blow during transportation.

The camp contractor will be required to collect all waste in secure containers, and to remove organic (food) waste daily. All containers containing food waste or items potentially contaminated by food shall be secure against animal access.

4.4.6 Sewage Generated at the Various Working Locations and at the Rail Camp Sites

Sewage will generate at all sites, throughout the period of construction and operation. During the period from beginning of construction until facilities are available, all sewage generated on site, will be collected in holding tanks, which will be pumped out for disposal once facilities become available. The trucks used for transport will be sealed and the unloading facility designed to minimize odor generation during waste transfer operations.

4.4.7 Hazardous Waste

Hazardous Waste handling is described in the Mary River Project Hazardous Waste Management Plan (H337697-0000-07-126-0002).

4.4.8 Other Miscellaneous Materials, or Items that No Longer Have Economic Value

During the operation miscellaneous tools, used parts, clothing etc will be discarded. Items requiring special handling should be dealt with by the generator either by disposal or breakdown into readily handled components to be treated in accordance with the previous sections.

Parts should be drained of oil or other liquids before disposal, with the drained fluids being disposed of as per Mary Rive r Project Hazardous Waste Management Plan (H337697-0000-07-126-0002).

4.4.9 Office Paper

All white paper waste generated at the office site shall be collected in secured bins for shredding and disposal. Paper waste generated elsewhere shall be placed in a waste disposal bin by site personnel. To reduce the amount of paper waste generated on site the following list of procedures could be developed and implemented:

- Distribute electronically – Electronic forms increase the amount of desk/shelf space available.
- Double Sided Printing – When practical ensure all documents are double sided.
- 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.
- Copier Maintenance – Only allow qualified personnel to provide maintenance to all copiers and printers.

4.5 Incinerators

The main disposal method for combustible non-hazardous wastes generated on-site will be incineration. This method will eliminate problems associated with odours attracting wildlife, or the creation of poisonous or flammable gases through the decomposition of putrescible materials.

Incinerators for the Project are proposed as follows in Table 4.6:

Table 4.6: Incinerator Allocation

	CONSTRUCTION		OPERATION			COMMENTS
	Waste Produced Suitable for Incineration	Units	Waste Produced Suitable for Incineration	Units	Capacity (t)	
Mine Site	2.68	2 ton (x1), 1 ton (x1)	1.51	2 ton (x1)	2	Less one 1 ton unit after construction
Steensby Port	1.34	1 ton (x2)	0.55	1 ton (x1)	1	Less one 1 ton unit after construction
Milne Port	0.37	1 ton (x1)	0.00	-	-	Milne is temporary facility only for construction
Ravn River	0.45	1 ton (x1)	0.00	-	-	Camp is temporary facility only for construction
Mid Rail	0.45	1 ton (x1)	0.00	-	-	Camp is temporary facility only for construction
North Cockburn	0.45	1 ton (x1)	0.00	-	-	Camp is temporary facility only for construction
South Cockburn	0.67	1 ton (x1)	0.00	-	-	Camp is temporary facility only for construction

The locations of the incinerators are shown in Annex 2.

The specifications for the proposed incinerators are presented in Annex 3.

All incinerators will 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 will be brought on-line as required to meet the Project's needs during the construction phase.

Waste that is destined for the incinerator will be segregated as part of operating procedures to ensure that only appropriate materials will be incinerated. Biomedical waste, hazardous wastes, non-combustible materials, or treated wood products must not be incinerated. The incineration of plastics will be minimized to the maximum extent practicable. Incineration of some food-related and other plastics is unavoidable; however, best efforts will be made to reduce volumes of potentially dioxin/furan related plastics during the procurement process.

All incinerator systems will operate in accordance with the Environmental Guideline for the Burning and Incineration of Solid Waste by the Department of the Environment, Government of Nunavut, 2010. This included all regulatory guidelines, operating procedures and best management practices whenever feasible.

4.5.1 Personnel Training Programs for Incinerator Operation

Only trained personnel will operate the incinerator(s), and operating manuals will be provided (see example in Annex 3), including standard operating procedures. The incinerator manufacturer will be requested to provide on-site specialized training as required.

4.5.2 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 technology or waste diversion practices. The following emission standards apply to 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 and modified burn barrels have not been established.

For existing, new or expanding solid waste incinerators the maximum concentration (corrected to 11% oxygen at stack) of dioxins, furans and mercury in the exhaust gases from the stack are provided in Table 4.7

Table 4.7: 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 25oC 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. 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.

Air monitoring for dioxins, furans, and mercury will be conducted on an as-required basis based on applicable federal and territorial standards and guidelines. Guidelines also exist for sulphur dioxide and total suspended particulates, which may be analyzed as a ‘best management practice.

Routine inspections and monitoring will be undertaken on incineration facilities as required. Details of the incinerators are provided in Annex 3.

4.5.3 Ash Disposal

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 always be exercised when handling ash because of its physical (i.e. glass, nails) and chemical hazards. Closed or covered containers will be used when moving or transporting bottom ash from the incinerator to the final disposal site. This will minimize physical contact with the ash and any release of fine ash particles to the environment. Bottom ash will only be handled once completely cooled.

Bottom ash from the open burning of paper, paperboard packing and untreated wood waste or unburned materials from modified burn barrels used to burn paper, paperboard packing, untreated wood, food waste, food packaging and natural fibre textiles is suitable for burial in a designated pit or municipal landfill.

Ashes from the incineration process will be buried within a designated area of the landfill. A Toxicity Characteristic Leaching Procedure (TCLP) analysis will be conducted on ash as required prior to disposal in the landfill. Ash that does not meet guidelines following TCLP analysis will be treated on-site if possible or transported for off-site disposal at an appropriate facility. The TCLP Procedure Test method 1311 (US EPA) will be 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.

4.5.4 Monitoring During Operation

Monitoring of the incinerators will be conducted in conjunction with other monitoring program required for the Project. Specifically, incinerator monitoring will include incinerators will be inspected for signs of leakage, 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 operation of incinerators will be monitored using on-line instruments capable of continuously measuring the combustion process and stack emission; this included the 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.

Continuous emissions monitoring will also be used at all permanent incinerator units. In-stack monitoring provides the operator with information on the combustion process and on pollutants being released to the environment and help detect if operating conditions malfunction and contaminates enter the environment (i.e. hydrogen chloride, dioxins, furans, mercury).

Each process and in-stack monitor will be equipped with visible and audible alarms to warn operators of poor incinerator operation.

Written records will be kept by incinerator operators of what waste is burned, when and how much.

Other record keeping requirements 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 will be maintained on-site throughout the operational life of the facility and be made available to Inspectors and other regulatory officials upon request.

4.6 Inert Landfill

A central inert landfill has been constructed near the Mine Site. The landfill design was submitted to the NWB for approval before construction, as required by the water license. The landfill is used for disposal of inert, non-combustible waste only (plastics, cement, sand, used construction materials, scrap metal, pipes, glass, etc.). Non-hazardous waste, including ashes from the incineration process, and waste which cannot be salvaged or incinerated, will be deposited in this site. Ash will only be disposed of following receipt of TCLP analysis that meets acceptable standards. There will be no disposal of food waste, hazardous materials, paper products or biomedical waste in the landfill. A secondary landfill will be constructed at the Steensby Port site. The locations of these landfills are shown in

Details of the Landfill design and closure are provided in Annex 5. The quantities of inert waste expected are presented in Table 4.2.

4.6.1 Landfill Operation

Landfill operation will be performed under the same guidelines at both the Mine Site and Steensby Port landfills. As is presently the practice, the landfill will be operated by trained personnel who will carry out regular inspection and monitoring of the facility. An operation and maintenance manual approved by the NWB will direct landfill operations. This manual will include:

- A general description of how the landfill is to be operated and maintained
- A proposed schedule for when specific operating and maintenance activities are to be conducted (i.e., seasonal surface water sampling, routine visual inspection, berm inspections, etc.)
- A list of who is responsible for completing each item scheduled
- Location of the landfill and proximity to receiving waters
- A description of the cover material to be used as well as the source of the material and how it will be placed
- Runoff and drainage control within and around the landfill, including erosion and sediment control and proposed restoration measures for erosion which occurs
- Treatment measures for contaminated drainage (although this is not seen as an issue)
- Prevention of windblown debris (although this is not seen as an issue)
- Method and frequency of site maintenance.

The manual will assist landfill site operators in establishing a proper waste management system and in ensuring that the system operates efficiently and in compliance with the permits.

4.6.2 Operating Procedure

Regular cover will be applied to reduce the risk of wind-blown debris, and the landfill will be engineered for closure. Open burning of un-treated wood and cardboard wastes may be conducted to reduce volume requirements as permits allow. Routine inspection and monitoring will be undertaken in terms of waste volume, type, source, water seepage, etc.

4.6.3 Placement of waste

The area method will be used to place the waste in the landfill. Once the first layer is completed and covered, a second layer will be formed. The following measures will be taken during the landfill operation:

- Compaction of waste will be undertaken typically once per week or in combination with collection frequency, depending on the nature of the waste. Generally the waste will be worked and compacted as they are dumped.
- Operations will be undertaken to minimize close-out requirements.
- Cover material will be placed to a thickness of 0.1 m between cells, 0.3 m on the surface of cells, and, 1.5 m for closure.

4.6.4 Monitoring during operation

Monitoring of the landfill will be conducted in conjunction with other monitoring program required for the Project. Specifically, landfill monitoring will include:

4.6.4.1 Volume and Waste Composition:

Records will be kept of waste volume / type and cover material placed in the landfill. The annual volume of waste disposed of in the landfill will be determined from these records. The annual volume may be confirmed through the use of survey.

4.6.4.2 Water sampling and soil:

The “Guidance Manual on Sampling and Data Management for Contaminated Sites” (CCME 1993) will be followed for all water and soil quality monitoring. Refer to the Site Water Management Plan for surface water sampling locations and procedures. A soil sampling program will be initiated at several locations around the landfill site(s) prior to construction and after the initial perimeter berm.

4.6.4.3 Ground temperature monitoring:

It is expected that the active layer will progress into the landfill waste and cover material. Ground temperatures are not expected to increase due to the presence of the landfill and the type of waste disposed in it. During regular landfill inspections, signs of ground warming will be monitored by watching for evidence of soil creep.

4.6.4.4 Leachate monitoring:

Leachate production is not expected based on the relatively dry, inert nature of the waste to be placed in the landfill. However, periodic surface water monitoring will allow for the detection of landfill leachate, in the unlikely event leachate is generated.

4.6.4.5 Inspection and maintenance:

Routine visual inspections will be conducted for various components of the landfill, including the berms, fencing (if installed), etc. If required, maintenance will be completed as soon as required. Records will be kept at all inspections and maintenance measures completed and will form part o the annual landfill site report.

4.6.5 Annual Report

An annual report will be completed for the overall project and will include the following information on the landfill:

- Total volume of waste deposited in the landfill site during the previous year
- Progression of the landfill site development, indicating the landfill site location currently in use and areas that have been closed
- Monitoring results
- Remaining life expectancy of the landfill site
- Details of operational problems encountered during the year and the measures taken to resolve the operational problems
- Photographs.

4.7 Hazardous Waste Storage and Disposal

Some of the materials included in the waste streams are classified as hazardous wastes because of the potential risk to human health and safety, property and the environment. Hazardous wastes that will be generated on-site will include, but not be limited to: used oils, solvents and paints, used and/or surplus chemicals, medical wastes, gas cylinders, electronic waste, batteries, light bulbs, and smoke detectors.

Baffinland is responsible for ensuring that all hazardous waste generated on its site will be properly managed from the time it is generated to final disposal. Hazardous waste must be properly stored, transported, treated and disposed. Contractors can manage waste on behalf of Baffinland; however, Baffinland is responsible for ensuring, in advance, that the waste management method is acceptable. All of Baffinland's contractors will be required to submit a Waste Management Plan for their specific activities.

All Hazardous waste will be managed according the Mary Rive r Project Hazardous Waste Management Plan (H337697-0000-07-126-0002).

4.8 In-Site Treatment of Hydrocarbon Contaminated Material

Soils contaminated by hydrocarbons from spills will be salvaged and deposited within a land farm cell for bioremediation. The land farm will initially be approximately 70 m x 100 m in size and no more than 0.3 m deep to ensure the soils are kept within the thermally active zone. The cell will be confined within a berm and underlain by an Arctic geomembrane beneath select fill material. The contaminated soils will be placed and spread during summer months for remediation through natural microbiological and evaporative processes. Soil that has reached acceptable levels of hydrocarbon degradation will be removed and transferred to the landfill. The land farm will be operated in accordance with Nunavut government guidelines. The soil will be turned regularly to provide aeration and promote the remediation process. Inspections and sampling will be done to assess the effectiveness of the cell under different climatic conditions. If the harsh climatic conditions at Mary River inhibit natural biological activity, special bacteria may be introduced. If it becomes evident that effective remediation is still not achievable, Baffinland will source an off-site land farm for disposal.

4.9 Ship waste management

Baffinland will not accept any type of waste originating from a ship. The vessels will be equipped with a sewage treatment plant and an incinerator for solid and liquid wastes. All tanks containing oil or oily waste will be placed in a location in the ship that will keep them separated from clean areas. A diesel fired incinerator for incinerating oil waste and sludge from the sewage plant will be installed in the incinerator room on board.

4.10 Used Tires

Used tires are a major waste stream of mining operations. Used tires will either be stockpiled at Milne or Steensby port facilities for shipment off site (re -treading, re-use, or disposal) or will be disposed on site in the landfill or in a designated location within the footprint of the waste rock pile at a depth that will allow for permafrost aggradations.

4.11 Propylene Glycol

Propylene glycol will be used at Steensby Port and Mine Site airstrips for plane de-icing as will in the heating of project buildings. All storage, handling, use and disposal of propylene glycol will be done in contained areas to avoid spills to the environment. Prior to use propylene glycol will be stored in tightly closed containers or tanks in a cool, dry, well-ventilated area away from incompatible substances. Used propylene glycol will be collected then stored in the waste management temporary storage facilities on site in secured containers for shipment off-site for disposal.

4.12 EPP Procedures Relevant to this Waste Management Plan

The following table outlines the EPP procedures that are relevant to the Waste Management Plan. The EPP is a living document and is subject to on-going updates.

Table 4.8: Content of the EPP Related to the Waste Management Plan

Section	Title / Description
2.5	**Geotechnical Drilling Operations**
2.6	**Equipment Operations**
2.7	**Fuel Storage and Handling**
2.14	**Solid Waste Management**
2.15	**Sewage Treatment**
2.16	**Hazardous Waste Management**
2.17	**Road Construction and Borrow Development**
2.19	**Road Traffic Management**
2.21	**Exploration Drilling Operations**
3.7	**Off-Site Waste Disposal Log**

Section 5: Roles and Responsibilities

The Sustainable Development department is responsible for environmental management, including ensuring compliance with applicable regulations and permit requirements through on-going monitoring, and the development and implementation of operational standards, procedures and employee training. Roles and responsibilities for implementation of the Waste Management Plan are described in **Tables 5.1**.

Tables 5.1: Roles and Responsibilities

Position	Responsibilities
Construction Manager	- Accountable for the environmental performance on site - Establishes goal and targets for environmental performance - Responsible for the implementation of Baffinland Environmental Management Plans
HSE Manager	- Provides direction on environmental issues to the Site Management Team - Staffing of Environmental Department - Supervise / conduct site inspection and audits - Initiate and manage environmental studies as required - Manage external environmental consultants / specialists - Environmental reporting as required by permits and authorizations - Liaise with regulatory agencies on all environmentally related issues - Conducting surveillance of facilities and project waste sites for the presence of wildlife to ensure that predator control measures are effective
Environmental Lead	- Provide specialist advice and input on environmental matters, - Conduct environmental studies and monitoring programs - Conducts audits of operations, as requested - Prepare environmental reports
Contractors / Subcontractors	All contractors / subcontractors are considered equivalent to Baffinland staff in all aspects of environmental management and control, and their responsibilities in this respect mirror those of Baffinland personnel. Contractor personnel will be included in the on-site induction process. The responsibilities of the Contractors / subcontractors include the following: • comply with the requirements of the EPP • conduct regular site checks / inspections to ensure that regular maintenance/enhancements are undertaken to minimize potential environmental impacts • provide personnel with appropriate environmental toolbox / tailgate meetings and training • work cooperatively and proactively with Environmental Coordinator t and Construction Manager to facilitate implementation of the above.

Table 5.2 presents the management team responsible for overseeing implementation of Baffinland's Environmental Management Plans and their contact information.

Table 5.2: Baffinland Management Members and Contact Information

Position	Individual	Telephone Contact	E-mail Contact
On-site Coordinator	**TBD**		
Environmental Superintendant	**TBD**		
Operations Manager	**TBD**		

NOTE: Upon approval of 2012 Work Plan, Baffinland Management Members and Contact information (Table 5.2) will be updated to reflect the organization of BIM and the EPCM contractor on site at the commencement of 2012 Work Plan.

Baffinland's On-Site Co-Coordinators are responsible for enforcement of waste management practices at the Mary River Project. They train and inform site personnel on matters pertaining to waste management practices. He works cooperatively to Baffinland's Environmental Superintendant and reports to the Operations Manager.

5.1 Training Programs

Baffinland will identify and document training needs and deliver the appropriate training to all employees and contractors whose work may impact on the risks to health and safety in the work place and whose work may cause a significant environmental impact. During orientation training, all employees and contractors will be made aware of:

- The importance of conformance with the Waste Management Plan and its procedures
- The risk to the environment and health & safety associated with handling of various types of waste products
- The consequences to the environment, health and safety if there are deviations from specified operational controls
- Best management practices related to waste handling and strategies to avoid attracting wildlife
- Their specific roles and responsibilities in achieving conformance.

Staff and sub-contractors working on site will receive environmental training as part of the Site Orientation, to achieve a basic level of environmental awareness understanding of their obligations regarding compliance with regulatory requirements, commitments and best practices.

Operations and Site Managers and contractor supervisors will be provided this Plan and will receive additional orientation with respect to the requirements outlined. In addition, all supervising level staff and sub-contractors will be provided with the Operational Standards (the EPP and applicable work procedures or work instructions) as written guidance/reference for their work.

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

a) The content of the environmental component of the site induction will include at a minimum:

b) Location of environmental sensitivities

c) Location of additional information on environmental matters

d) Due diligence responsibilities

e) Responsibilities related to waste management, minimizing noise as necessary, road traffic rules, etc.

f) Principles and necessary steps to avoid encounters with bears or other wildlife and what to do if one such encounter occurs

With respect to waste management, Baffinland will have a written training and awareness plan which will consider:

- the differing level of risks and potential consequences associated with different types of wastes
- the different responsibilities, abilities, and literacy of employees
- the culture of the employees
- contractors involved and their relevant experience / expertise
- the trainers, training methods and settings
- training frequency
- documentation of training and evaluation of training.

Baffinland will regularly review and update the training and awareness plan based on changes in training needs and regulatory required training.

5.2 Communication

The types of communications for which members of the team will participate include the following:

a) formal written correspondence and meetings with stakeholders

b) site visits by community representatives

c) design, construction and planning meetings

d) field inspections and monitoring reports disseminated by the Environmental Health & Safety HSE Manager

e) electronic communications

f) tailgate / toolbox meetings

g) formal written correspondence and meetings with government regulatory bodies

h) formal environmental awareness training

Communications will be appropriately recorded and filed for future reference. Where appropriate, the copies of communications will be forwarded to the Operations Manager(s), and Vice President Sustainability.

5.3 External Communications

Effective forms of communication include the proactive notification to external stakeholders of Project activity. Project activity updates will be provided to the communities of north Baffin Island through various means including regular meetings, public notices and radio announcements as appropriate. Baffinland will endeavour to maintain Community Liaison Offices to assist in this regard. Information on waste management will be integral to this external communication effort.

5.4 Construction

During the construction phase of the Project, the EPCM (Engineering Procurement and Construction Management) contractor will be responsible for implementing this Plan. The waste management will take into account the numerous construction sites, volumes and types of waste generated. The organizational structure of the EPCM contractor will reflect the waste management complexity of the construction phase.

5.5 Operation & Closure

During the operations phase, the Maintenance and Warehouse HSE Manager will be responsible for operation of waste management facilities in accordance with this Plan, and subsequent updates to the majority of the Plan. Environmental guidance and monitoring will be the responsibility of the Baffinland Environmental HSE Manager.

Section 6: Performance Indicators, Thresholds, and Incident Response

Periodic inspections of waste management facilities will ensure compliance with this waste management plan. The EPP and associated operations procedures / work instructions outline detailed procedures for handling and storage of fuel, lubricants and other waste materials. These procedures are in place and training will be provided to all employees and contractors on waste handling. Accidental spills are the most likely type of environmental incident to occur while conducting the above mentioned activities. Response procedures, documented in the EPP and the Emergency and Spill Response Plan, are in place to deal with these occurrences.

The ultimate performance indicator for hazardous materials management is the number of incidents of non compliance reported on a daily or monthly basis. Incidents of non-compliance are classified by type and each type entails remedial actions as outlined in Appendix 10A-2: Hazard Identification and Risk Assessment Standard.

Where an investigation triggers a review and update of established EPP procedures, these reviews and update will be carried out in accordance the procedures established by Baffinland`s EHS Framework.

Section 7: Monitoring and Reporting Requirements

7.1 Waste Monitoring

Waste monitoring includes the visual inspection of three main components of the waste management system (described below) and the measurement and recording of all wastes taken off site. The following information will be reported on an annual basis as currently is the practice:

a) The quantities hazardous waste transported off-site for disposal

b) The location and name of the disposal facility for each waste type

c) The date that each was hauled off-site for disposal, for each occasion that these are removed from the site

d) Quantities of non-hazardous inert solid wastes disposed in the landfill.

e) Quantities of hydrocarbon contaminated soils and water processed in treatment facilities.

Inert solid wastes will be stored and disposed in a manner that minimizes the opportunity for wind-blown debris and animal attraction. Any wastes that are shipped off site will be recorded using an Off-Site Waste Disposal Log or equivalent developed from the EPP.

Regular visual inspection of waste management facilities will be conducted by the HSE Manager to ensure proper operation and adequate environmental/health and safety controls are in place.

Waste audits will be undertaken periodically generation points to ensure waste streams are properly segregated

7.1.1 Incinerator Monitoring

Monitoring of the incinerator operation involves ensuring proper operation and that appropriate wastes are incinerated as well as those described in Section 4.1.

7.1.2 Landfill Monitoring

Monitoring of the inert landfill, involves visual inspections to ensure that only inert wastes are deposited in the landfill, and that adequate cover is provided so that wastes are contained and are not being dispersed by the wind. The Waste Disposal Facility (Landfill) Inspection Form is included in the EPP and landfill operating procedures. Wastes will be managed and monitored for compatibility with landfill disposal prior to disposal in the landfill. Also Waste audits will be undertaken periodically at generation points to ensure waste streams are properly segregated and that potential wildlife attractants are diverted from landfill.

A written operations manual has been developed and submitted to the Water Board as part of the landfill design and commissioning process. The operations manual provides the following information:

- a description of the facility and the design
- the maintenance schedule, frequency of inspection of dams, dykes and drainage works
- the operation schedule
- identify the personnel responsible for completion of operations
- the runoff and drainage control within and around the facility and restoration of erosion
- treatment option for contaminated drainage
- the control of effluent discharge and effluent quality
- prevention measures for windblown debris
- management procedures for sorting of waste, along with management of hazardous waste and recyclable materials

7.1.3 Hazardous Waste Monitoring

All Hazardous waste will be monitored according the Mary Rive r Project Hazardous Waste Management Plan (H337697-0000-07-126-0002)

7.2 Operations Monitoring

In addition to specific monitoring and reporting requirements under the regulatory approvals such as the water license, QIA land lease, land use permits, and fisheries authorization as well as monitoring of project effects, the Environmental Lead will coordinate routine inspections of various aspects of the operations. Routine inspections are conducted to confirm overall conformance with the requirements of the Waste Management Plan, companion EPP, and operating procedures / work instructions, and will include inspections of site-based waste management activities.

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

7.3 Data Management

The Environmental Lead is responsible for data management and reporting related to waste management. The data management system includes conducting routine inspections and monitoring, and providing these results to appropriate parties as required.

7.4 Water Licence Reporting

Since waste disposal is regulated by the Nunavut Water Board (NWB) through the water licensing process, there will be monthly water license reporting requirements. An annual Project report will be prepared that addresses requirements specified by the water licence, the Nunavut Impact Review Board (NIRB), and the landowners. Information likely to be included in reporting regarding waste disposal includes:

- GPS coordinates and photographic records of waste disposal facilities and status
- annual geotechnical inspection recommendations from a geotechnical engineer concerning the performance of lined and bermed waste containment structures
- quantities and fate of various types of waste on and off site Any other details on waste disposal requested by the NWB.

Records of waste disposal activities will be available upon request to NWB and landowner's inspectors.

7.5 Stakeholder Reporting

Future arrangements regarding reporting could be made through the Inuit Impact Benefits Agreement (IIBA) or other mechanisms; this will be incorporated in future Plan updates.

Section 8: Adaptive Strategies

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

Housekeeping and operational measures have been instituted. As part of the EPP, work procedures will continuously be adapted with the goal to reduce, recover, reuse and recycle waste. Regular scheduled inspections of waste management facilities along with the non-compliance reporting system described in Section 6 will ensure continual improvement and adaptation of waste management strategies throughout the life cycle of the Project.

As per the requirements of Baffinland`s EHS Management Framework, the company will conduct and document management reviews of its Waste Management Plan on a regular basis. Such reviews will ensure the integration of monitoring results for the waste management plan are integrated with other aspects of the Project and that necessary adjustments are implemented as required. These reviews also provide a formal mechanism to assess the effectiveness of the management in achieving the company's objectives and maintaining on-going compliance with Project permits and authorizations.

Section 9: QA /QC

As per the requirements of Baffinland`s EHS Framework, regular audits will be undertaken to ensure compliance with the current Waste Management Plan and that best management practices are implemented for waste management. The result of these audits will form the basis for an annual written statement of assurance by management on the effectiveness of its Waste Management Plan.

Camp incinerators are installed at each of the camps associated with the Mary River Project, namely Milne Port, Mine Site, Mid-Rail and Steensby. Each of these incinerators utilizes dual chamber, variable air flow design technology and is specifically designed for remote camp operations. QA/QC procedures for air emission monitoring are outlined in the *Air Quality & Noise Abatement Management Plan*.

Section 10: References

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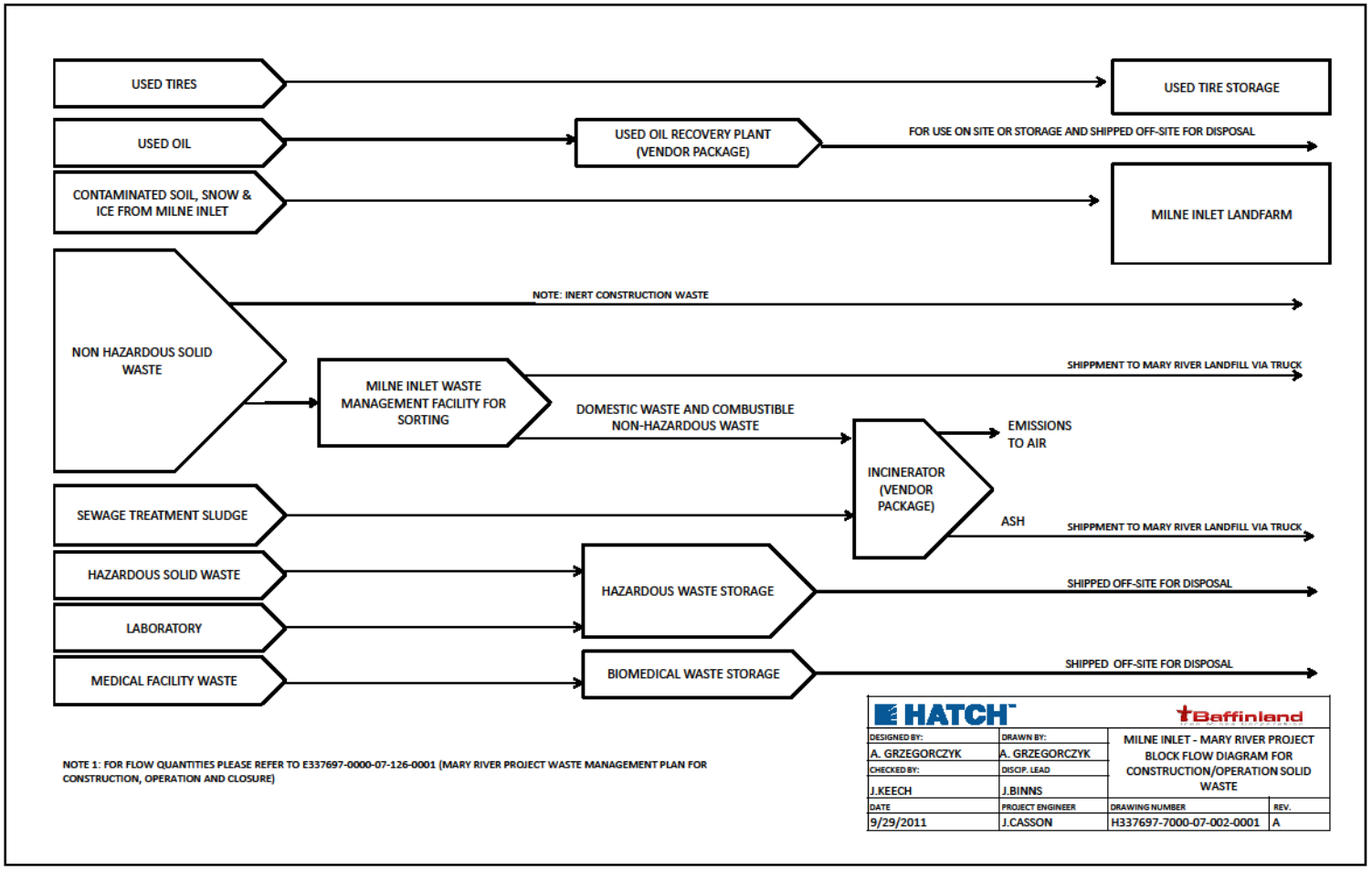
Annex 1

Block Waste Flow Diagrams

H337697-7000-07-002-0001	Milne Port Site Layout
H337697-4210-07-002-0001	Mine Site Layout
H337697-4510-07-002-0001	Steensby Port Site Layout
H337697-7000-07-002-0003	Ravn River Rail Camp Layout
H337697-7000-07-002-2002	Mid Rail Rail Camp Layout
H337697-7000-07-002-0004	North Cockburn Lake Rail Camp Layout
H337697-7000-07-002-0005	South Cockburn Lake Rail Camp Layout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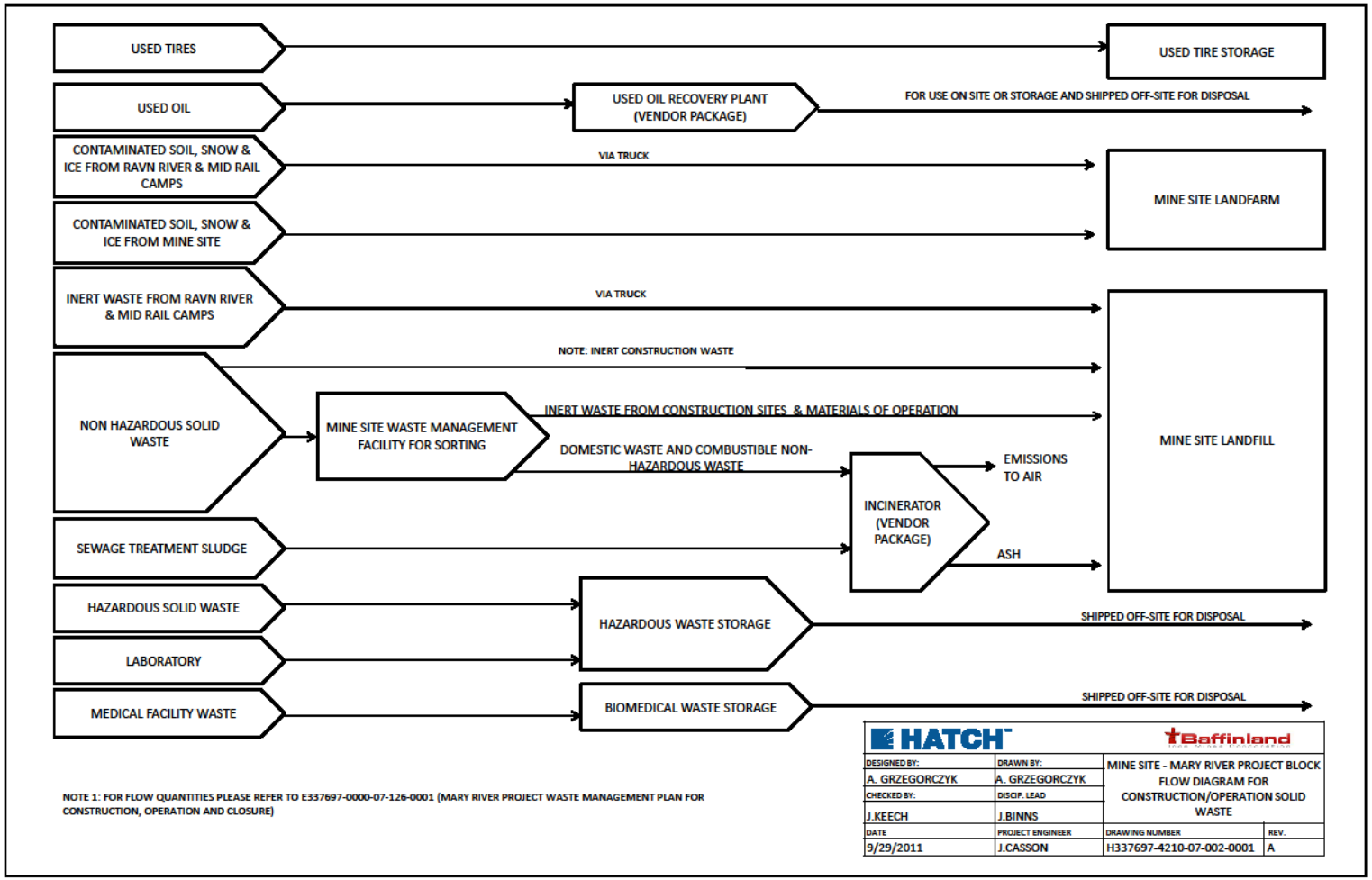
CONTAMINATED SOIL, SNOW & ICE FROM MILNE INLET
MILNE INLET LANDFARM
NOTE: INERT CONSTRUCTION WASTE
NON HAZARDOUS SOLID WASTE
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
MILNE INLET WASTE MANAGEMENT FACILITY FOR SORTING
DOMESTIC WASTE AND COMBUSTIBLE NON-HAZARDOUS WASTE
EMISSIONS TO AIR
INCINERATOR (VENDOR PACKAGE)
SEWAGE TREATMENT SLUDGE
ASH
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
HAZARDOUS SOLID WASTE
HAZARDOUS WASTE STORAGE
SHIPPED OFF-SITE FOR DISPOSAL
LABORATORY
MEDICAL FACILITY WASTE
BIOMEDICAL WASTE STORAGE
SHIPPED OFF-SITE FOR DISPOSAL
NOTE 1: FOR FLOW QUANTITIES PLEASE REFER TO E337697-0000-07-126-0001 (MARY RIVER PROJECT WASTE MANAGEMENT PLAN FOR CONSTRUCTION, OPERATION AND CLOSURE)
HATCH
Baffinland
DESIGNED BY: A. GRZEGORCZYK
DRAWN BY: A. GRZEGORCZYK
CHECKED BY: J.KEECH
DISCIP. LEAD: J.BINNS
DATE: 9/29/2011
PROJECT ENGINEER: J.CASSON
MILNE INLET - MARY RIVER PROJECT BLOCK FLOW DIAGRAM FOR CONSTRUCTION/OPERATION SOLID WASTE
DRAWING NUMBER: H337697-7000-07-002-0001
REV.: A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VIA TRUCK
MINE SITE LANDFARM
CONTAMINATED SOIL, SNOW & ICE FROM MINE SITE
INERT WASTE FROM RAVN RIVER & MID RAIL CAMPS
VIA TRUCK
NOTE: INERT CONSTRUCTION WASTE
NON HAZARDOUS SOLID WASTE
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SEWAGE TREATMENT SLUDGE
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HAZARDOUS SOLID WASTE
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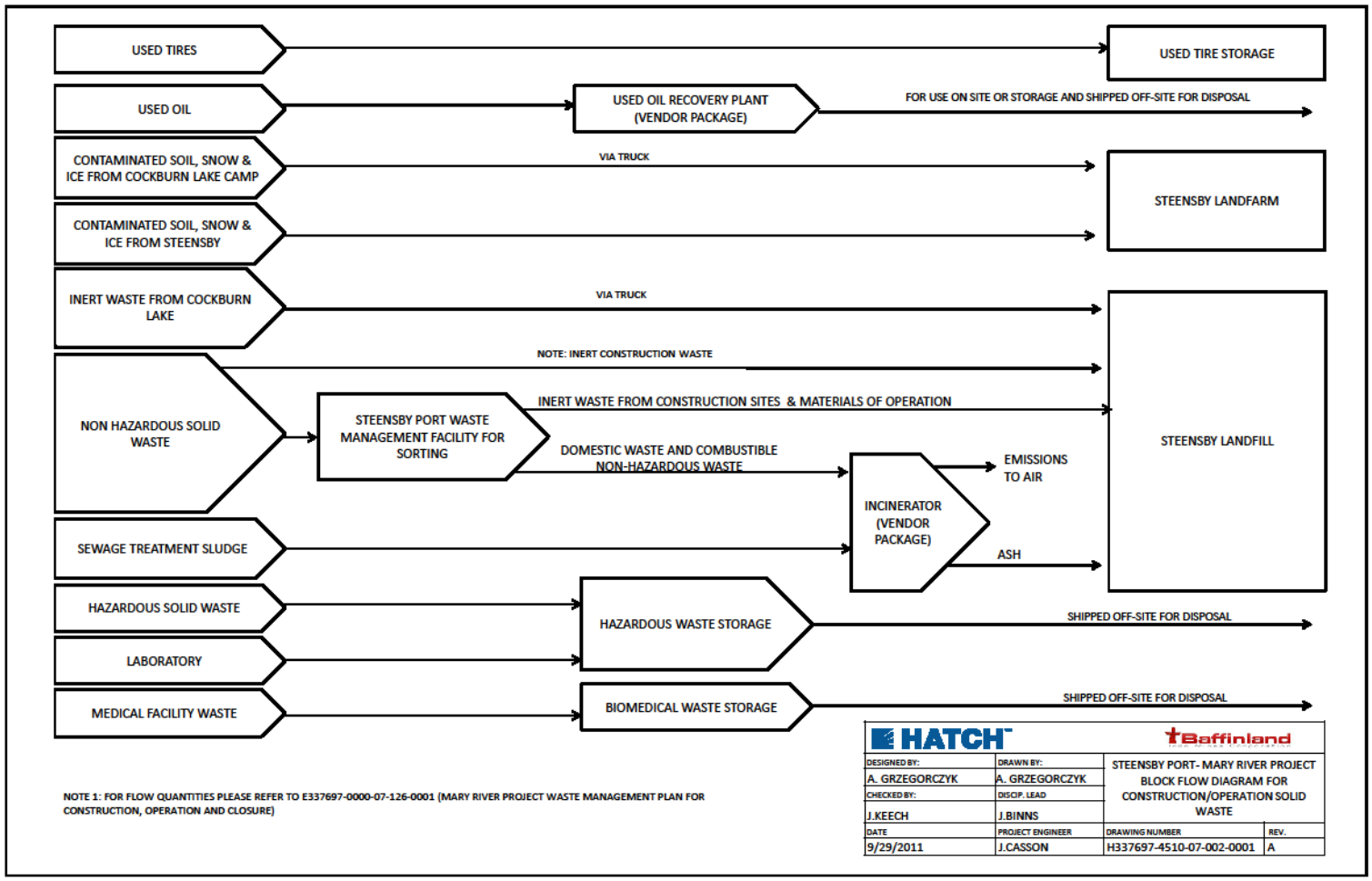
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VIA TRUCK
STEENSBY LANDFARM
CONTAMINATED SOIL, SNOW & ICE FROM STEENSBY
INERT WASTE FROM COCKBURN LAKE
VIA TRUCK
NOTE: INERT CONSTRUCTION WASTE
NON HAZARDOUS SOLID WASTE
STEENSBY PORT WASTE MANAGEMENT FACILITY FOR SORTING
INERT WASTE FROM CONSTRUCTION SITES & MATERIALS OF OPERATION
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HAZARDOUS SOLID WASTE
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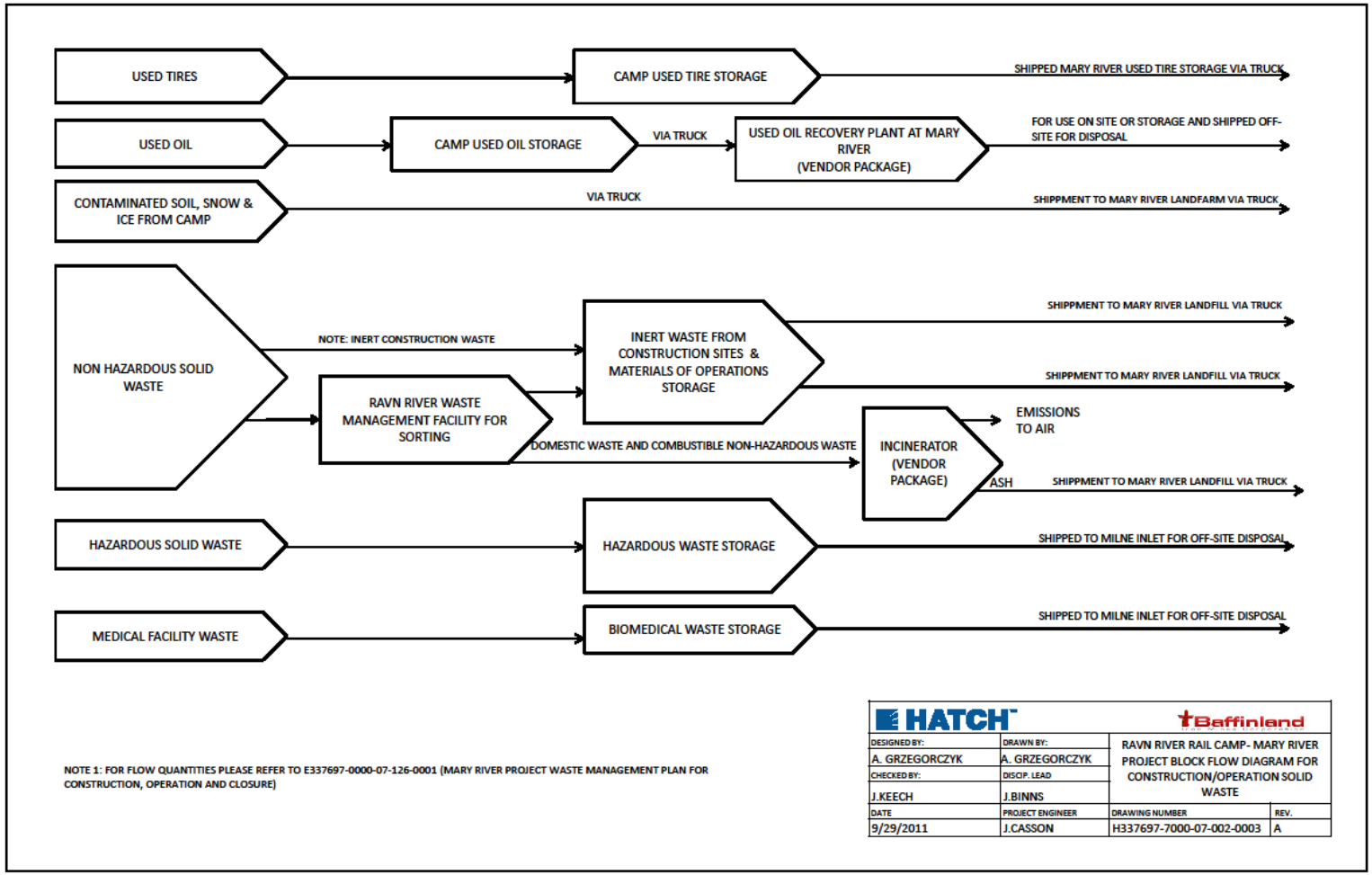
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FOR USE ON SITE OR STORAGE AND SHIPPED OFF-SITE FOR DISPOSAL
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VIA TRUCK
SHIPPMENT TO MARY RIVER LANDFARM VIA TRUCK
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NOTE: INERT CONSTRUCTION WASTE
INERT WASTE FROM CONSTRUCTION SITES & MATERIALS OF OPERATIONS STORAGE
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
RAVN RIVER WASTE MANAGEMENT FACILITY FOR SORTING
EMISSIONS TO AIR
DOMESTIC WASTE AND COMBUSTIBLE NON-HAZARDOUS WASTE
INCINERATOR (VENDOR PACKAGE)
ASH
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
HAZARDOUS SOLID WASTE
HAZARDOUS WASTE STORAGE
SHIPPED TO MILNE INLET FOR OFF-SITE DISPOSAL
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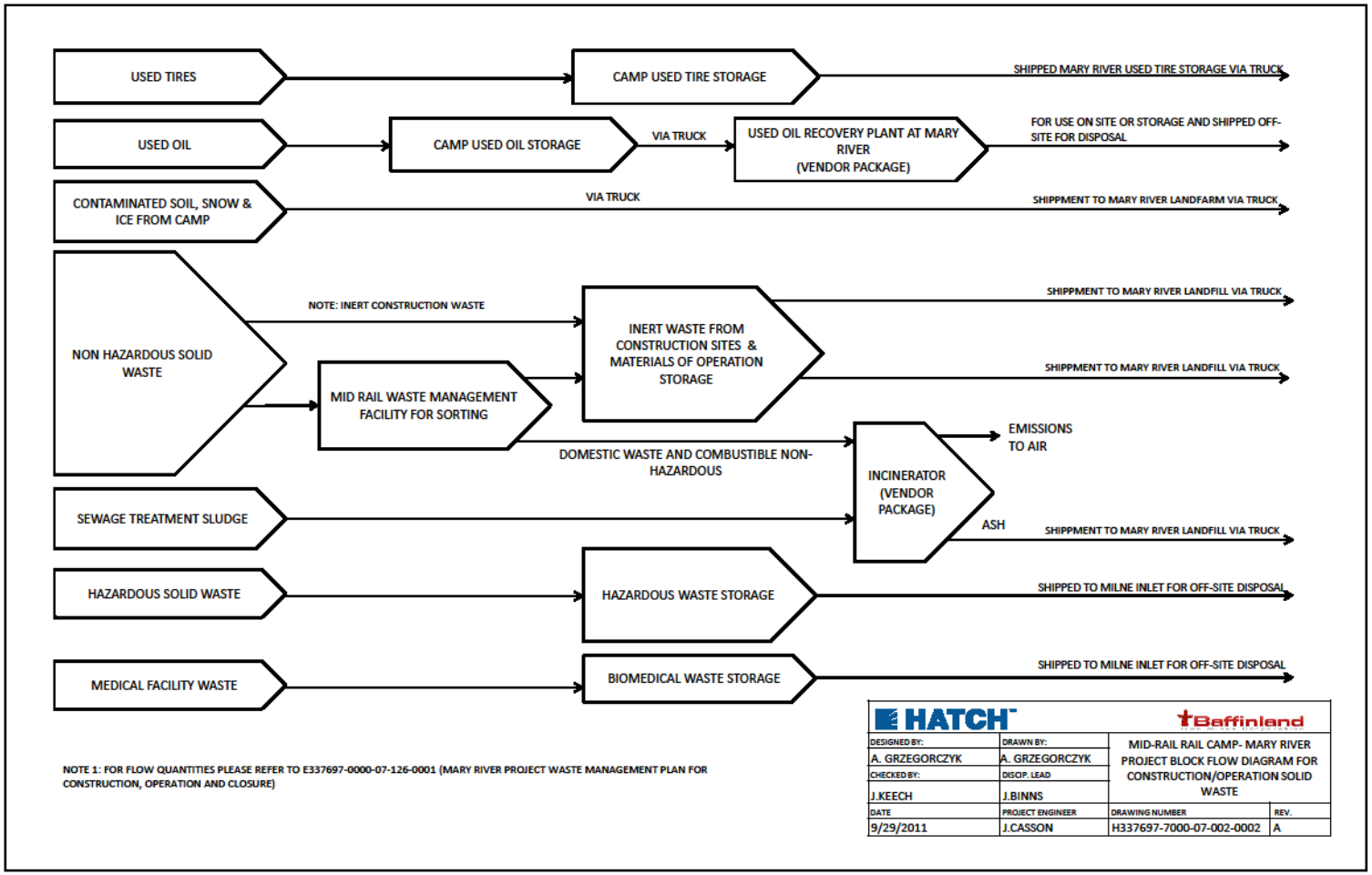
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EMISSIONS TO AIR
DOMESTIC WASTE AND COMBUSTIBLE NON-HAZARDOUS
INCINERATOR (VENDOR PACKAGE)
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ASH
SHIPPMENT TO MARY RIVER LANDFILL VIA TRUCK
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MID-RAIL RAIL CAMP- MARY RIVER PROJECT BLOCK FLOW DIAGRAM FOR CONSTRUCTION/OPERATION SOLID WASTE
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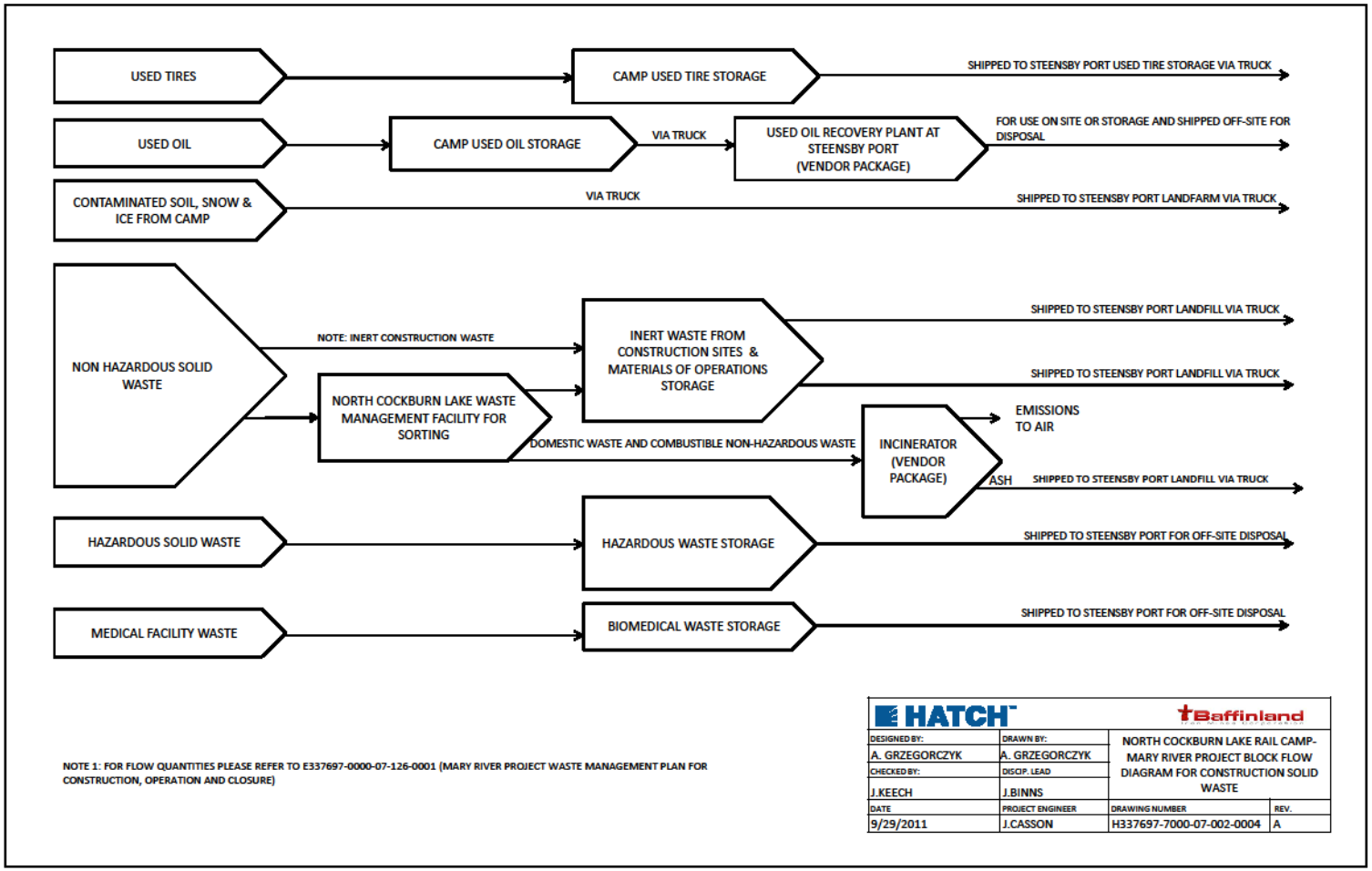
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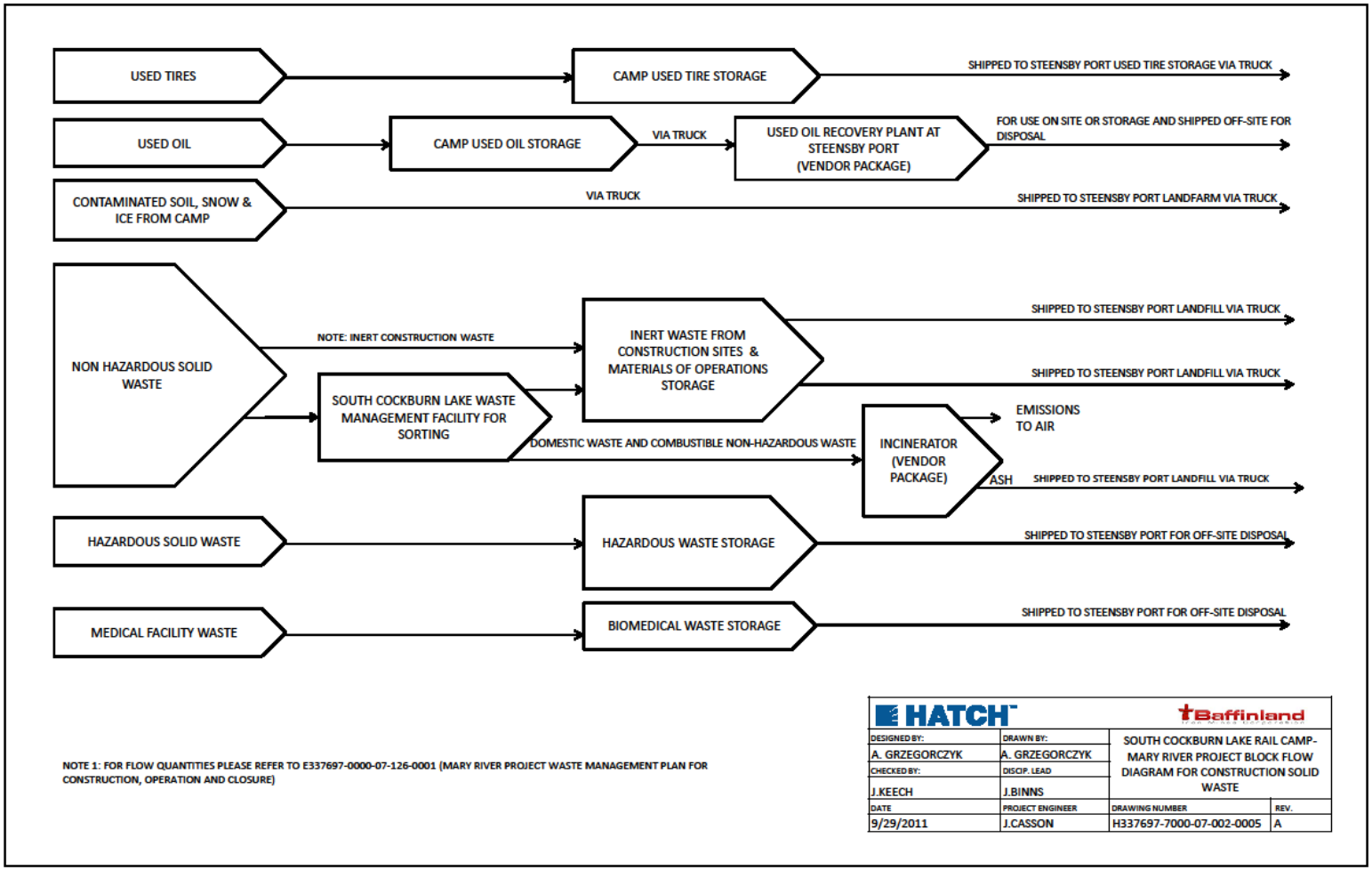
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SHIPPED TO STEENSBY PORT LANDFARM VIA TRUCK
NON HAZARDOUS SOLID WASTE
NOTE: INERT CONSTRUCTION WASTE
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SHIPPED TO STEENSBY PORT LANDFILL VIA TRUCK
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SOUTH COCKBURN LAKE WASTE MANAGEMENT FACILITY FOR SORTING
EMISSIONS TO AIR
DOMESTIC WASTE AND COMBUSTIBLE NON-HAZARDOUS WASTE
INCINERATOR (VENDOR PACKAGE)
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SHIPPED TO STEENSBY PORT LANDFILL VIA TRUCK
HAZARDOUS SOLID WASTE
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DATE: 9/29/2011
PROJECT ENGINEER: J.CASSON
SOUTH COCKBURN LAKE RAIL CAMP-MARY RIVER PROJECT BLOCK FLOW DIAGRAM FOR CONSTRUCTION SOLID WASTE
DRAWING NUMBER: H337697-7000-07-002-0005
REV.: A

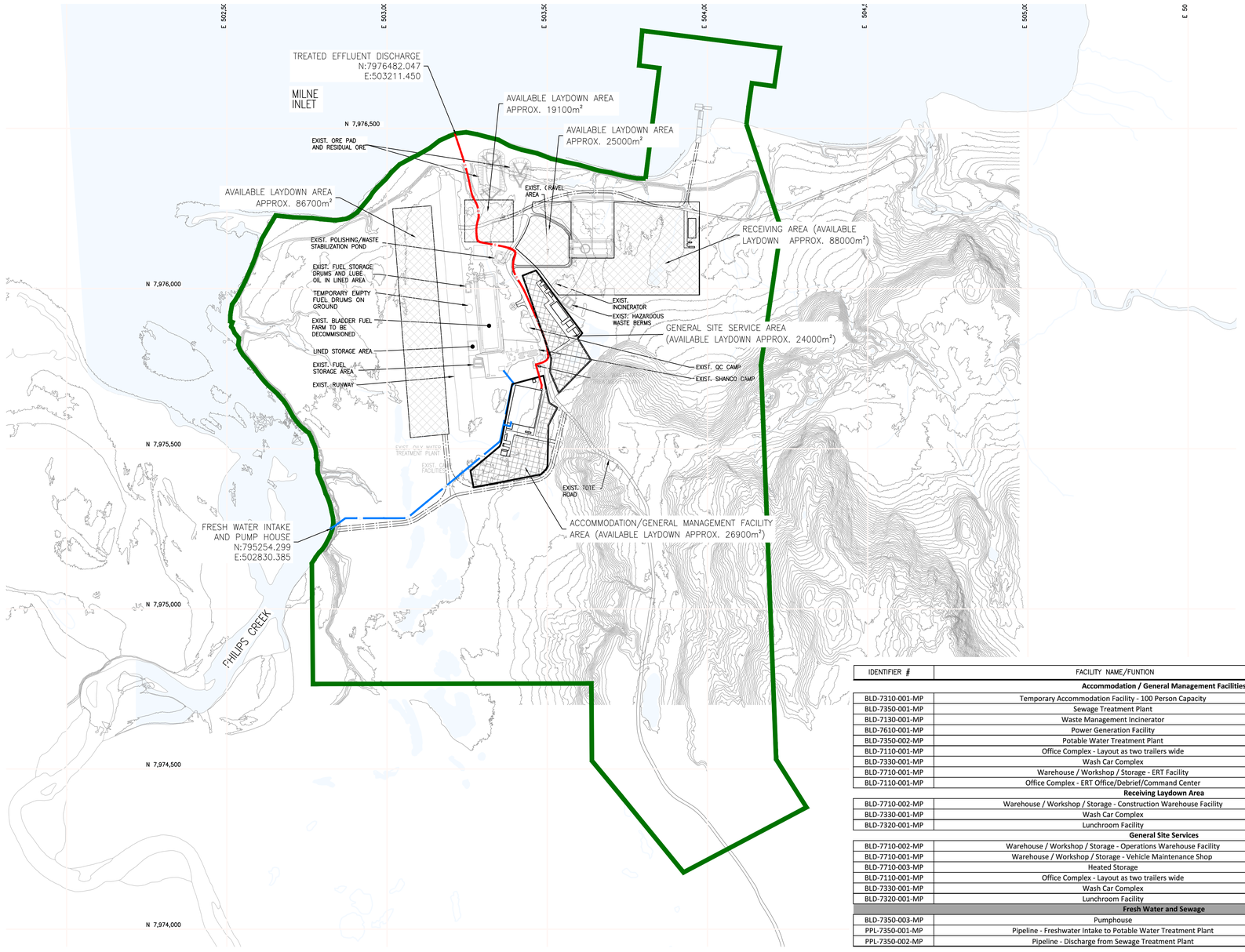
Annex 2

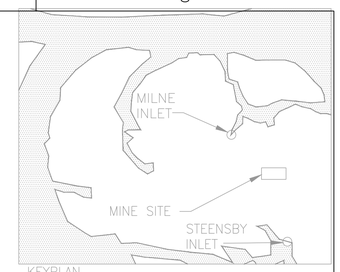
Locations and Layouts of Waste Management Facilities

Please refer to Attachment 9 of Type A Water License Application for Drawings

H337697-7000-10-014-1001	Milne Port Construction Works Site Layout
H337697-7000-10-014-1002	Mary River Mine Site Construction Works Site Layout
H337697-7000-10-014-1003	Ravn River Rail Camp Construction Works Site Layout
H337697-7000-10-014-1004	Mid Rail Camp Construction Works Site Layout
H337697-7000-10-014-1005	South Cockburn Lake Rail Camp Construction Works Site Layout
H337697-7000-10-014-1006	Steensby Inlet Construction Works Site Layout
H337697-4610-07-042-0003	Steensby Inlet Environmental Monitoring Plan Site Layout (for proposed landfill location)
E337697-0000-10-042-0001	Hydrocarbon Impacted Soils Storage and Landfarm Facility - General Arrangement of Typical Landfarm
E337697-PM406-50-014-0001	Milne Inlet Environmental Waste Management Building Layout
H337697-7000-10-042-0007	Milne Inlet Environmental Waste Management Facilities
H337697-4350-10-014-0001	Mine Site Landfill and Landfarm Site Layout
H337697-4350-10-042-0001	Mine Site Environmental Waste Management Facility
E337697-PM406-50-014-0002	Mine Site Environmental Waste Management Building Layout
H337697-4660-10-014-0001	Steensby Inlet Landfill and Landfarm Site Layout
E337697-PM406-50-014-0003	Steensby Inlet Environmental Waste Management Building Layout
H337697-4660-10-042-0001	Steensby Inlet Environmental Waste Management Facility

DWG. NO. H337697-7000-10-014-1001





KEYPLAN

LEGEND:

- WATER
- PROPOSED QUARRY
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- BAFFINLAND'S COMMERCIAL LEASE ON INUIT OWNED LAND
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 1.5 METRES.
4. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR IN 2008.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ.
	Accommodation / General Management Facilities				
BLD-7310-001-MP	Temporary Accommodation Facility - 100 Person Capacity	Pre-Fab / Pre-Eng	-	-	1
BLD-7350-001-MP	Sewage Treatment Plant	Module	-	-	1
BLD-7130-001-MP	Waste Management Incinerator	Module	20' x 20'	6m x 6m	1
BLD-7610-001-MP	Power Generation Facility	Module	-	-	1
BLD-7350-002-MP	Potable Water Treatment Plant	Module	-	-	1
BLD-7110-001-MP	Office Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-001-MP	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
BLD-7710-001-MP	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-MP	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
	Receiving Laydown Area				
BLD-7710-002-MP	Warehouse / Workshop / Storage - Construction Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7330-001-MP	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
BLD-7320-001-MP	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
	General Site Services				
BLD-7710-002-MP	Warehouse / Workshop / Storage - Operations Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-001-MP	Warehouse / Workshop / Storage - Vehicle Maintenance Shop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-003-MP	Heated Storage	Sea Container	40' x 8'	12m x 2m	10
BLD-7110-001-MP	Office Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-001-MP	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
BLD-7320-001-MP	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
	Fresh Water and Sewage				
BLD-7350-003-MP	Pumphouse	Module	-	-	1
PPL-7350-001-MP	Pipeline - Freshwater Intake to Potable Water Treatment Plant	HDPE Pipe	-	Xm	1
PPL-7350-002-MP	Pipeline - Discharge from Sewage Treatment Plant	HDPE Pipe	-	Xm	1

SCALE 1:7500

DRAWING NO.	DRAWING TITLE
H337697-4020-G-002	FUEL SYSTEM UPGRADE-GENERAL ARRANGEMENT

REFERENCE DRAWINGS

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE

ISSUE AUTHORIZATION

HATCH™

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CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

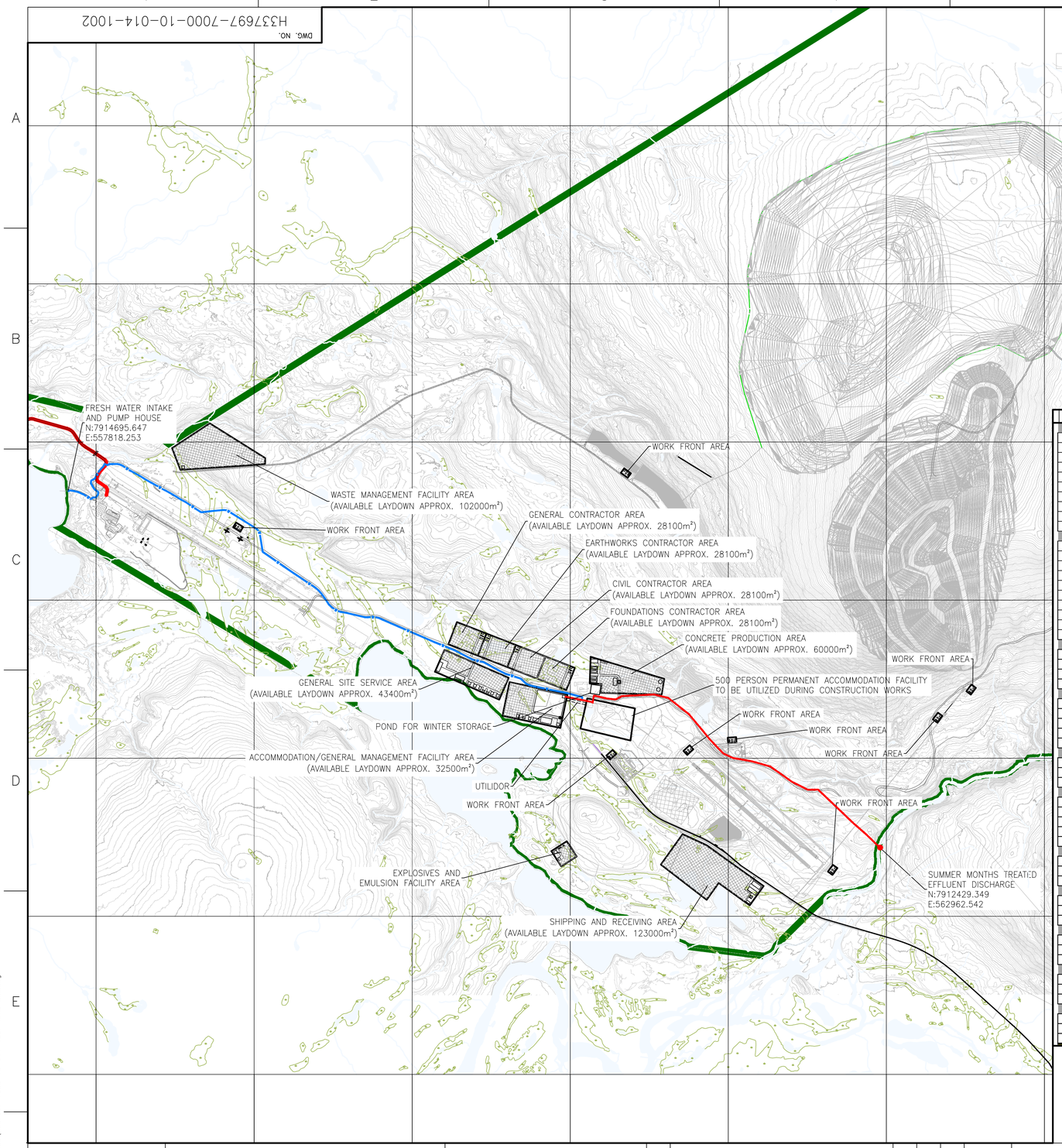
MARY RIVER PROJECT

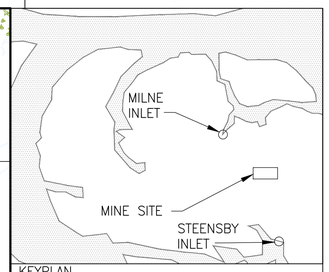
MILNE INLET
CONSTRUCTION WORKS
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1001	A

Sep 30, 2011 1:58pm Login name: HUA59318 Layout: MILNE INLET
Drawing Name: c:\prj\projectwise\yhuang\dms14683\H337697-7000-10-014-1001-MILNE.dwg

DWG. NO. H337697-7000-10-014-1002





KEYPLAN

IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ
Accommodation / General Management Facilities					
BLD-7310-001-MR	Temporary Accommodation Facility - 500 Person Capacity	Pre-Fab / Pre-Eng	-	-	1
BLD-7350-001-MR	Sewage Treatment Plant	Module	-	-	1
BLD-7610-001-MR	Power Generation Facility	Module	-	-	1
BLD-7350-002-MR	Potable Water Treatment Plant	Module	-	-	1
BLD-7130-001-MR	Waste Management Incinerator	Module	60' x 60'	18m x 18m	1
BLD-7110-001-MR	Office Complex - Layout as ten trailers wide	Trailer	60' x 120'	18m x 37m	1
BLD-7330-002-MR	Wash Car Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7710-001-MR	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-MR	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
BLD-7440-001-MR	Medical Facility - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
General Site Services					
BLD-7710-002-MR	Warehouse / Workshop / Storage - Light and Heavy Vehicle Maintenance Shop	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-002-MR	Warehouse / Workshop / Storage - Light and Heavy Vehicle Maintenance Shop (Annex)	Pre-Fab / Pre-Eng	200' x 30'	61m x 9m	1
BLD-7710-002-MR	Warehouse / Workshop / Storage - Equipment Assembly and Storage Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-001-MR	Warehouse / Workshop / Storage - Carpentry & Civil Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-MR	Warehouse / Workshop / Storage - Piping & Mechanical Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-MR	Warehouse / Workshop / Storage - Structural Steel Fabrication Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-MR	Warehouse / Workshop / Storage - Electrical Fabrication Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-MR	Office Complex - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
BLD-7320-001-MR	Lunchroom Facility - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
BLD-7330-002-MR	Wash Car Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
Explosives and Emulsion Facility					
BLD-7990-001-MR	Explosives Storage - Temporary Emulsion Building	Sea Container	40' x 8'	12m x 2m	8
BLD-7710-001-MR	Warehouse / Workshop / Storage - Explosives Maintenace and Equipment Storage Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7320-001-MR	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-MR	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
Shipping and Receiving Laydown Area					
BLD-7710-002-MR	Warehouse / Workshop / Storage - Construction Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-002-MR	Warehouse / Workshop / Storage - Operations Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	10
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-MR	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
Work Front Area					
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	8
BLD-7330-002-MR	Wash Car Complex	Trailer	60' x 12'	18m x 4m	8
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	16
Concrete Production					
BLD-7710-004-MR	Shelter - Concrete Batch Plant Facility	Pre-Fab / Pre-Eng	150' x 80'	46m x 24m	1
BLD-7710-005-MR	Shelter - Concrete Aggregate & Cement Stockpiles (layout 2 shelters side by side)	Pre-Fab / Pre-Eng	150' x 72'	46m x 22m	4
BLD-7710-004-MR	Warehouse / Workshop / Storage - Concrete Batch Plant Maintenance and Equipment Storage	Pre-Fab / Pre-Eng	150' x 80'	46m x 24m	1
BLD-7320-001-MR	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-MR	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
General Contractor Laydown Area					
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-MR	Wash Car Complex - Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Earthworks Contractor Laydown Area					
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-MR	Wash Car Complex - Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Foundations Contractor Laydown Area					
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-MR	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Civil Contractor Laydown Area					
BLD-7320-001-MR	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-MR	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-MR	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Fresh Water and Sewage					
BLD-7350-003-MR	Pumphouse	Module	-	-	1
PPL-7350-001-MR	Pipeline - Freshwater Intake to Potable Water Treatment Plant	HDPE Pipe	-	Xm	1
PPL-7350-001-MR	Pipeline - Discharge from Sewage Treatment Plant	HDPE Pipe	-	Xm	1

LEGEND:

- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE

NOTES:

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 10 METRES.
4. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

SCALE 1:15000

REFERENCE DRAWINGS	
DRAWING NO.	DRAWING TITLE
H337697-4210-10-014-0001	MIME SITE PROPOSED PERMANENT WORKS SITE LAYOUT

REVISIONS					
NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30

ISSUE AUTHORIZATION			
REV.	ISSUE FOR	AUTH. BY	DATE

HATCH™

DESIGNED BY Y.H. DATE	DRAWN BY Y.H. DATE
CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

MARY RIVER MINE SITE
CONSTRUCTION WORKS
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1002	A

Sep 30, 2011 - 4:21pm Login name: HUA59318
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DWG. NO. H337697-7000-10-014-1003

IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ
General Site Services					
BLD-7310-001-RR	Temporary Accommodation Facility - 200 Person Capacity	Pre-Fab / Pre-Eng	-	-	1
BLD-7610-001-RR	Power Generation Facility	Module	-	-	1
BLD-7350-002-RR	Potable Water Treatment Plant	Module	-	-	1
BLD-7130-001-RR	Waste Management Incinerator	Module	20' x 20'	6m x 6m	1
BLD-7710-001-RR	Warehouse / Workshop / Storage - General Complex/Site Services Maintenance and Storage	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-RR	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-RR	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
BLD-7320-001-RR	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-RR	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
Fresh Water and Sewage					
BLD-7350-003-RR	Pumphouse	Module	-	-	1
PPL-7350-001-RR	Pipeline - Freshwater Intake to Potable Water Treatment Plant	HDPE Pipe	-	Xm	1

593500 E

595000 E

7895500 N

7894000 N

FRESH WATER INTAKE AND PUMP HOUSE
N:7895658.80
E:594610.99

FRESHWATER STORAGE TANK AND POTABLE WATER TREATMENT PLANT

CULVERT CROSSING

EXPLOSIVES MAGAZINE

WASTE MANAGEMENT FACILITY

INCINERATOR BUILDING

POWER GENERATOR FACILITY

200 PERSON CONSTRUCTION CAMP

AVAILABLE LAYDOWN AREA
APPROX. 56200m²

LUNCHROOM FACILITY

WASH CAR COMPLEX

CAMP ACCESS ROAD

ERT OFFICE/DEBRIEF /COMMAND CENTER

ERT FACILITY

GENERAL COMPLEX/SITE SERVICES MAINTENANCE AND STORAGE

W.L. 164.5 ±
W.L. 177.1 ±
W.L. 140.7 ±
W.L. 139.1 ±
W.L. 139.4 ±
W.L. 133.9 ±
W.L. 134.3 ±
W.L. 134.3 ±
W.L. 132.6 ±
W.L. 146.9 ±
W.L. 146.2 ±
W.L. 149.4 ±
W.L. 148.0 ±
W.L. 144.3 ±
W.L. 139.5 ±
W.L. 133.6 ±
W.L. 138.2 ±
W.L. 135.5 ±

MILNE INLET
RAVN RIVER RAIL CAMP
MID RAIL CAMP
SOUTH COCKBURN LAKE RAIL CAMP
COCKBURN LAKE TUNNELS RAIL CAMP
STEENSBY INLET
MINE SITE

KEYPLAN

LEGEND:

- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
ISSUE AUTHORIZATION			

HATCH™

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CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

RAVN RIVER RAIL CAMP
CONSTRUCTION WORKS
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1003	A

Sep 30 , 2011 - 2:03pm Login name: HUA59318 Layout: RAVN RIVER CAMP
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DWG. NO. H337697-7000-10-014-1004

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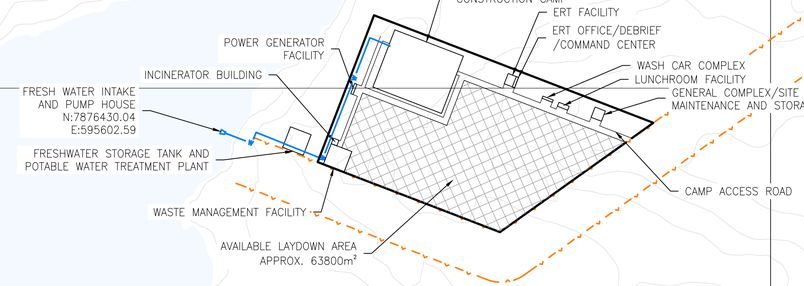
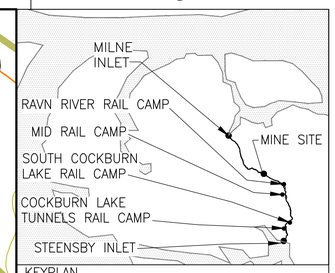
598000 E

7876500 N



EXPLOSIVES MAGAZINE

ACCESS ROAD



KEYPLAN

IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ.
General Site Services					
BLD-7310-001-MD	Temporary Accommodation Facility - 200 Person Capacity	Pre-Fab / Pre-Eng	-	-	1
BLD-7610-001-MD	Power Generation Facility	Module	-	-	1
BLD-7350-002-MD	Potable Water Treatment Plant	Module	-	-	1
BLD-7130-001-MD	Waste Management Incinerator	Module	20' x 20'	6m x 6m	1
BLD-7710-001-MD	Warehouse / Workshop / Storage - General Complex/Site Services Maintenance and Storage	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-MD	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-MD	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
BLD-7320-001-MD	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-MD	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
Fresh Water and Sewage					
BLD-7350-003-MD	Pumphouse	Module	-	-	1
PPL-7350-001-MD	Pipeline - Freshwater Intake to Potable Water Treatment Plant	HDPE Pipe	-	Xm	1

LEGEND:

- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

SCALE

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE

ISSUE AUTHORIZATION

HATCH™

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CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

MID RAIL CAMP
CONSTRUCTION WORKS
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1004	A

Sep 30, 2011 - 2:05pm Login name: HUA59318 Layout: Mid Rail Camp
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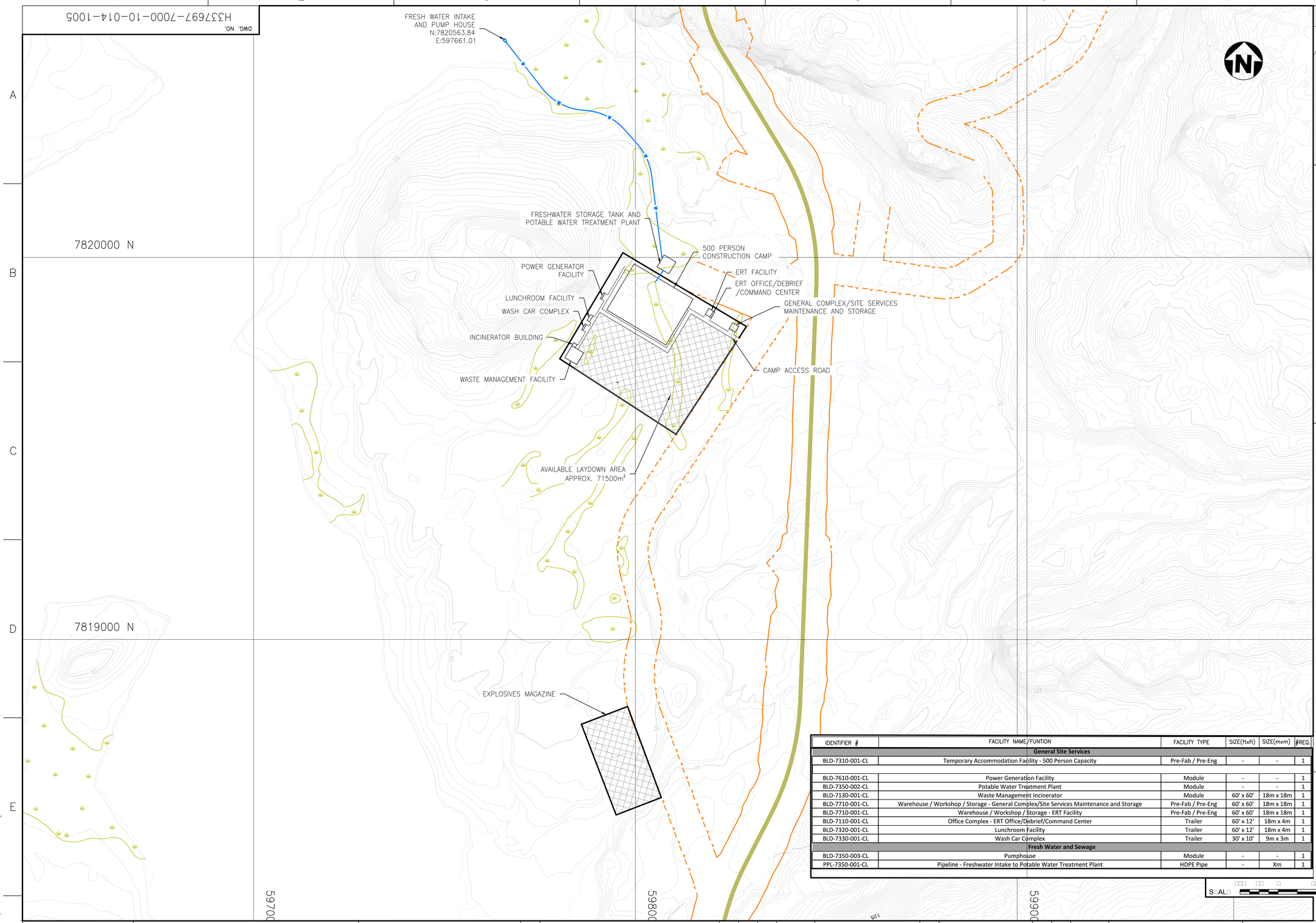
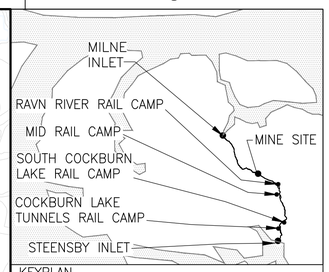
DWG. NO. H337697-7000-10-014-1005





KEYPLAN

LEGEND:

- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ.
General Site Services					
BLD-7310-001-CL	Temporary Accommodation Facility - 500 Person Capacity	Pre-Fab / Pre-Eng	-	-	1
BLD-7610-001-CL	Power Generation Facility	Module	-	-	1
BLD-7350-002-CL	Potable Water Treatment Plant	Module	-	-	1
BLD-7130-001-CL	Waste Management Incinerator	Module	60' x 60'	18m x 18m	1
BLD-7710-001-CL	Warehouse / Workshop / Storage - General Complex/Site Services Maintenance and Storage	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-CL	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-CL	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
BLD-7320-001-CL	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-CL	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
Fresh Water and Sewage					
BLD-7350-003-CL	Pumphouse	Module	-	-	1
PPL-7350-001-CL	Pipeline - Freshwater Intake to Potable Water Treatment Plant	HDPE Pipe	-	Xm	1

S□AL□ □□□ □□ □ □□□ □□□ □□□ □□□ m

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE

ISSUE AUTHORIZATION

HATCH™

DESIGNED BY Y.H. DATE	DRAWN BY Y.H. DATE
CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

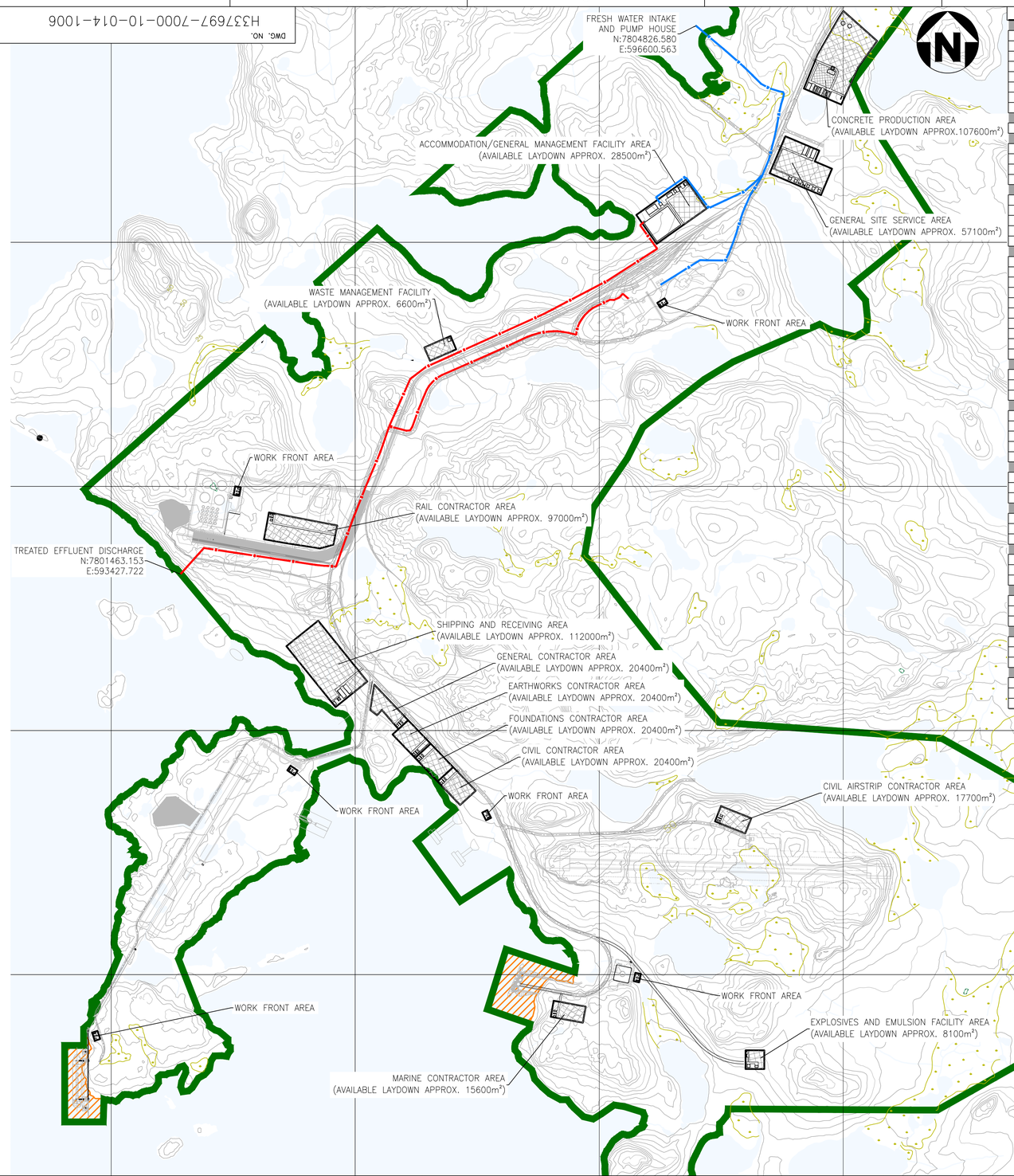
MARY RIVER PROJECT

SOUTH COCKBURN LAKE RAIL CAMP CONSTRUCTION WORKS SITE LAYOUT

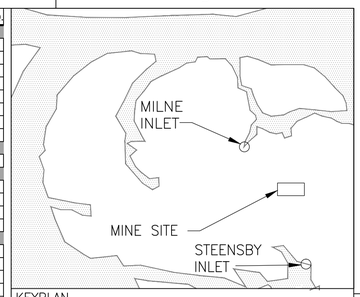
SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1005	A

Sep 30, 2011 - 2:06pm Login name: HUA59318 Layout: SOUTH COCKBURN LAKE CAMP
Drawing Name: C:\pr\projectwise\yhuang\dms14683\H337697-7000-10-014-1005.dwg

DWG. NO. H337697-7000-10-014-1006



IDENTIFIER #	FACILITY NAME/FUNTION	FACILITY TYPE	SIZE(ftxft)	SIZE(mxm)	#REQ.
Accommodation / General Management Facilities					
BLD-7350-001-SP	Sewage Treatment Plant	Module	-	-	1
BLD-7610-001-SP	Power Generation Facility	Module	-	-	1
BLD-7350-002-SP	Potable Water Treatment Plant	Module	-	-	1
BLD-7110-001-SP	Office Complex - Layout as ten trailers wide	Trailer	60' x 120'	18m x 37m	1
BLD-7330-002-SP	Wash Car Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7710-001-SP	Warehouse / Workshop / Storage - ERT Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-SP	Office Complex - ERT Office/Debrief/Command Center	Trailer	60' x 12'	18m x 4m	1
BLD-7440-001-SP	Medical Facility - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
Waste Management Facility					
BLD-7130-001-SP	Waste Management Incinerator	Module	60' x 60'	18m x 18m	1
Explosives and Emulsion Facility					
BLD-7990-001-SP	Explosives Storage - Temporary Emulsion Building	Sea Container	40' x 8'	12m x 2m	8
BLD-7710-001-SP	Warehouse / Workshop / Storage - Explosives Maintenace and Equipment Storage Facility	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7320-001-SP	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-SP	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
Shipping and Receiving Laydown Area					
BLD-7710-002-SP	Warehouse / Workshop / Storage - Construction Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-002-SP	Warehouse / Workshop / Storage - Operations Warehouse Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	10
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
General Site Services					
BLD-7710-002-SP	Warehouse / Workshop / Storage - Light and Heavy Vehicle Maintenance Shop	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-002-SP	Warehouse / Workshop / Storage - Light and Heavy Vehicle Maintenance Shop (Annex)	Pre-Fab / Pre-Eng	200' x 30'	61m x 9m	1
BLD-7710-002-SP	Warehouse / Workshop / Storage - Equipment Assembly and Storage Facility	Pre-Fab / Pre-Eng	200' x 80'	61m x 24m	1
BLD-7710-001-SP	Warehouse / Workshop / Storage - Carpentry & Civil Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-SP	Warehouse / Workshop / Storage - Piping & Mechanical Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-SP	Warehouse / Workshop / Storage - Structural Steel Fabrication Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7710-001-SP	Warehouse / Workshop / Storage - Electrical Fabrication Workshop	Pre-Fab / Pre-Eng	60' x 60'	18m x 18m	1
BLD-7110-001-SP	Office Complex - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
BLD-7320-001-SP	Lunchroom Facility - Layout as four trailers wide	Trailer	60' x 48'	18m x 15m	1
BLD-7330-002-SP	Wash Car Complex - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
Work Front Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	6
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	6
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	12
Concrete Production					
BLD-7710-004-SP	Shelter - Concrete Batch Plant Facility	Pre-Fab / Pre-Eng	150' x 80'	46m x 24m	1
BLD-7710-005-SP	Shelter - Concrete Aggregate & Cement Stockpiles (layout 2 shelters side by side)	Pre-Fab / Pre-Eng	150' x 72'	46m x 22m	4
BLD-7710-004-SP	Warehouse / Workshop / Storage - Concrete Batch Plant Maintenance and Equipment Storage	Pre-Fab / Pre-Eng	150' x 80'	46m x 24m	1
BLD-7320-001-SP	Lunchroom Facility	Trailer	60' x 12'	18m x 4m	1
BLD-7330-001-SP	Wash Car Complex	Trailer	30' x 10'	9m x 3m	1
General Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Earthworks Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Foundations Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	5
Civil Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	2
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	2
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	10
Civil Airstrip Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	2
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	2
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	10
Rail Contractor Laydown Area					
BLD-7320-001-SP	Lunchroom Facility - Layout as two trailers wide	Trailer	60' x 24'	18m x 7m	1
BLD-7330-002-SP	Wash Car Complex	Trailer	60' x 12'	18m x 4m	1
BLD-7710-003-SP	Heated Storage	Sea Container	40' x 8'	12m x 2m	5



KEYPLAN

LEGENDS:

- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREAS
- FORESHORE AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- FUTURE RAILWAY ALIGNMENT
- ACCESS ROAD
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 5 METRES.
4. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR IN 2008.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

SCALE 1:15,000

DRAWING NO.	DRAWING TITLE
H337697-4510-10-014-0001	STEENSBY INLET PROPOSED PERMANENT WORKS SITE LAYOUT

REFERENCE DRAWINGS

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR ENVIRONMENTAL PERMIT	YH	AS	TH	11/09/30

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE

ISSUE AUTHORIZATION

HATCH™

DESIGNED BY Y.H. DATE	DRAWN BY Y.H. DATE
CHECKED BY A.S. DATE	DISCIP. ENGR. DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

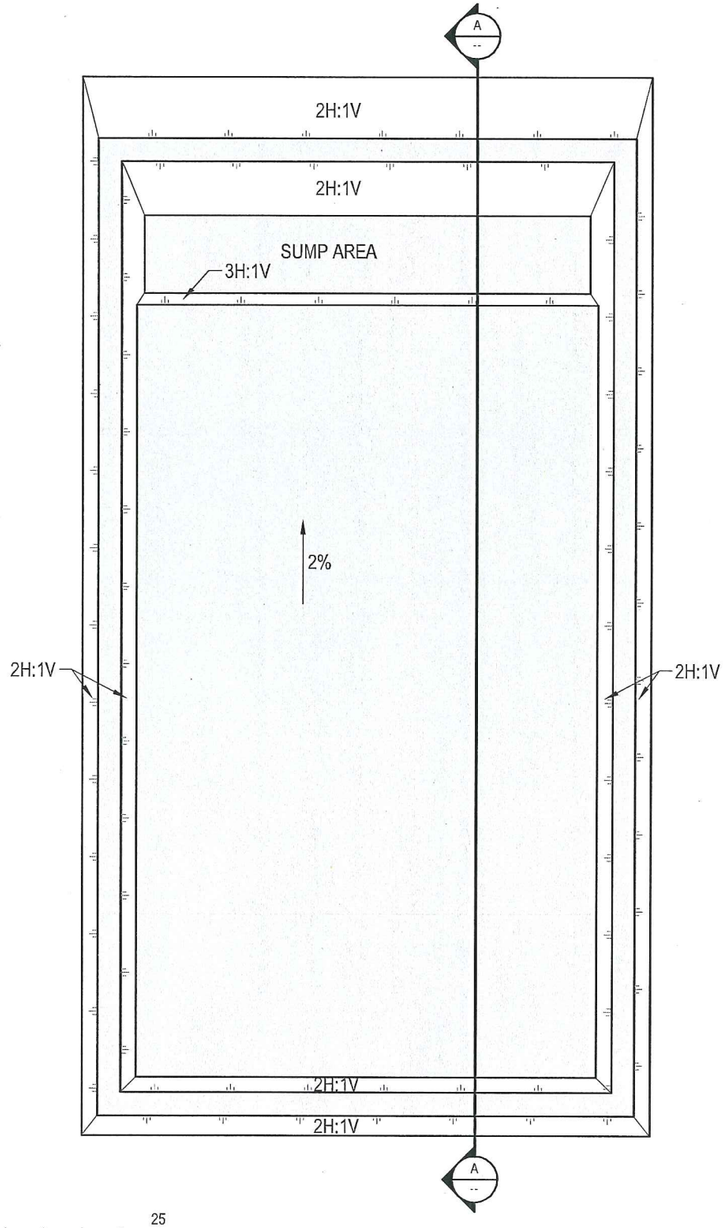
Baffinland Iron Mines Corporation

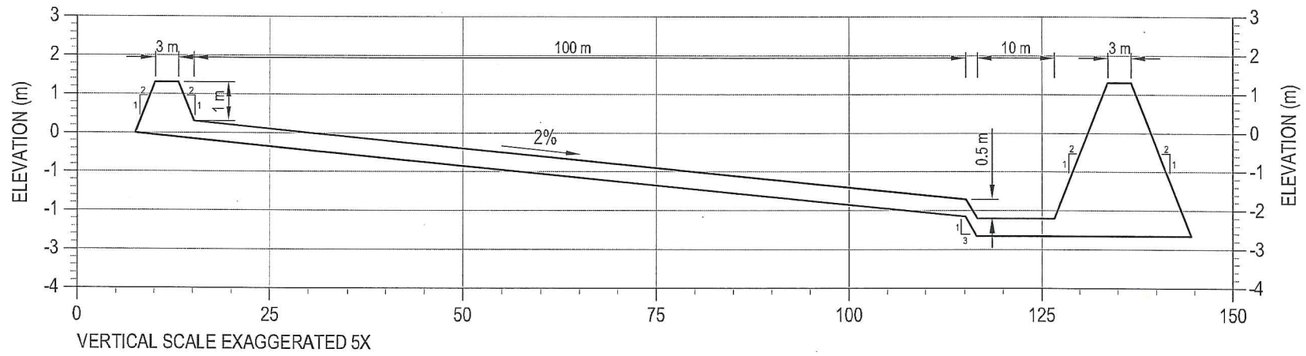
MARY RIVER PROJECT

STEENSBY INLET CONSTRUCTION WORKS SITE LAYOUT

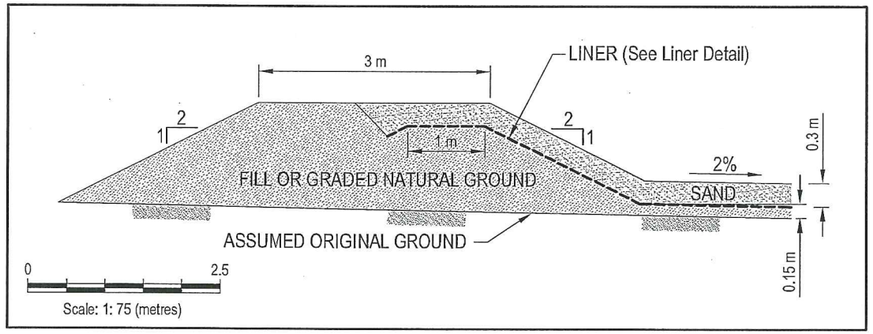
SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-014-1006	A

Sep 30, 2011 1:51pm Login name: HUA59318 Layout: STEENSBY INLET
Drawing Name: C:\prj\projectwise\yhuang\dms14683\H337697-7000-10-014-1006-STEENSBY.dwg

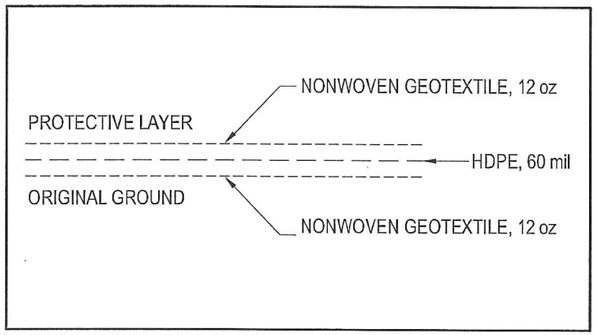




SECTION A



TYPICAL SECTION DETAIL



LINER DETAIL

NOT FOR CONSTRUCTION

E337697-0000-10-042-0001

REGISTERED PROFESSIONAL ENGINEER
J.V. CASSON
LICENSEE
Sept 30/11
NT/NU

NOTES
BERM HEIGHTS AND GRADES TO BE ADJUSTED BASED ON ACTUAL TOPOGRAPHY

STATUS
FOR INTERNAL USE ONLY

CLIENT
Baffinland Iron Mines Corporation

Hydrocarbon Impacted Soils Storage and Landfarm Facility

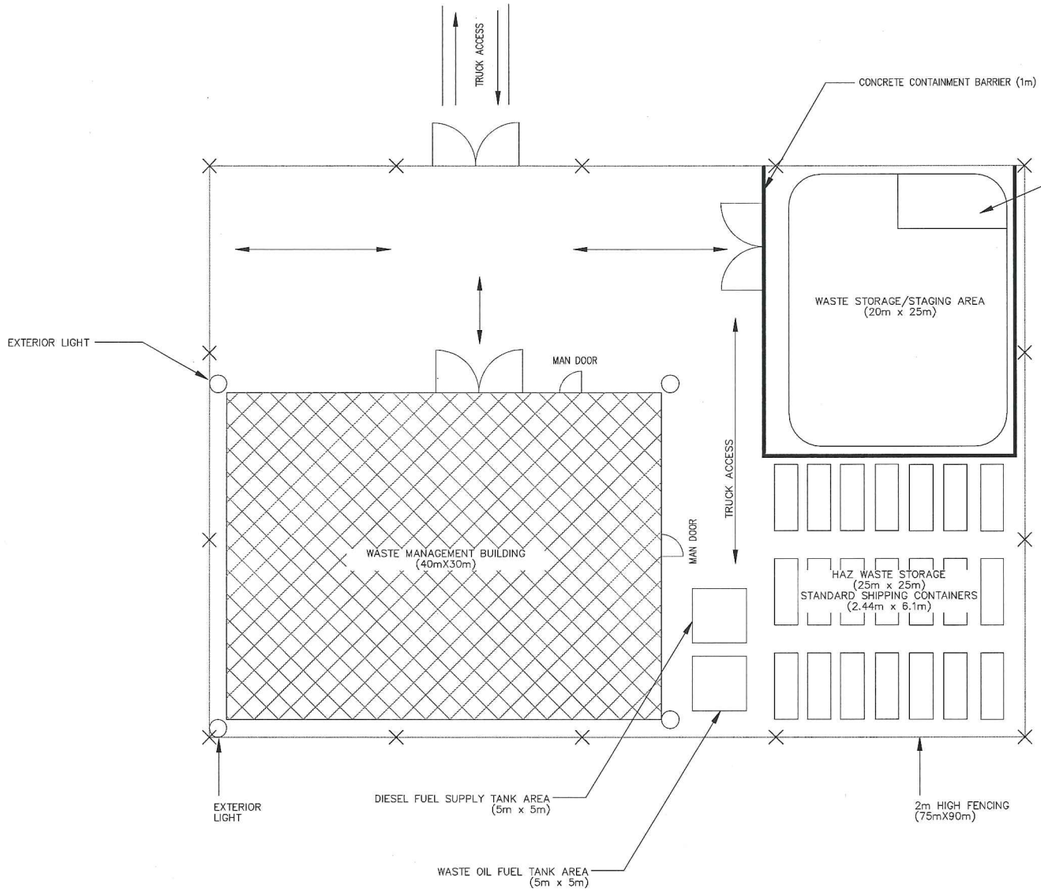
Landfarm Facility

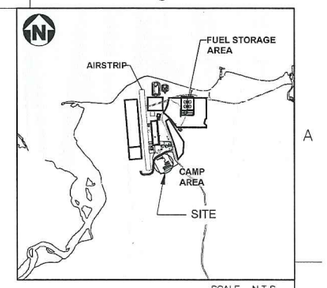
eba A TETRATECH COMPANY

PROJECT NO.	DWN	CKD	REV
E14101092	RH	DF	0
OFFICE: EDM	DATE: December 23, 2010		

Figure 3

DWG. NO. H337697-7000-10-042-0007





KEY PLAN
MILNE SITE

SCALE N.T.S.

LEGENDS

- WATER
- RIVER/STREAM/DRAINAGE
- FENCE

NOTES:

ALL BUILDING AND FACILITIES TO HAVE INTERIOR AND EXTERIOR LIGHTING.

SCALE 5 2.5 0 5 10 15 20 25 m

SCALE 1:250

Sep 23, 2011 - 2:38pm Login name: fan51283 Layout: Layout1
Drawing Name: P:\2899980 - Mary River\CAD\Can\Woods\Environmental Dwg\Waste Management Facilities\H337397-7000-10-042-0007.dwg

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL ENGINEER
J.V. CASSON
LICENSEE
SEAL:

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INTERNAL REVIEW				
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMIT		
ISSUE AUTHORIZATION			

HATCH™

DESIGNED BY / DATE	DRAWN BY D.F. / DATE
CHECKED BY R.L. / DATE	DISCIP. ENGR. / DATE
PROJ. DES. COORD. / DATE	PROJ. ENGR. / DATE
PROJ. MGR. / DATE	

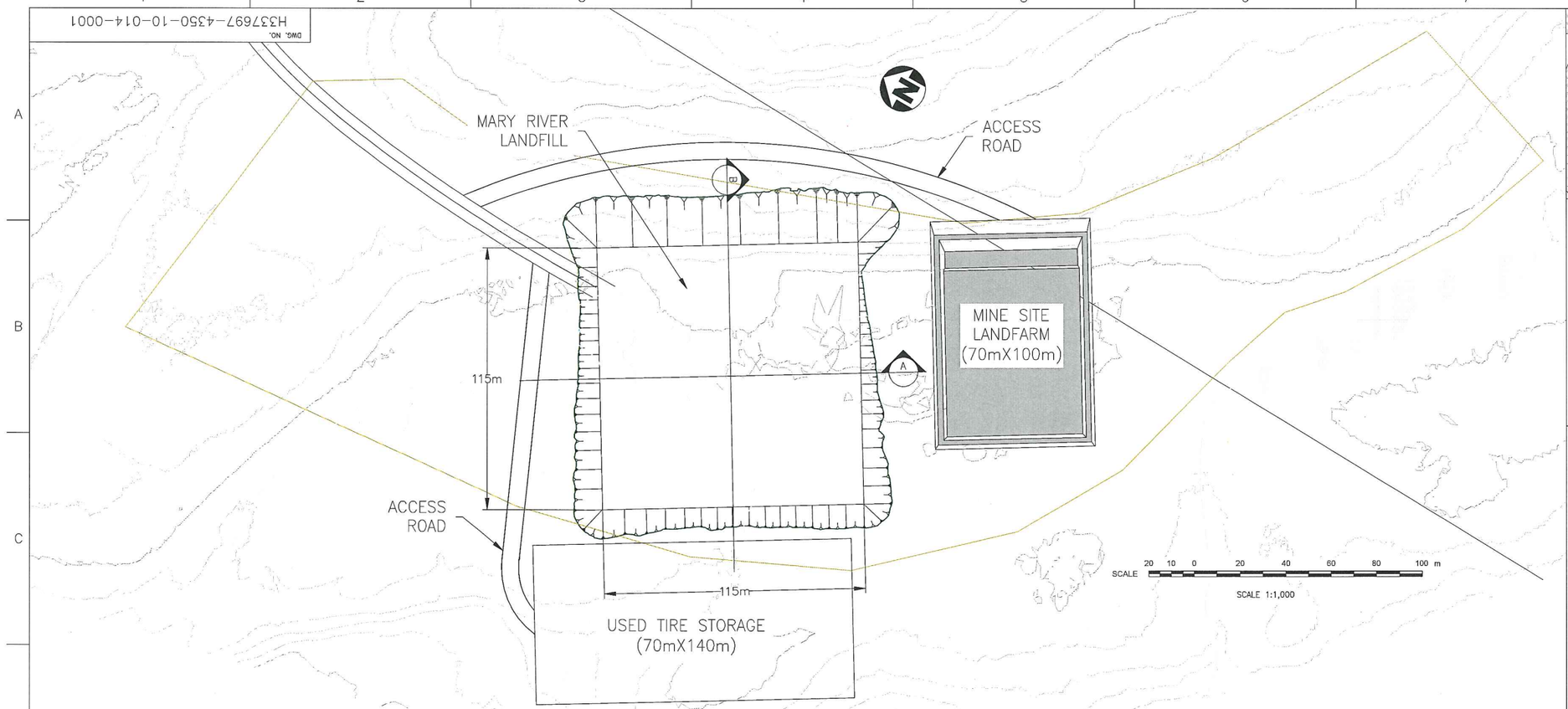
Baffinland Iron Mines Corporation

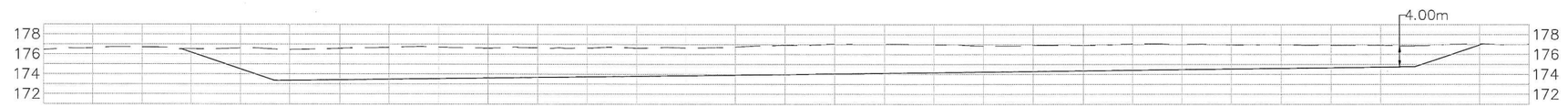
MARY RIVER PROJECT

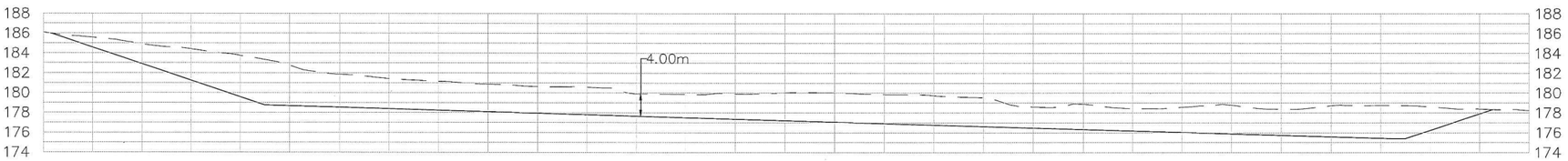
MILNE INLET
ENVIRONMENTAL
WASTE MANAGEMENT FACILITIES

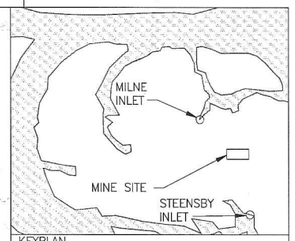
SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-10-042-0007	A

DWG. NO. H337697-4350-10-014-0001









KEYPLAN

LEGEND:

- WATER
- EXISTING BORROW AREA
- TEMPORARY LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- ACCESS ROAD

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
4. MINE SITE INFRASTRUCTURE IS BASED ON EIS AND AMEC DRAWINGS ADDITIONAL DETAILS PROVIDED IN DRAWINGS : A1-164512-6120-121-0100 A1-165926-6000-121-GAD-0100 A1-159952-6020-121-0200
5. MATERIAL HANDLING AND PROCESSING LAYOUT WAS REVISED BASED ON AKER KVAERNER DRAWING DWG-2000-M-0003, REV C.
6. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR, SURVEYED AS OF JAN. 2009.

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL ENGINEER
J.V. CASSON
LICENSEE
NT/NU

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INTERNAL REVIEW				
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMIT		
ISSUE AUTHORIZATION			

HATCH

DESIGNED BY J. LIU DATE 2011/08/29	DRAWN BY J. RANGEL DATE 2011/08/29
CHECKED BY J. LIU DATE 2011/08/29	DISCIP. ENGR. T. HO DATE 2011/08/29
PROJ. DES. COORD. D. HINTON DATE 2011/08/29	PROJ. ENGR. J. CASSON DATE 2011/08/29
PROJ. MGR. H. CHARALAMBU DATE 2011/08/29	

Baffinland Iron Mines Corporation

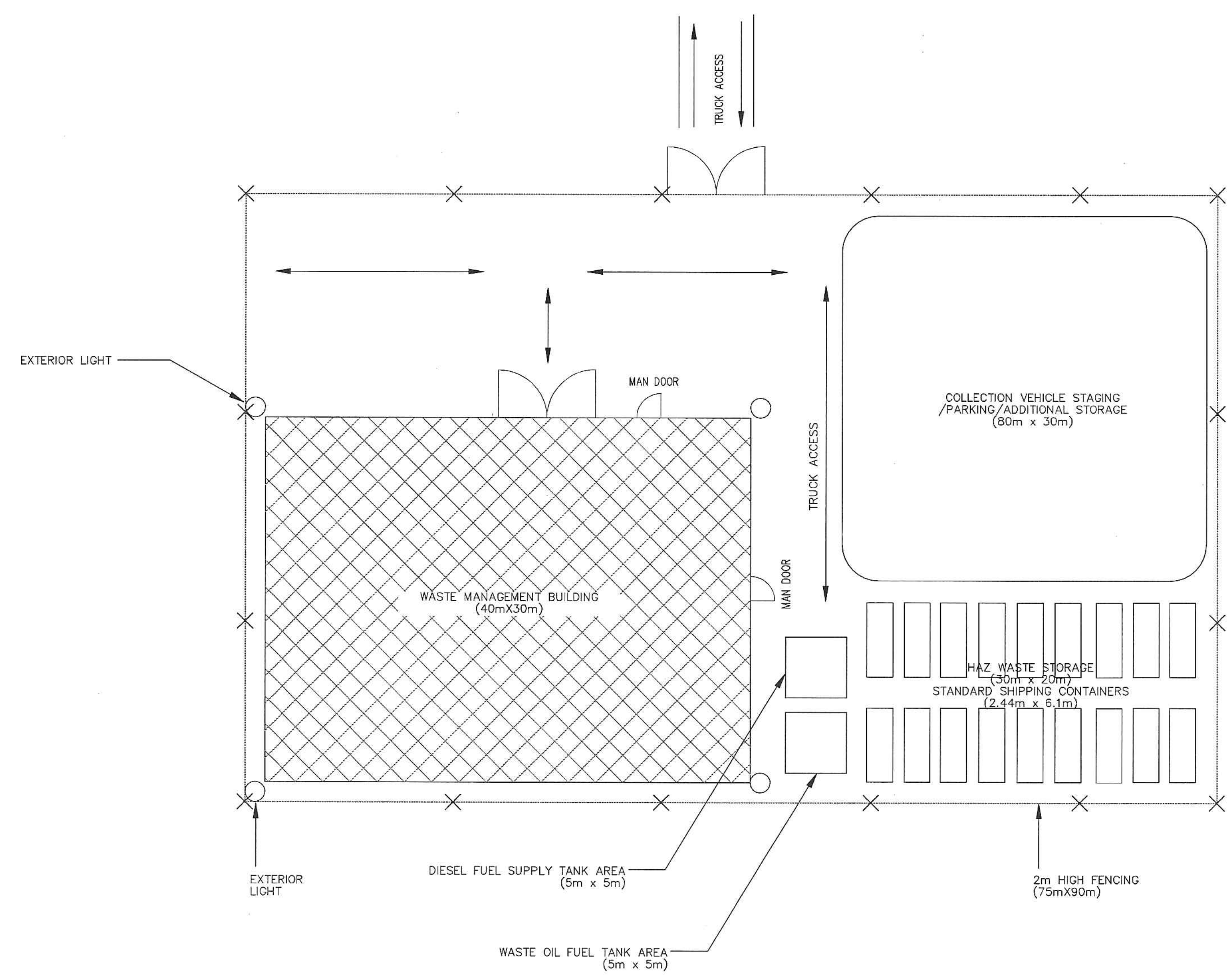
MARY RIVER PROJECT

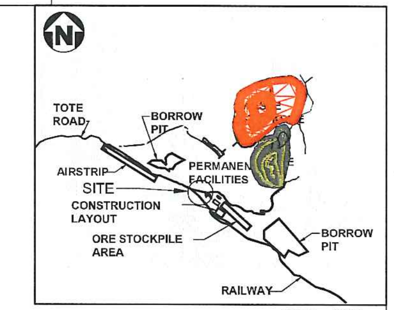
MINE SITE
LANDFILL AND LANDFARM
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-4350-10-014-0001	A

Sep 22 , 2011 - 5:07pm Login name: lun01283
Drawing Name: P:\389980 - Mary River\CAD\Civil\Roads\Environmental Dwg\Land Farm & Land Fill\H337697-4350-10-014-0001.dwg Layout: Layout1

DWG. NO. H337697-4350-10-042-0001





SCALE N.T.S.

KEY PLAN MINE SITE

LEGENDS

WATER

RIVER/STREAM/DRAINAGE

FENCE

NOTES:

ALL BUILDING AND FACILITIES TO HAVE INTERIOR AND EXTERIOR LIGHTING.

SCALE 5 2.5 0 5 10 15 20 25 m

SCALE 1:250

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL ENGINEER — J.V. CASSON — LICENSEE — NT/NU — Sept 29/11

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INTERNAL REVIEW				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMIT		

ISSUE AUTHORIZATION

HATCH

DESIGNED BY	DRAWN BY D.F.
DATE	DATE
CHECKED BY R.L.	DISCIP. ENGR.
DATE	DATE
PROJ. DES. COORD.	PROJ. ENGR.
DATE	DATE
PROJ. MGR.	
DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

MINE SITE
ENVIRONMENTAL
WASTE MANAGEMENT FACILITIES

SCALE OR AS NOTED — DWG. NO. H337697-4350-10-042-0001 — REV. A

Sep 23, 2011, 2:35pm Login name: fun51283 Layout: Layout1
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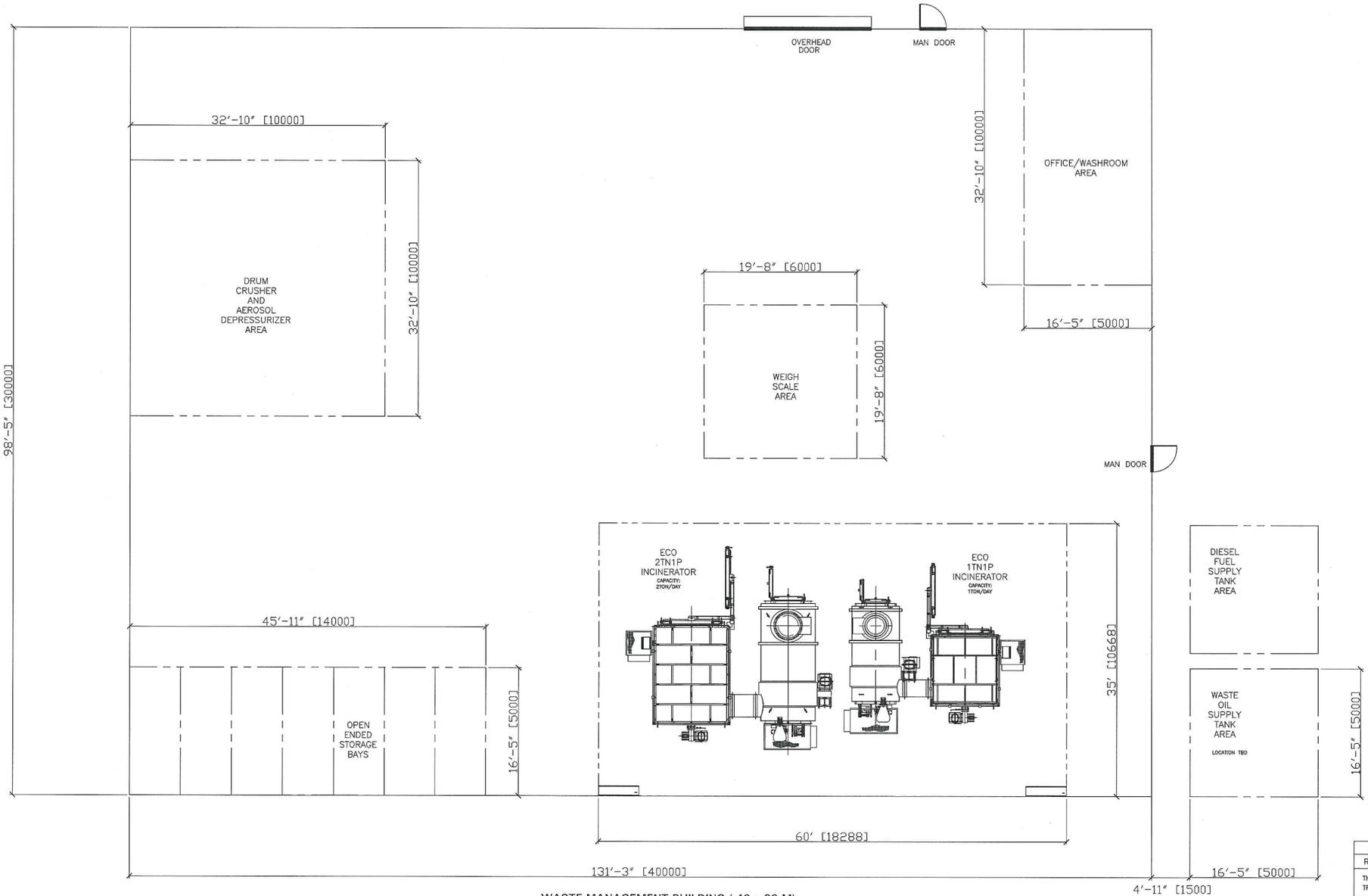


WASTE MANAGEMENT BUILDING (40 x 30 M)

REGISTERED PROFESSIONAL ENGINEER
J.V. CASSON
LICENSEE
Sept 30/11
NT/NU

REV.	DATE	DESCRIPTION	BY	APPROVED
A	22/09/11	INITIAL RELEASE	JX	

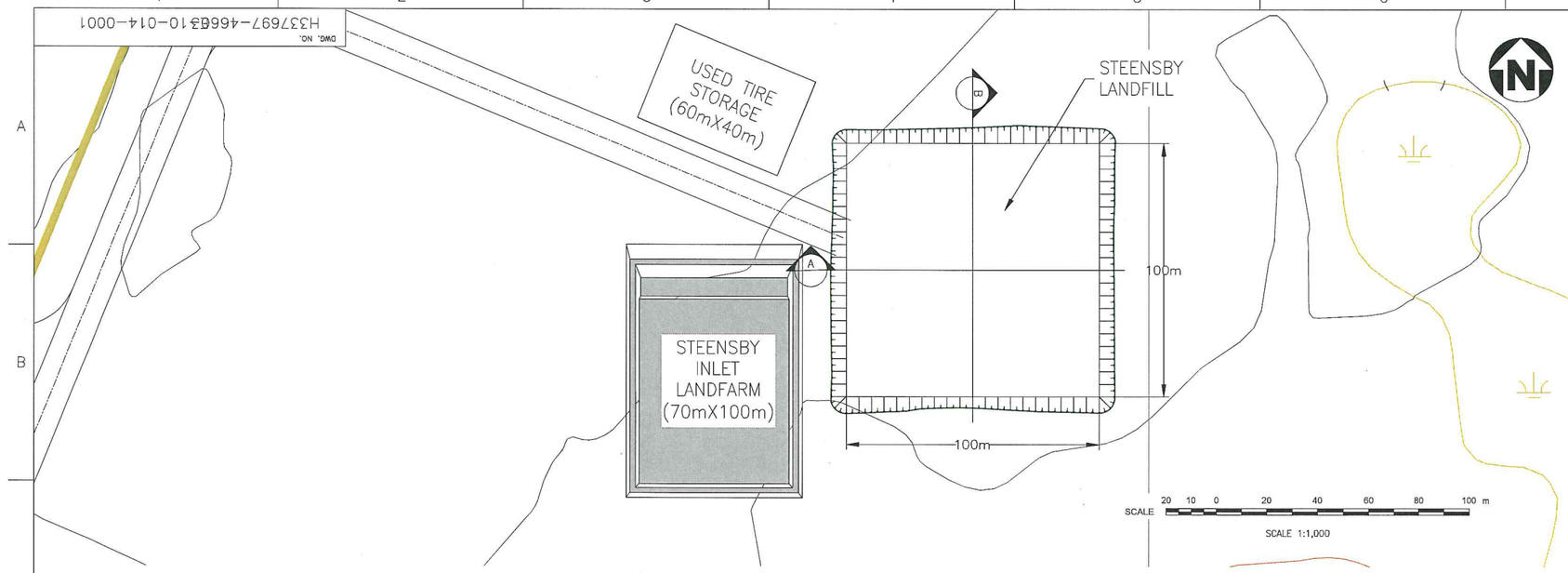
DRAWN: JX	DATE: 21-09-2011
CHECKED: –	DATE: –

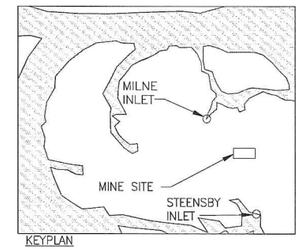
ECO WASTE SOLUTIONS
ECO BURN INC.

PROJECT NAME: MARY RIVER PROJECT	CUSTOMER P.O. NO.12292
PROJECT NUMBER: H337697	CUSTOMER EQUIPMENT. # PM406 WASTE INCINERATORS
SCALE: –	TITLE: MINE SITE ENVIRONMENTAL WASTE MANAGEMENT BUILDING LAY OUT
JOB NO. 11-2MS	P.1_OF_1
THIRD ANGLE	DWG. NO. MINE BUILDING LAYOUT
	REV. A

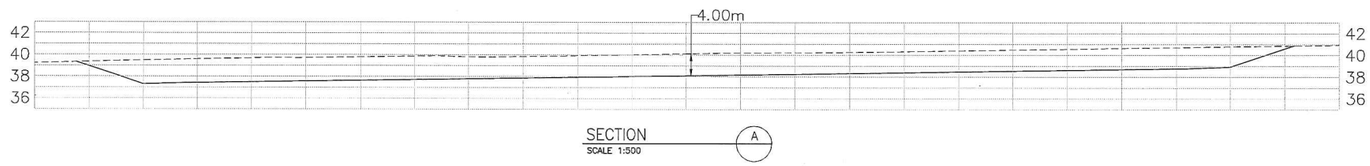
E337697-PM406-50-014-0002

DWG. NO. H337697-4660-10-014-0001

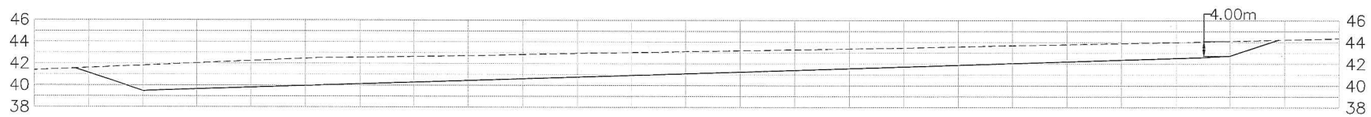




KEYPLAN



SECTION A
SCALE 1:500



SECTION B
SCALE 1:500

SCALE 5 2.5 0 5 10 15 20 25 m
SCALE 1:250

WATER
WETLAND
PERMANENT LAYDOWN AREA
RIVER/STREAM/DRAINAGE
PROPOSED RAILWAY ALIGNMENT
ACCESS ROAD

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 5 METERS AND IS TO GEODETIC DATUM WHERE ELEVATIONS ARE GIVEN.
4. THE SITE LAYOUT IS BASED ON EIS 2010, FIGURE 3-2. 9 AND AMEC'S DRAWINGS:
   A1-159952-8120-121-0201
   A1-159952-8120-121-0203
5. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR, SURVEYED IN SEP. 2008

Sep 22 , 2011 , 5:21pm Login name: tuns1283 Layout: H337697-4510-10-014-0001
Drawing Name: P:\289880 - Mary River\CAD\Civil\Roads\Environmental Dwg\Land Form & Land Fill\H337697-4660-10-014-0001.dwg

DRAWING NO.	DRAWING TITLE
	REFERENCE DRAWINGS

REGISTERED PROFESSIONAL ENGINEER J.V. CASSON LICENSEE NT/NU Sept 29/11

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INTERNAL REVIEW				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMIT		

ISSUE AUTHORIZATION

HATCH

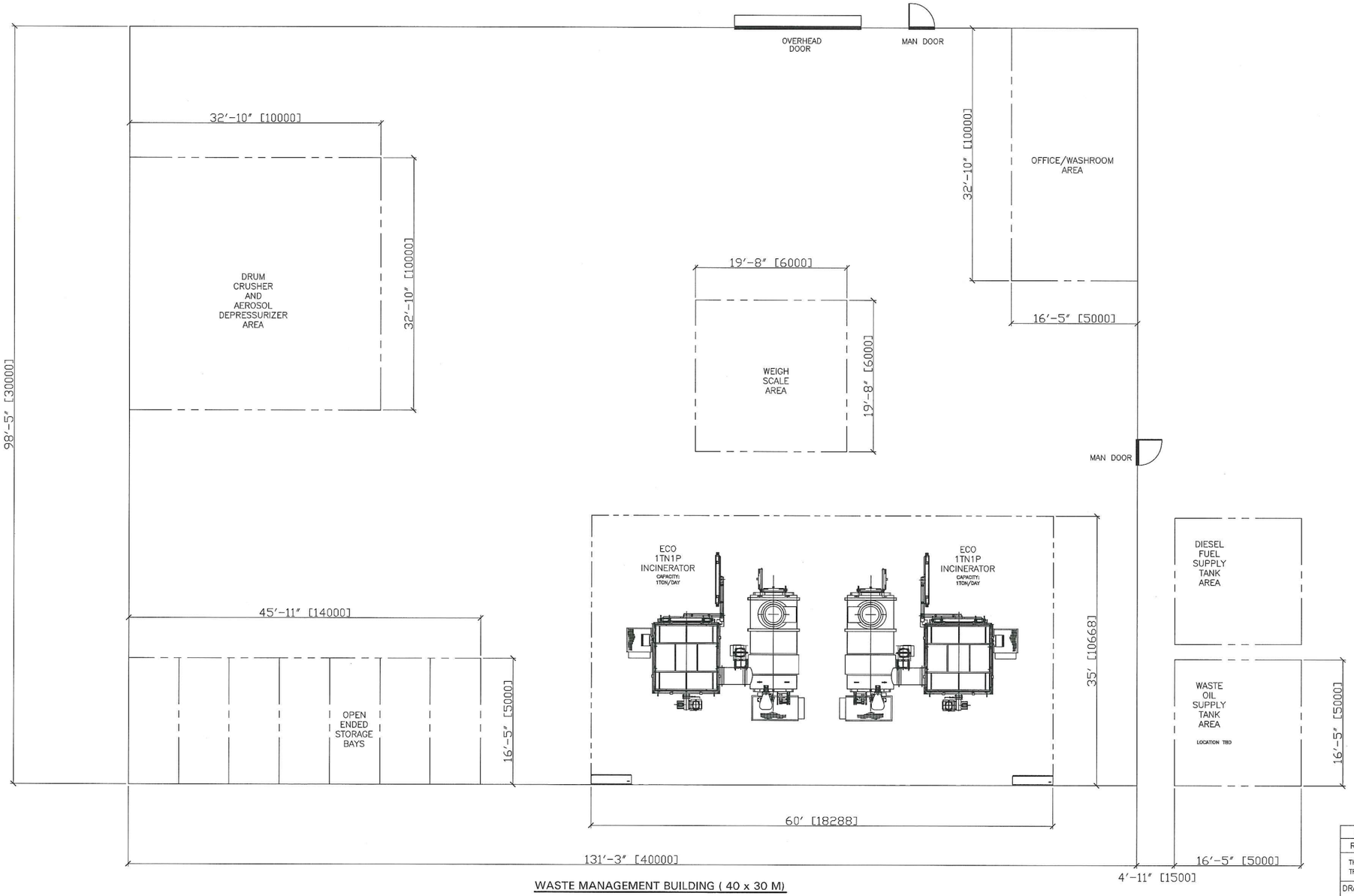
DESIGNED BY J. LIU DATE 2011/08/29	DRAWN BY J. RANGEL DATE 2011/08/29
CHECKED BY J. LIU DATE 2011/08/29	DISCIP. ENGR. T. HO DATE 2011/08/29
PROJ. DES. COORD. D. HINTON DATE 2011/08/29	PROJ. ENGR. J. CASSON DATE 2011/08/29
PROJ. MGR. H. CHARALAMBU DATE 2011/08/29	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

STEENSBY INLET LANDFILL AND LANDFARM SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-4660-10-014-0001	A



WASTE MANAGEMENT BUILDING (40 x 30 M)

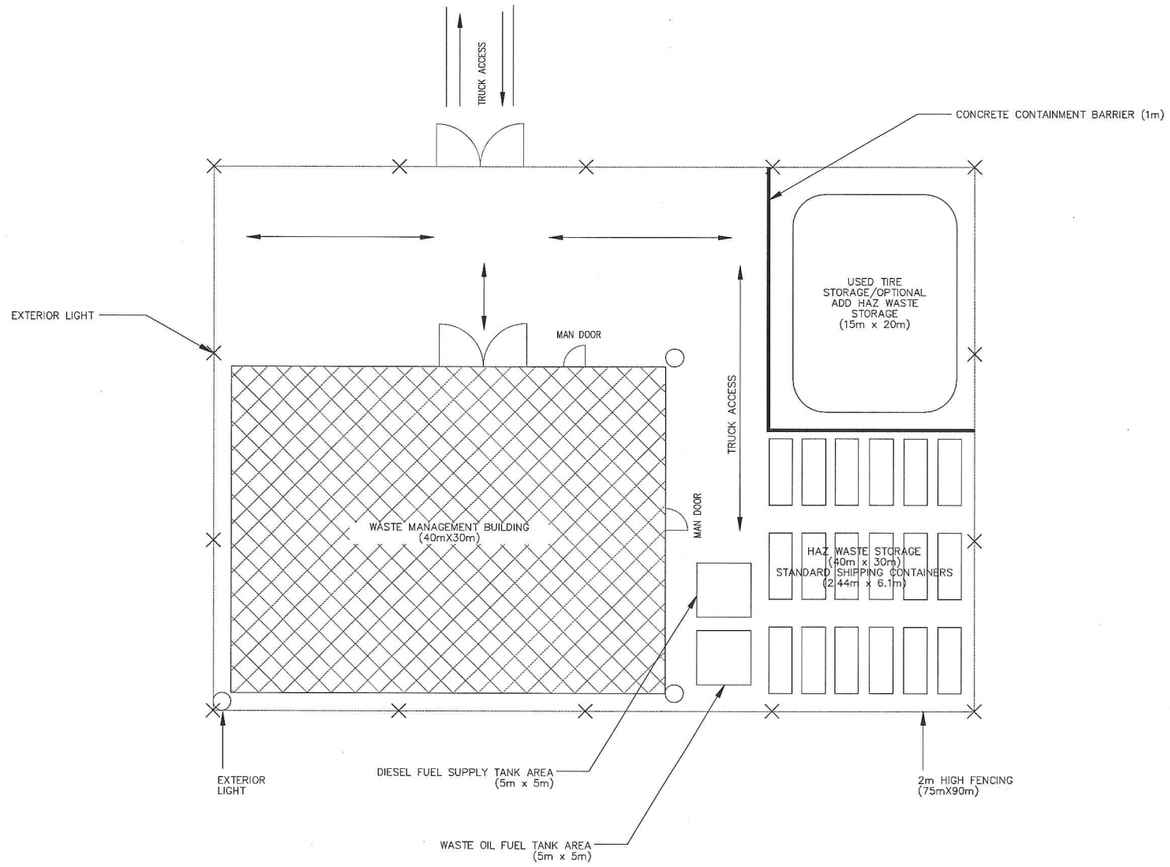
REGISTERED PROFESSIONAL ENGINEER
J.V. CASSON
LICENSEE
Sept 30/11
NT/NU

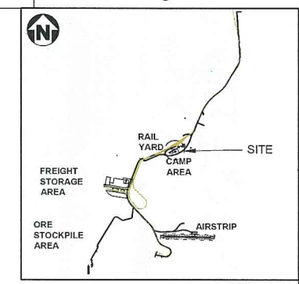
E337697-PM406-50-014-0003

REV.	DATE	DESCRIPTION	BY	APPROVED
A	22/09/11	INITIAL RELEASE	JX	

DRAWN: JX	DATE: 21-09-2011	ECO WASTE SOLUTIONS ECO BURN INC.	
CHECKED: –	DATE: –		
PROJECT NAME: MARY RIVER PROJECT		CUSTOMER P.O. NO.12292	
PROJECT NUMBER: H337697		CUSTOMER EQUIPMENT. # PM406 WASTE INCINERATORS	
SCALE: –	TITLE: STEENSBY INLET ENVIRONMENTAL WASTE MANAGEMENT BUILDING LAY OUT		P.1_OF_1
JOB NO. 11-2MS			
THIRD ANGLE	DWG. NO. STEENSBY BUILDING LAYOUT	REV. A	

DWG. NO. H337697-4660-10-042-0001





SCALE N.T.S.

KEY PLAN
STEENSBY SITE

LEGENDS

- WATER
- RIVER/STREAM/DRAINAGE
- FENCE

NOTES:

ALL BUILDING AND FACILITIES TO HAVE INTERIOR AND EXTERIOR LIGHTING.

SCALE 5 2.5 0 5 10 15 20 25 m

SCALE 1:250

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL ENGINEER J.V. CASSON LICENSEE NT/NU

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INTERNAL REVIEW				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMIT		

ISSUE AUTHORIZATION

HATCH

DESIGNED BY / DATE	DRAWN BY D.F. / DATE
CHECKED BY R.L. / DATE	DISCIP. ENGR. / DATE
PROJ. DES. COORD. / DATE	PROJ. ENGR. / DATE
PROJ. MGR. / DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

STEENSBY INLET
ENVIRONMENTAL
WASTE MANAGEMENT FACILITIES

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-4660-10-042-0001	A

Sep 23, 2011, 2:54pm Login name: tuni1283 Layout: Layout1
Drawing Name: P:\2289580 - Mary River\04\Civil\Roads\Environmental Dwg\Waste Management Facilities\H337697-4660-10-042-0001.dwg

Annex 3

Incinerator Operation Information

- H377697-PM406: Section 2 - General Description ECO 1TN 1P
- H377697-PM406: Section 5 - Operating Instructions ECO 1TN 1P
- H377697-PM406: Section 6 - Maintenance Instructions ECO 1TN 1P

ECO WASTE SOLUTIONS

Mary River Project

#H377697-PM406

SECTION 2

GENERAL DESCRIPTION

ECO 2TN 1P

Corporate Office:

Eco Waste Solutions

5195 Harvester Road, Unit 14

Burlington, ON, Canada L7L 6E9

Tel: 905-634-7022 Fax: 905-634-0831

Email: info@ecosolutions.com

Web: www.ecosolutions.com

General Description - Thermal Oxidation Concept

The **ECO 2TN 1P** Incinerator system consists of a **Primary Chamber** and a **Secondary Chamber** (also known as the Afterburner). Both chambers are vessels constructed of steel with a special insulating liner known as refractory.

The **Primary Chamber** has a front door for loading of waste material and for the removal of residual ash.

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

Primary Chamber

In the first stage, a burner is used to elevate the temperature of the **Primary Chamber** to ignite the waste. Once the **Primary Chamber** reaches a temperature of approximately 650-800°C, the burn process becomes self-fuelling and the burner will shut off. To save fuel and control temperatures, only when the energy contained within the waste is depleted, will the burner periodically turn on. At these operating temperatures, waste is allowed to fully combust and is rendered sterile. Waste is reduced in volume by over 90%. Independent tests have shown that the residual ash is non-hazardous, non-leaching and essentially inert. After enduring the combustion process, metals and glass remain intact. Preservation of metals and glass not only protects the refractory lining from damage caused by melted and fused metals and glass, but also allows for post-combustion recycling where possible.

The **Primary Chamber** operates under *controlled temperature* conditions. The amount of heat released, from the burning of the waste, is controlled by limiting the air into the **Primary Chamber** to less than what is required to complete combustion. This is described as *starved air* conditions. With controlled air and temperature the waste is dried, heated and burned thereby releasing moisture and volatile components. The non-volatile, combustible portion of the waste is burned in the **Primary Chamber** to provide heat while the non-combustible portion accumulates as ash. These conditions ensure that the waste is allowed to fully combust and is rendered sterile. In the end, the waste volume is reduced by over 90%.

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

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

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

Secondary Chamber

As waste burns in the Primary Chamber, gases containing the products of combustion enter the high temperature zone of the **Secondary Chamber** for cleansing. The Secondary Chamber is sized to retain the incoming gases for a minimum of 2 seconds at 1000°C (1832°F). This chamber utilizes a packaged, high output, fully modulating diesel burner to maintain the required temperature (even in the absence of energy input from the first stage which is important when processing wet or low energy waste). This stage employs a large blower, tightly controlled by the control system using a variable frequency drive on the motor. The blower creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour.

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

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

The **Secondary Chamber Burner** is similar to the burner used in the **Primary Chamber** except that it is a much higher output burner and its output is self modulated over a broad range for very precise temperature control.

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

Main Control Panel

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

Protecting the Environment

Why Incinerate

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

Primary Advantages of incineration are:

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

Environmental Concerns

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

Air Pollutants of Concern

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

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

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

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

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

Solid Waste Ash Quality

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

The Operator – Your Role

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

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

Basic Combustion Principles

The Combustion Process

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

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

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

Energy in the form of heat is required to raise the temperatures of the incinerator chamber and organic material and O_2. Initially, this energy usually is supplied by the pilot and auxiliary fuel burners. After the system is in full operation, the energy released from the burning waste often is adequate to maintain these high temperatures.

Fate of Combustion Air

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

Oxygen Reaction

Solid waste contains two types of organic materials

1. Volatile Matter
2. Fixed Carbon

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

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

- A minimum temperature is needed to start and sustain the chemical reaction.

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

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

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

Products of complete combustion are:

- Carbon dioxide
- Water

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

Operating Factors Related to Combustion

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

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

These three factors are all related. Controlling them controls the combustion reaction. The two key questions about combustion air are:

- How much combustion air is needed to sustain the combustion reaction?
- What happens if there is too much or too little combustion air?

Stoichiometric Air

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

Substoichiometric Air

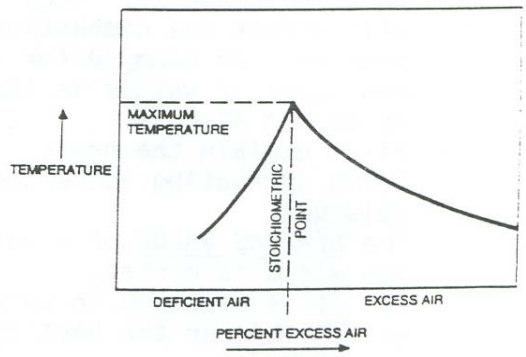
Airflows less than those required at stoichiometric levels are called deficient air or substoichiometric starved-air levels. Under starved-air conditions, the combustion gas would again contain no oxygen, but organics also would remain because combustion is not complete.

Excess Air

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

Control of Temperature as a Function of Air Level

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



CONTROL OF TEMPERATURE AS A FUNCTION OF EXCESS AIR

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

Waste Characteristics

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

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

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

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

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

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

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

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

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

Summary of Key Operation Factors Affecting Combustion

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

Waste characteristics also are important

- Heating value
- Measure of energy released
- Heat input determines air required
- Moisture content
- Requires energy to vaporize water
- Chlorine content
- Affects HCl emissions

This summarizes the key parameters affecting combustion.

Products of Combustion Reaction

Complete Combustion

The primary products of waste incineration are:

- Combustion gases
- Solid residue (ash)
- Energy

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

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

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

This ideal reaction represents complete combustion.

Incomplete Combustion

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

The waste feed also includes inorganic materials; generally, they are not involved in the combustion reaction. The inorganic materials in the waste feed (ash) are either retained in the ash or are emitted as particulate matter in the combustion gas. Air velocities in the combustion bed are controlled to reduce the amount of inorganic material entrained (picked up by) the combustion gas and emitted with the combustion gas. If combustion is not complete, organics will remain in ash; this is typical…it is atypical to have 100 percent combustion of ash bed. Under poor conditions (low temperature, low turbulence in ash bed) may have pathogens remaining in ash; i.e., may not sterilize ash.

Combustion Indicators

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

Opacity

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

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

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

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

Ash Quality

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

Equipment Warranty

To the original Purchaser, **EWS** warrants that the products and parts manufactured by the Corporation and supplied hereunder shall be free from defective workmanship and material for a period of 18 months from notice of ready to ship or 12 months from start-up at Purchaser's site, whichever is less. **EWS**' warranty is limited to **EWS** supplying the Purchaser with parts F.O.B. Purchaser site, replacement of any product or parts which shall be proved to the Corporation to be defective, provided that the Purchaser gives notice in writing within three (3) days after defect discovery.

To provide all labour related to **EWS** manufactured / warranted parts for 12 months. In the case where **EWS** has purchased components from other vendors or suppliers, warranty will be limited to providing, render reasonable assistance to Purchaser when requested, in order to enable Purchaser to enforce such warranties and guarantees by third party manufacturers suppliers.

Equipment Covered by Warranty

Equipment supplied under a purchase order to **EWS** including:

- Primary and Secondary Chamber
- Connecting ductwork between Primary and Secondary Chambers (Breech Sections) and the Stack Sections
- Controls – Manual, Electronic and Electric

Extent of Warranty Coverage

All costs related to the repair or replacement of system components where failure is due to defect in material, workmanship or design is covered by **EWS** for one year from the date of repair or replacement.

Replacement due to abuse, misuse, and/or lack of maintenance or carelessness is not covered. Wear from normal use, or alternative disposal costs are not covered.

There is no warranty on the following parts (consumables):

- All burner flame-front parts
- Thermocouple elements + protection tubes
- Electrodes, photocells
- Gaskets, Seals and tubing
- Fuses, light bulbs and glass assemblies
- Nozzles, filters, sensors/probes
- Refractory Surface Cracks*
- Tubing

*Note: Normal in high temperature applications

Warranty Provisions and Exceptions

EWS does not guarantee or warrant, either expressly or implied, the materials and workmanship of supplies, materials, equipment or machinery manufactured by third parties and furnished and installed by **EWS** (outside of the scope of this proposal) in the performance of the Work, to the extent such supplies, materials, and equipment or machinery is itself an end product with its own customary warranty.

EWS shall endeavor to obtain from all such vendors and suppliers and assign to Purchaser the customary warranties and guarantees of such vendors and suppliers with respect thereto. **EWS** shall, at the sole expense to Purchaser, render reasonable assistance to Purchaser when requested in order to enable Purchaser to enforce such warranties and guarantees by third party manufacturer's suppliers.

EWS will not be liable for any consequential damages, loss or expense arising from any change in or alteration to equipment of its manufacturer such changes or alterations having been made by any persons other than personnel of **EWS** or its agents, in which event such agents must have written permission of **EWS** prior to making such changes or alterations.

EWS shall in no event, be liable for consequential damages as a result of any breach of this agreement by or for any other reason. This warranty shall not apply to products or parts not manufactured by **EWS** or to equipment parts which shall be subject negligence, accident or improper control, improper operation, maintenance, storage, or damage or circumstances beyond the control of **EWS** or to other than normal use or service. Regarding parts of the equipment purchased by **EWS**, no warranty is made other than that offered by the original equipment manufacturer.

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ECO WASTE SOLUTIONS

Mary River Project

#H377697-PM406

SECTION 5

OPERATING AND MONITORING INSTRUCTIONS

ECO 2TN1P

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ECO WASTE SOLUTIONS

Table of Contents

Important Information

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

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

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

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

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

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

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

NOTE

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

Incinerator Design

The **ECO 2TN1P** incinerator is designed specifically for to process 2,000 kg per batch (one batch per day) of the waste. This waste stream is assumed to include the following:

3.2.3 Waste will include food waste, hydrocarbon and solvent contaminated maintenance shop waste and dewatered sewage treatment sludge.

The incinerator will be used for combustible, non-hazardous wastes including, but not limited to:

- Putrescible wastes from construction and accommodation camps;
- Organics from construction camps;
- Maintenance / workshop waste (such as hydrocarbons and solvents contaminated rags, oil filters, etc.) and
- Sludge from the sewage treatment plant.

Biomedical waste, hazardous waste, non-combustible materials, or treated wood products must not be incinerated. Incineration of plastics will be minimized to reduce the volume of potentially dioxin/furan-related plastics during the procurement process.

This waste will need to be comingled to ensure that wet low heat value waste is mixed with other drier materials. Dewatered sewage treatment sludge will be added onto a layer of other wastes and will comprise no more than 20% of the batch by weight.

Regardless of recycling programs that may or may not be available, it is assumed that the waste is typical of domestic solid waste and will include some plastic packaging and containers. The waste is expected to be bagged, stored in skips/bins around the mine operation then brought to the incinerator by truck.

It is important to note that inappropriate materials including, but not limited to, reactive/explosive chemicals and items containing heavy metals will not be processed in the incinerator proposed herein.

Waste Assumptions

Based on the waste streams anticipated, the following characteristics have been used in the design of the ECO 1TN1P unit:

Description	Total Moisture Content	Density	Higher Heat Value
Mixed Solid Waste	Up to 40%	10-15 lbs/ft^3 160-240 kg/m^3	6,500 BTU/lb 15,150 KJ/kg

NOTE

This incinerator was designed for the type of waste and amount of waste described in this document. It is important that the waste processed in the incinerator is in line with the quantities and characteristics described. The processing of other waste amounts and properties will impact performance, emissions and wear on the incinerator.

To ensure a high standard of performance, it is important that:

- **waste segregation and tracking procedures are in place;**
- **operators are required to be properly trained, and;**
- **the equipment is properly maintained.**

It is also important to note that some waste-streams are unacceptable and SHOULD NOT be processed in the incinerator (please see next page).

Unacceptable Waste-streams

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

Waste Materials Not Suitable for Processing in Eco Waste Solutions Technology

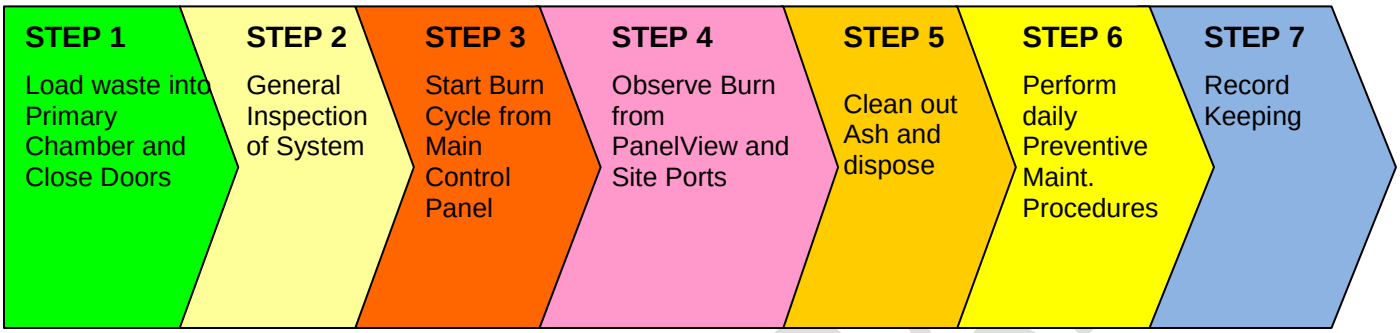
Solid Waste	Description	Origin
Bulky Materials	Automotive or heavy equipment parts such as engine blocks and transmissions	From vehicles and equipment maintenance shop
Non-Combustible Materials	Drywall, asbestos, bricks, concrete, soils	Construction activity
Radioactive Materials	Smoke detectors, laboratory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

Important Notes:

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

General Operating Overview

The operation of the **ECO 2TN1P Waste Incinerator** package follows 7 general steps that take place over a 24-hour period.



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

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

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

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

Monitoring and Data Acquisition System

Overview

The **PanelView** operator interface system automatically monitors the entire process and all system inputs are recorded and logged for record-keeping purposes and also allows for historical trending of key operating conditions.

The integrated **PanelView** in the Main Control Panel monitors and records the following:

1. Temperature in the Primary Chamber, Secondary Chamber and Stack
2. Differential pressure in the Primary Chamber
3. Auxiliary burner operation
4. Fan amperage monitoring (via current transducer)
5. Interlocks (door position, high temp limit, low fuel level limit, air proving switch)
6. Integrated weigh scale to record weight of waste prior to incineration (if purchased)[1]

This system automatically records the operations log and the USB data port allows for data transfer to Windows OS computers for printing of data for easy record-keeping.

The operating and monitoring system for the **ECO 1TN1P** incinerator designed for the **Mary River Project** complies with the monitoring requirements outlined in the CCME "*Technical Document for Batch Waste Incineration*" March 2009. All parameters listed above will be monitored and recorded by the system.

Notes:

1. If the integrated scale is not purchased as part of the incinerator package, owner/operator must have weigh scale available and manually take weight measurements daily and maintain records to meet the guideline requirements.

PanelView Operator Interface

Main Control Panel Components

Number	Name	Purpose
1	**Main Disconnect Switch**	Isolates the incinerator from its source of electric power.
2	**PanelView Operator Interface**	Displays various screens reflecting system performance.
3	**Control Power ON**	1. Green light indicates the control power in the panel is on. 2. Pushing it if the **Emergency-Stop** is out will turn on the control power.
4	**Emergency Stop Pushbutton**	Stops the cycle if it is on and disables any possibility of starting it.
5	**Burn Cycle Stop/Start**	This switch starts stops or restarts the cycle.
6	**Primary Chamber Pressure Gauge**	Indicates the amount of vacuum in the Primary Chamber: This should never read less than zero or smoke will escape from the Primary Chamber.
7	**Waste Material Selection Switch**	Select either Solid Waste, Waste Oil or Both

The PanelView Operator Interface

The **PanelView Operator Interface** controls the operation of the incinerator directly from the **Main Control Panel.**

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

The **PanelView** has a touch-screen and items can be selected by touching them on the screen.

Main Menu

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

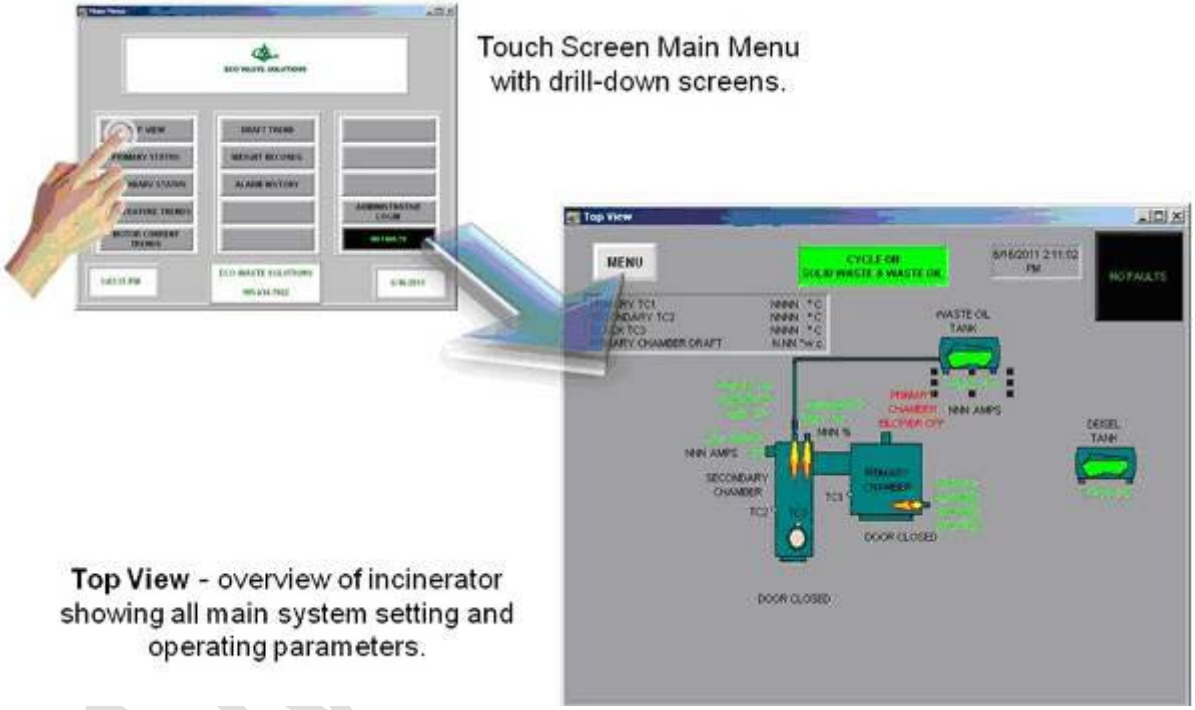
Top View

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

NOTE

The system will not start if there are alarms or faults present. To clear and/or acknowledge faults, go directly to page 14 of this section of the Manual.

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



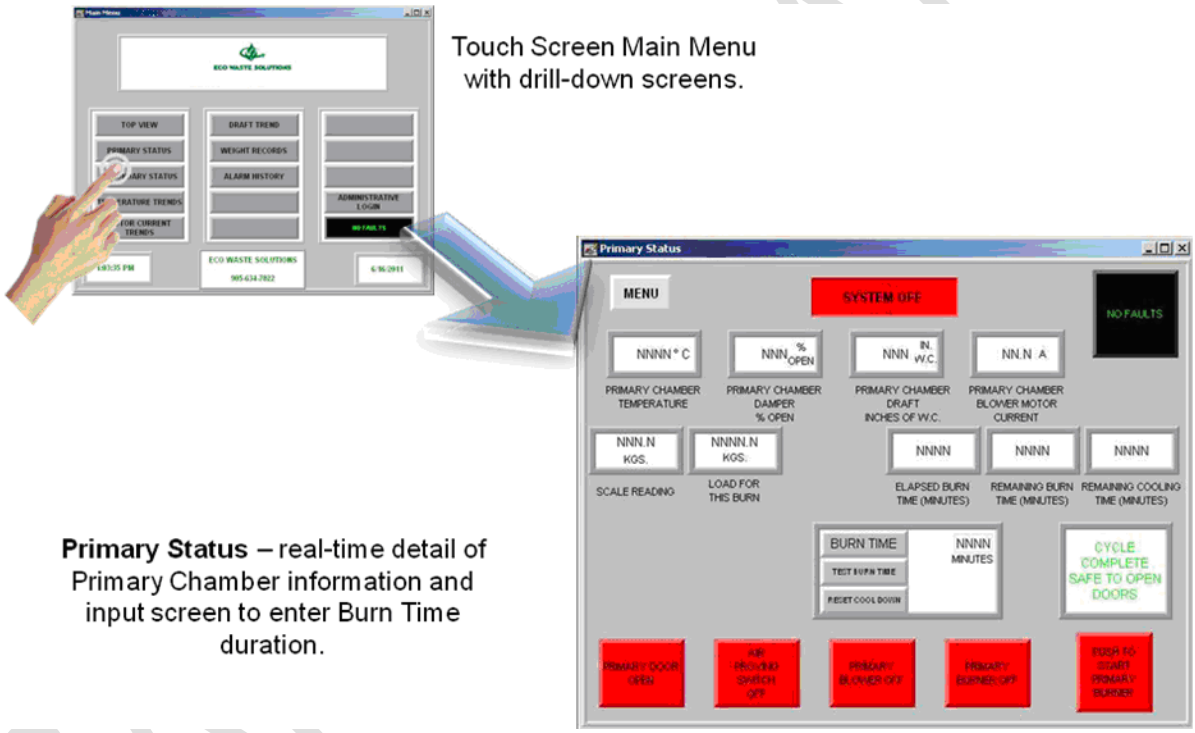
Top View - overview of incinerator showing all main system setting and operating parameters.

Primary Status

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

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

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

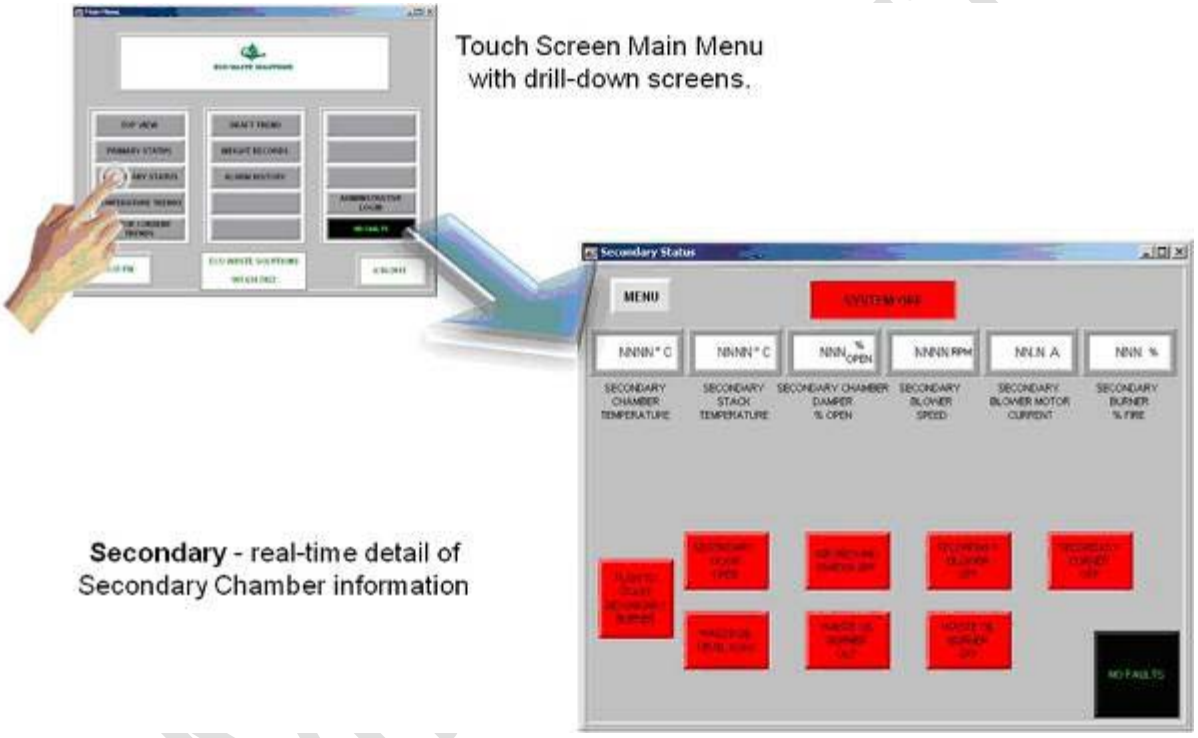


Primary Status – real-time detail of Primary Chamber information and input screen to enter Burn Time duration.

Secondary Status

When the ***Secondary Status*** button is selected from the **Main Menu**, a screen will display the status of all the operating parameters of the Secondary Chamber, such as the temperatures, burner and blower status, etc.

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

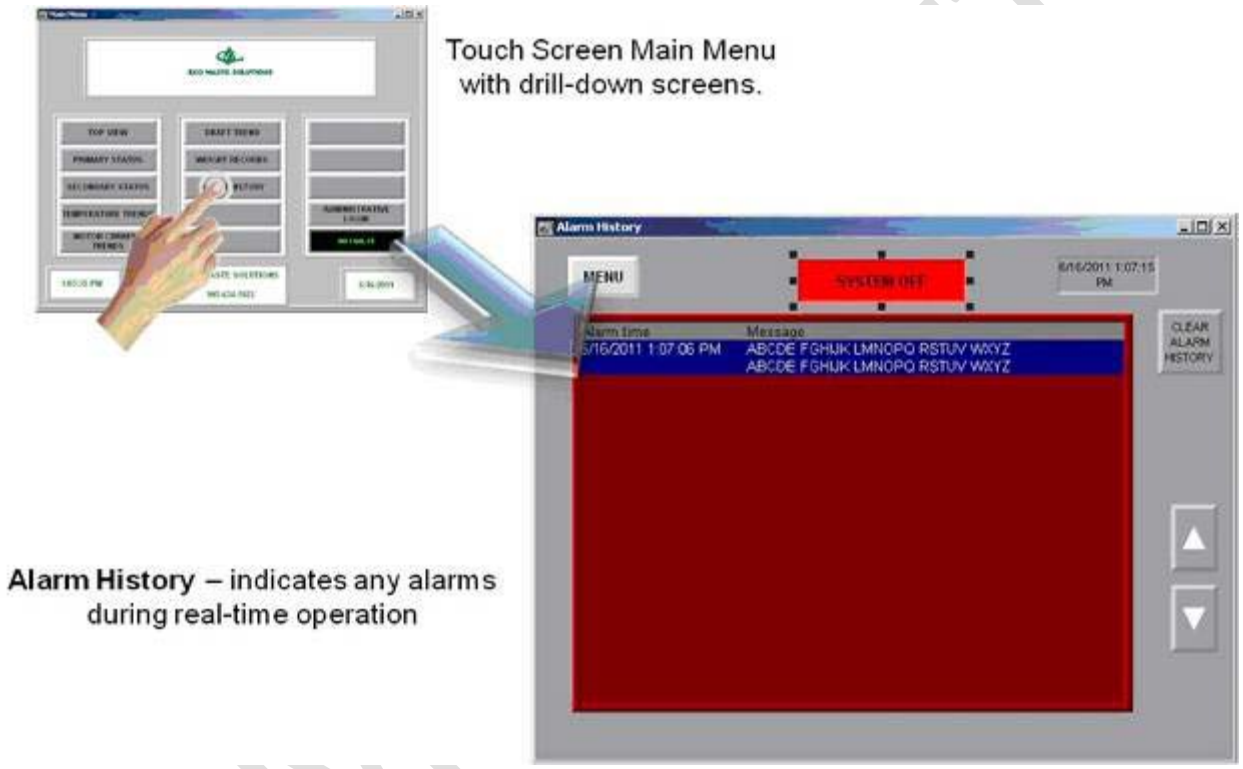


Alarm History

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

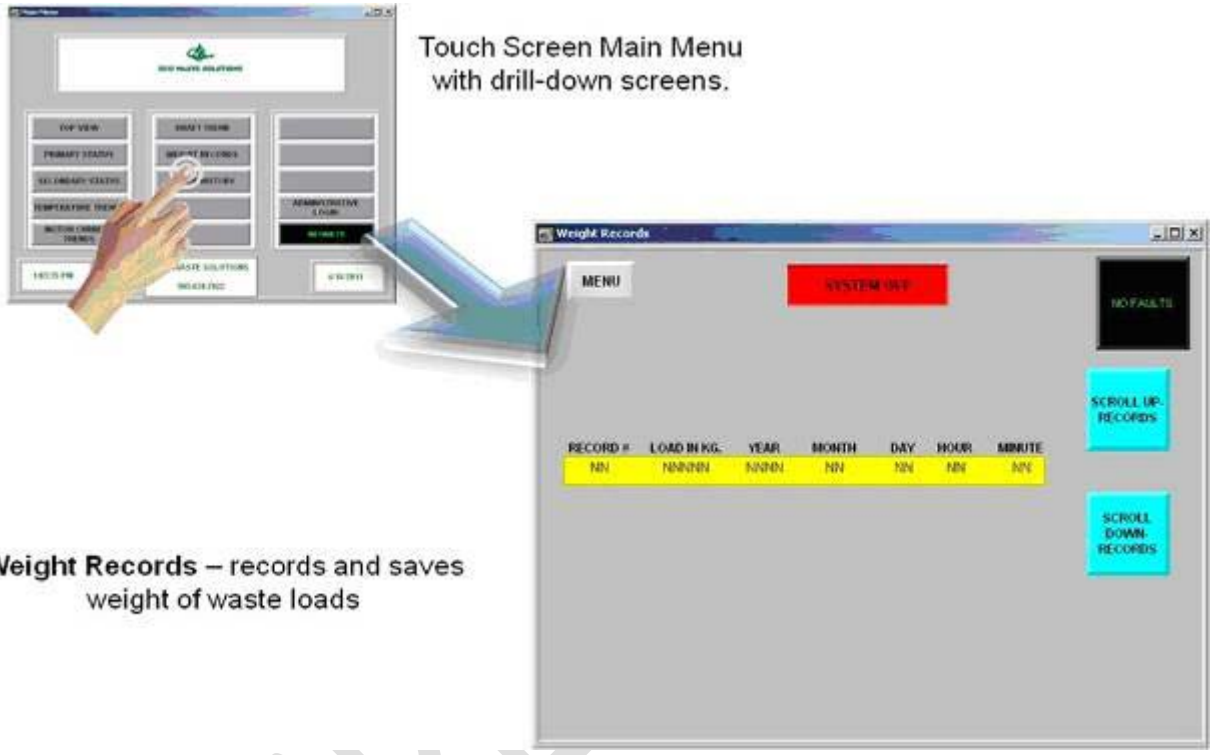
The operator can press the *CLEAR ALARM HISTORY* to clear all of the faults, if they wish to. This does not affect the record-keeping feature of the system.

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



Load Records

When the ***Load Records*** button is selected a screen will display the weight of the total waste load on any given day.



Weight Records – records and saves weight of waste loads

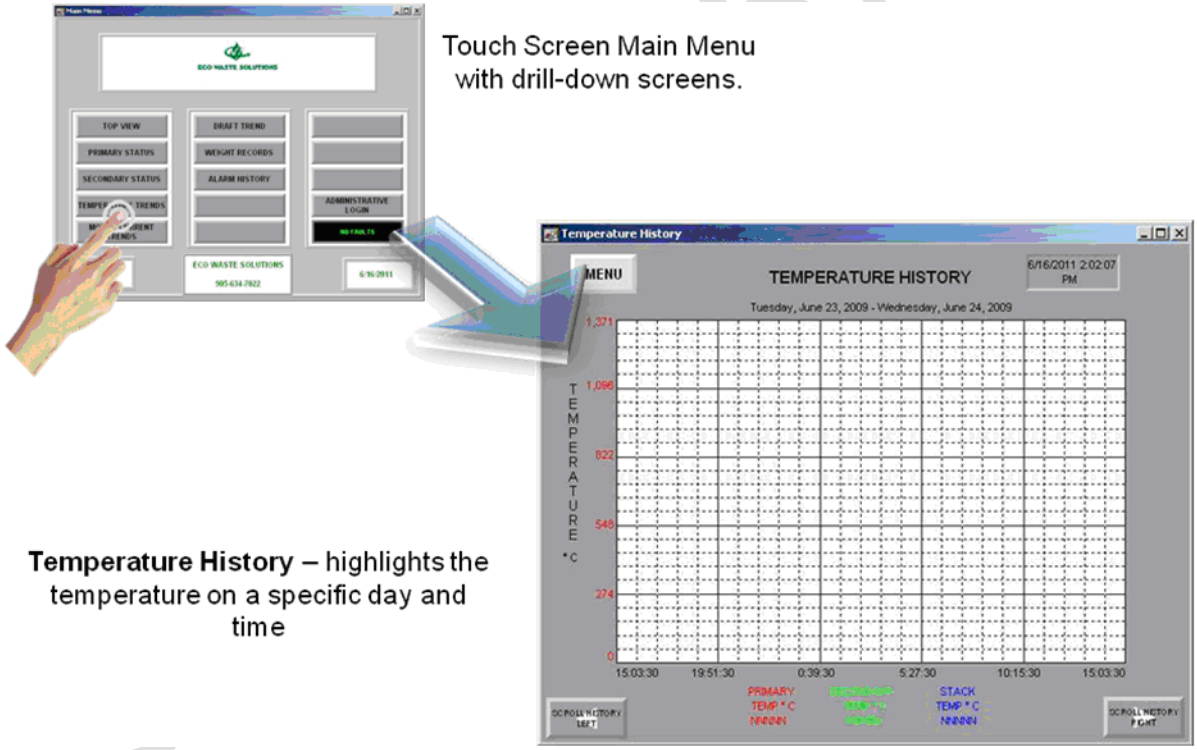
Overview of Historical Charts

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

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

Temperature History

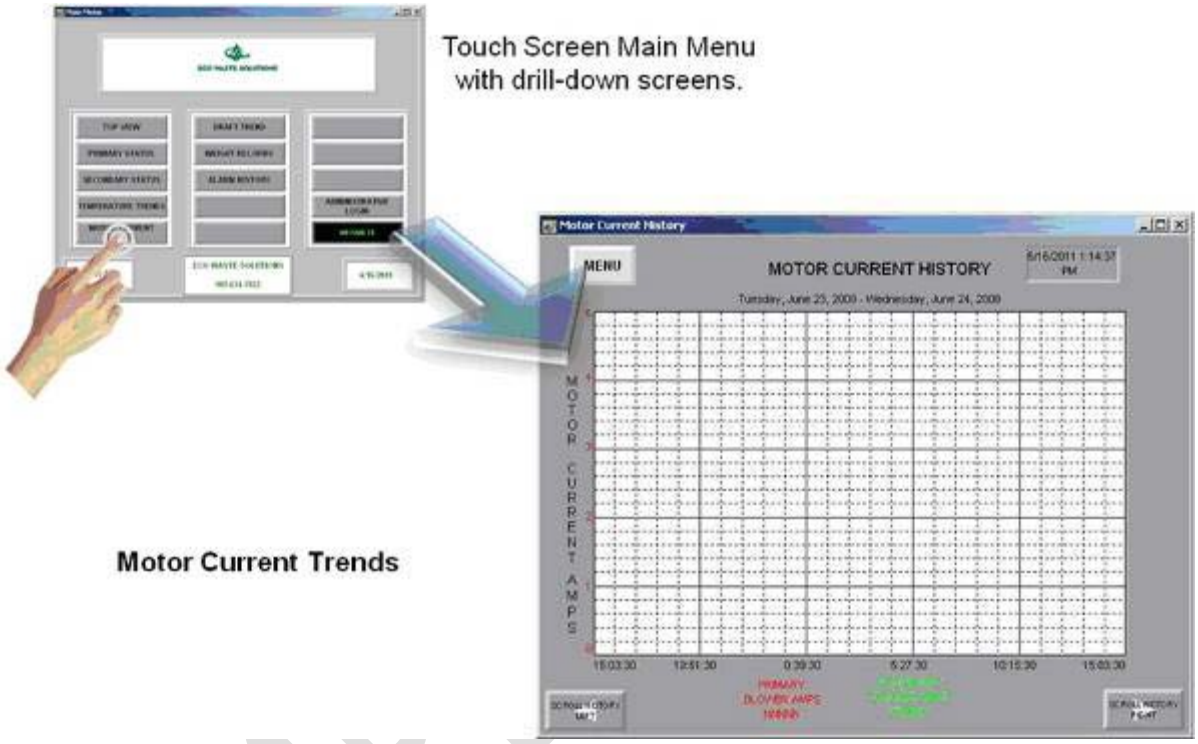
For example, when the ***Temperature History*** button is selected, the screen will display the trend in temperature during the operation of the system, include date & time of occurrence of that specific temperature.



Temperature History – highlights the temperature on a specific day and time

Motor Currents History

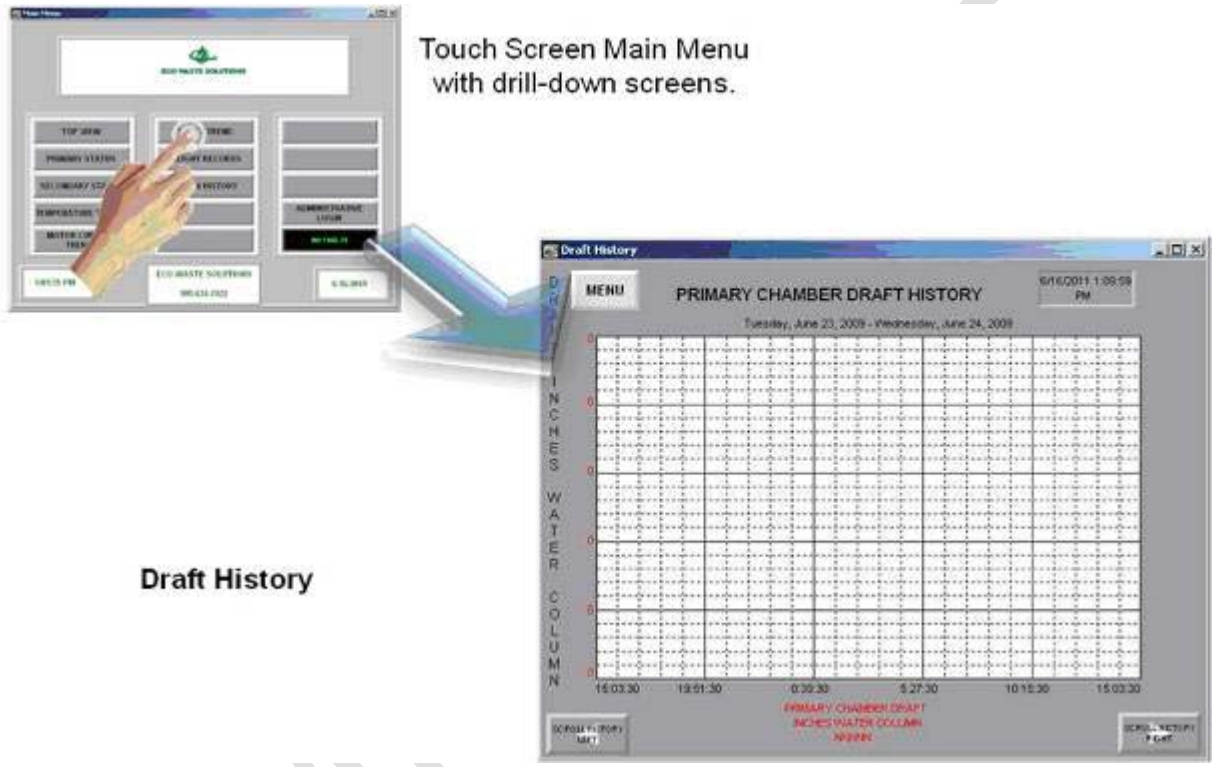
When the ***Motor Currents History*** is selected a screen will display the motor currents from the Primary Burner and the Secondary Burner, in AMPS, during the operation of the system, including date & time of occurrence of that specific motor current.



Motor Current Trends

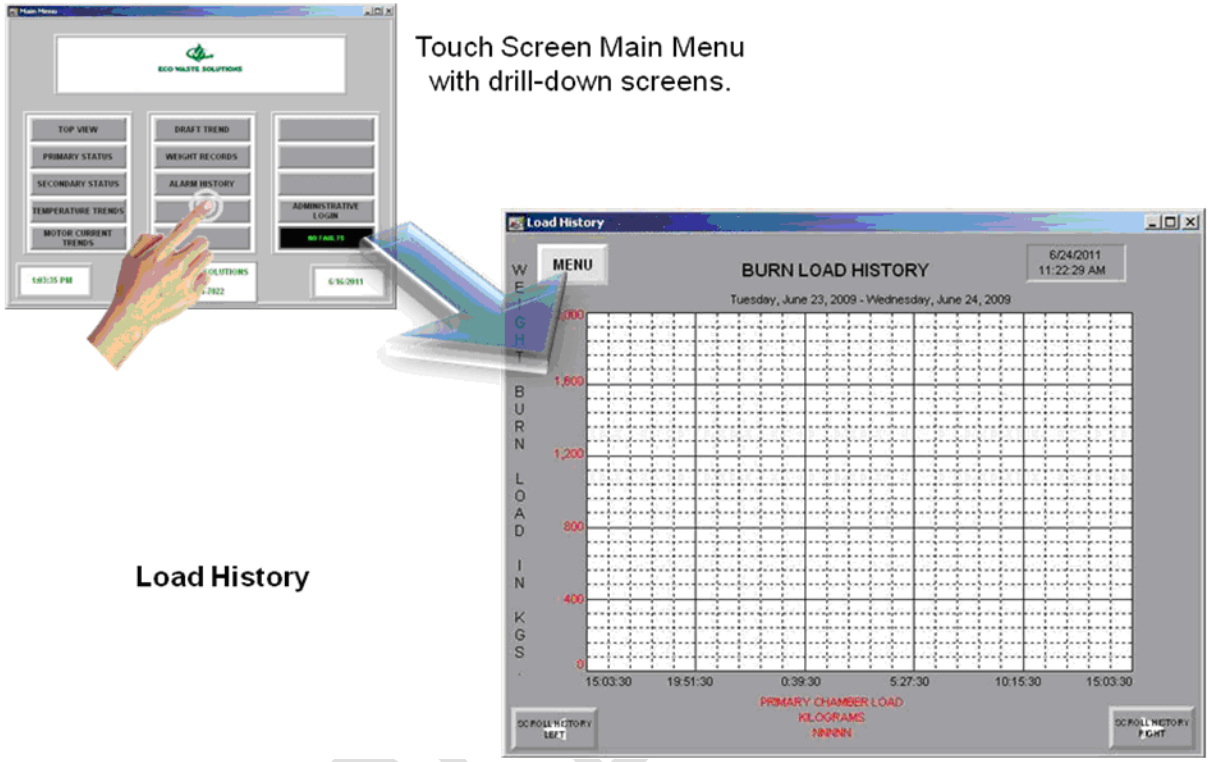
Draft History

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



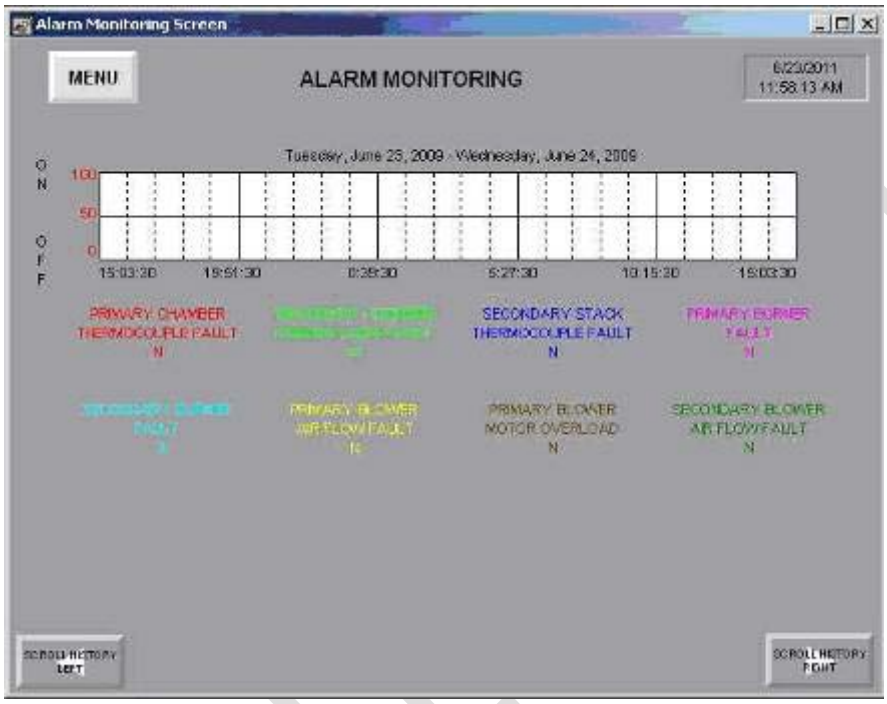
Load History

When the ***Load History*** button is selected, the daily waste volumes will be displayed as a trend.

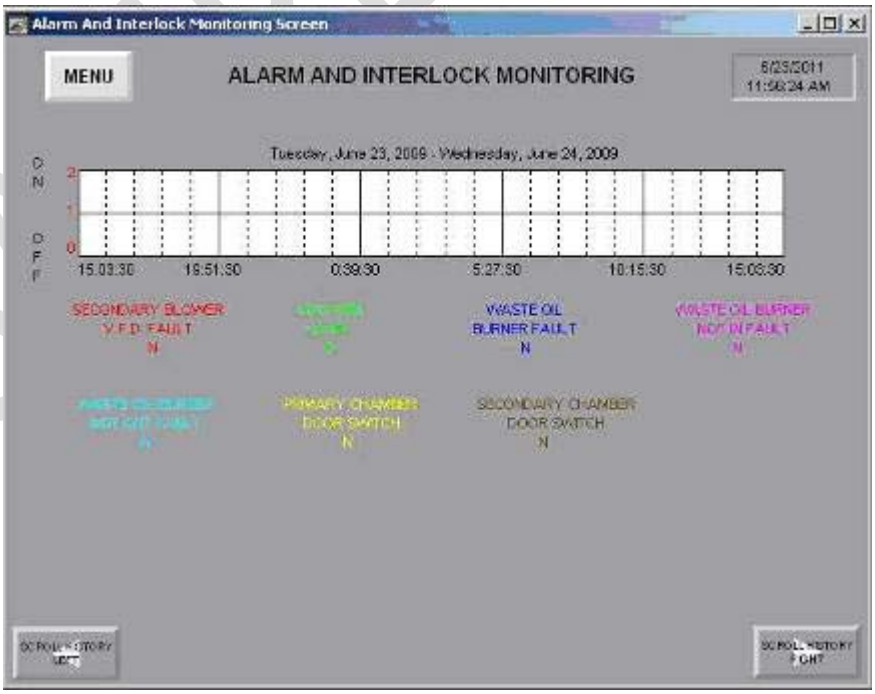


Alarm Monitoring Display

In order to download the alarm history, the **PanelView** monitors the alarms in one of two display pages shown below. By selecting these displays, the operator can view a selected alarm.



Alarm and Interlock Monitoring Display



Procedures For Commissioning (Initial Start Up ONLY)

NOTE

This section highlights a set of mandatory commissioning/start-up procedures to be performed prior to operating the incinerator system for the first time. Please follow them carefully. Once the procedures have been completed, the operator will not have to perform them again, unless a new burner is installed (has to be replaced).

NOTE

If this set of procedures has already been followed, please go directly to the next section "Standard Daily Operating Procedures".

Commissioning Procedures

NOTE

The following commissioning/start-up procedures are to be read and followed after all proper installation and assembly instructions have been completed and inspected.

1. Turn on main disconnect on the **Main Control Panel**, **Panel View** will load
2. Once the **Panel View** is running, push the "Control Power On" button.
3. Ensure there is power supply to the incinerator by selecting the ***Top View*** button from **Main Menu** and check:
    a. All temperature readings (if 1371˚C is displayed the thermocouple is not connected or is faulty.)
    b. That the Primary and Secondary Chamber door position on screen is the same as on the system.
4. Fill Diesel and Waste Oil Tanks, and ensure they are full. (see instructions below)
5. Located on the fuel train outside the Primary Chamber, ensure all ball valves are in the closed position.

ONLY DIESEL FUEL CAN BE STORED IN THE DIESEL FUEL TANK AND ONLY WASTE OIL (WITHOUT ADDITIVES) CAN BE STORED IN THE WASTE OIL STORAGE TANK

NOTE

Before filling either tank ensure:

a. The storage tank is in good condition, e.g. tank shall not exhibit severe rusting, apparent structural defects or deterioration.

b. No leaking visible. If leaking is detected perform the following clean-up steps:

   i. Stop the release.
   ii. Contain the released waste oil.
   iii. Clean up and properly manage the released waste liquid as per best environmental standards.
   iv. Repair or replace the leaking waste storage tank prior to returning it to service.

c. Inspect the bottom of tank for sludge formation. Perform the following steps:

   i. Remove fuel tank access cover.
   ii. Do a visual inspection of the inside of the tank, clean if necessary. A drain valve is located at the bottom of the tank to assist with cleanout. Ensure the drain valve is in place before filling.
   iii. Ensure valve is closed.
   iv. Fill the tank through the access.
   v. When the tank is full, do a "walk around" of the tank and inspect tank for leaks and structural defects.

NOTE

Load the oldest liquid (waste oil) inventory first. Long term storage may result in the formation of sludge or the growth of soluble and insoluble bacteria that can clog the downstream filters.

6. Prime the fuel lines by attaching a tee fitting to the highest point closest to the fuel tank on the supply fuel line.
   a. Loosen the Pressure Gauge Attachment (item # 3) on both burners, see figure A and C).

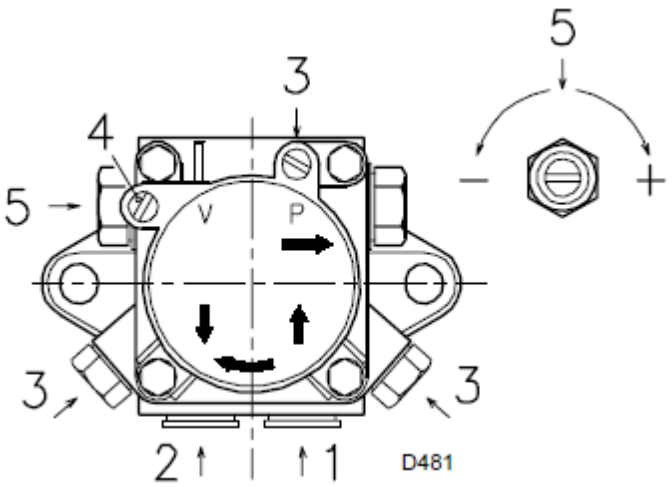
   b. Remove the plug from the fitting and insert a funnel.

   c. Fill the fuel lines until light oil starts coming thru the pressure gauge attachment on the burner pump.

7. Physically prime the Primary Burner located in the Primary Chamber.

   a. Before starting the Primary Burner, make sure that the tank return line is not clogged.

   b. The pump leaves the factory with the by-pass closed.



Legend:

1. Suction
2. Return
3. Pressure Gauge Attachment
4. Vacuum Gauge Attachment
5. Pressure Adjustment Screw

Figure A

c. In order for self-priming to take place, one of the screws #3 in Figure A (above) of the pump must be loosened in order to bleed off the air contained in the suction line. Start the Primary Burner by closing the control devices and with switch #1 in Figure B (below) in the "ON" position. The pump must rotate in the direction of the arrow marked on the cover.

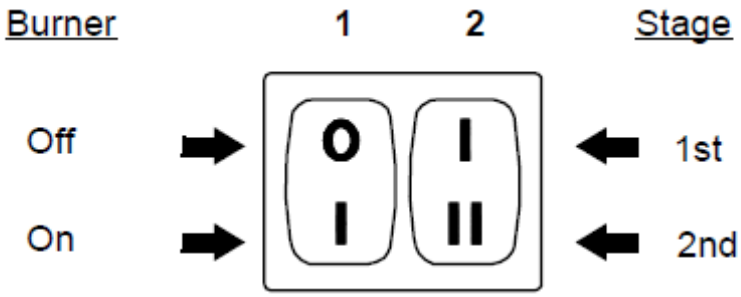


Figure B

d. The pump can be considered to be primed when the light oil starts coming out of the screw #3 in Figure A with no air bubbles. Stop the burner: switch #1 in Figure B set to "OFF" and tighten the screw #3 in Figure A. The time required for this operation depends upon the diameter and length of the suction tubing. If the pump fails to prime at the first starting of the burner and the burner locks out, wait approx. 15 seconds, reset the burner, and then repeat the starting operation as often as required. And so on.

e. After 5 or 6 starting operations allow 2 or 3 minutes for the transformer to cool.

f. Be careful to not allow ambient light to illuminate the photocell or the burner will lock out.

g. Assuming tank is installed at ground level and piping is ½" line. If the length of the suction piping exceeds 60 meters, the supply line must be filled using a separate pump. If the tank is installed below or above grade refer to the Riello Manual.

8. Physically prime the Secondary Burner located in the Secondary Chamber

   a. Before starting the burner, make sure that the tank return line is not clogged. Obstructions in the line could cause the sealing organ located on the pump shaft to break.

   b. In order for self-priming to take place, screw #3 in Figure C (below) of the pump must be loosened in order to bleed off the air contained in the suction line.

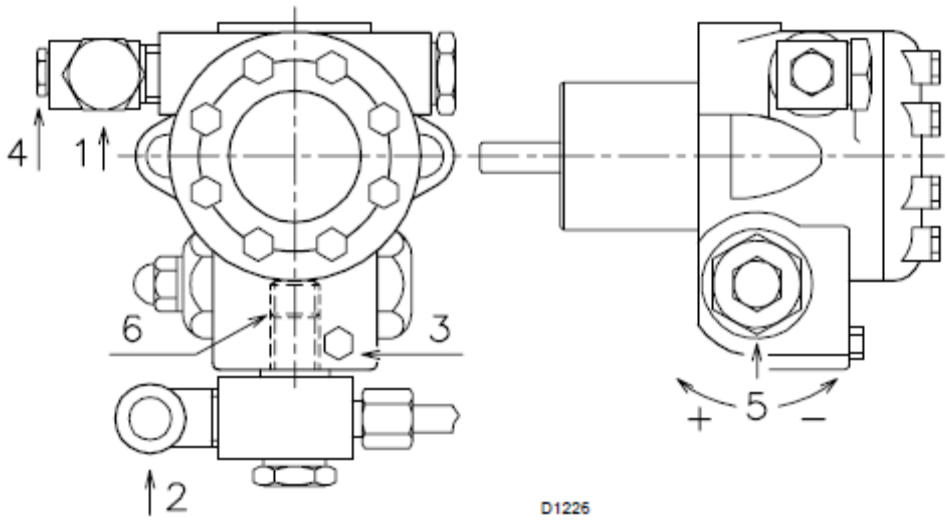


Figure C

Legend:

1. Suction
2. Return
3. Pressure Gauge Attachment
4. Vacuum Gauge Attachment
5. Pressure Adjustment Screw

c. Start the burner by closing the control devices with switch #1 in Figure D (below) in the "MAN" position. As soon as the burner starts, check the direction of rotation of the fan blade, by looking through the flame inspection window.

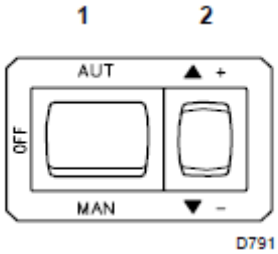


Figure D

d. The pump can be considered primed when the light oil starts coming out of screw #3 in Figure C (above) with no air bubbles. Stop the burner: switch #1 in Figure D (above) set to "OFF" and tighten screw #3 in Figure C (above). The time required for this operation depends upon the diameter and length of the suction tubing. If the pump fails to prime at the first starting of the burner and the burner locks out, wait approx. 15 seconds, reset the burner, as often as required. After 5 or 6 starting operations allow 2 or 3 minutes for the transformer to cool.

e. Assuming the tank is installed at ground level and piping is ½" line. If the length of the suction piping exceeds 40 meters, the supply line must be filled using a separate pump. If the tank is installed below or above grade refer to the Riello Manual in *Section 10: Supplier Catalogues, Volume 2 of 2*.

9. Physically prime the Waste Oil Burner located in the Secondary Chamber
   a. Refer to supplier manual *Clean Burn Waste Oil burner* in *Section 10: Supplier Catalogues, Volume 2 of 2.*

Curing Refractory

NOTE

A username and password is required to proceed with the following procedures. To obtain them you must contact Eco Waste Solutions directly at (905) 634-7022.

NOTE

This procedure is ALSO only to be performed the first time the system is ever used; it will only be required to be done once.

1. From the **Main Menu Screen**, select the ***Administrative Login*** button and then select the *Curing and Settings Menu* button.

2. From the **Curing & Settings Menu** select ***Curing Status*** button, push the following buttons to set up the curing for Primary and Secondary Chamber ***Push to enable Primary Curing*** and ***Push to enable Secondary Curing.***

3. From Main Control Panel turn the switch to Start.

4. The system will start the curing process which takes 24 – 30 hours.

.

5. If the curing cycle is interrupted turn the switch to START.

6. The cycle will restart from where it got interrupted.

7. To start the curing cycle from the beginning after an interruption, reset the cycle from the curing status screen.

NOTE

In the event of a power shut down to the system, the Main Control Panel must be re-started from the PanelView.

1. On the **Main Menu** of the Panel View, select the ***Administrative Login*** button, and then select the ***Push to Login*** button.

2. From this menu, then select ***Administrative Settings*** button. From this screen, select the ***PanelView Configuration*** button. The application will now shut down. (This will take 1-2 minutes).

3. There will be a GREY screen with a number of Touch Buttons.

4. Press the “RUN (F1)” button on this screen.

5. The application will now restart. (This will take approximately 1-2 minutes)

6. When it is up and running, the system is now ready for operation.

Operating the Integrated Weigh Scale

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

   Option 1: The operator may use a bin or skid (that is previously tared) to load waste onto the weigh scale.

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

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

3. Then, the operator must take the waste and load it into the Primary Chamber.

4. The operator returns to the weigh scale with some more waste and repeats Steps One, Two and Three. This entire procedure is repeated until the maximum load weight is reached. The PLC will indicate this to the operator when the MAXIMUM WEIGHT (green light) comes on and remains on. This indicates that the maximum weight permitted, in this case, the incinerator is designed for a maximum of 1500 kg of waste material, has been reached.

NOTE

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

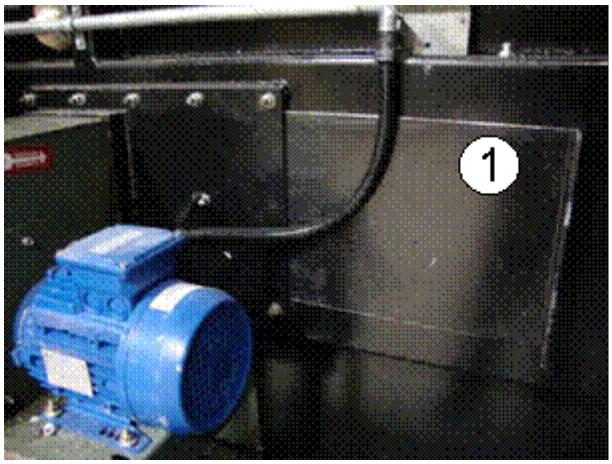
NOTE

If an automated weighing and recording system is not available, waste must be manually weighted and recorded.

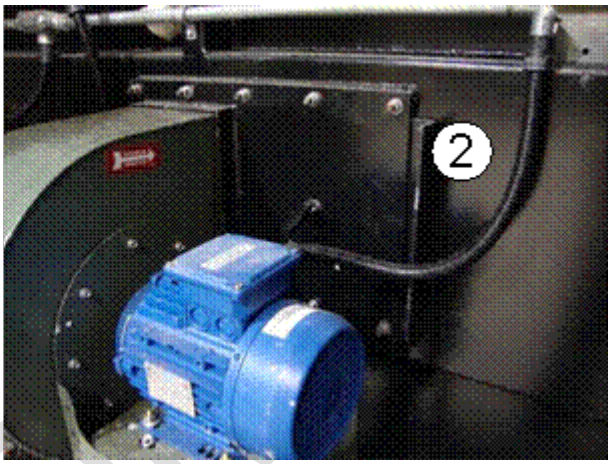
5. The Primary Chamber is loaded, and the incinerator is ready to start.

Incinerator Daily Start up

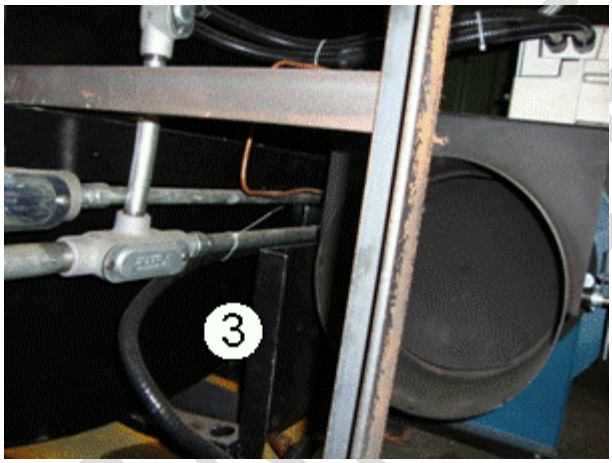
1. Ensure that manual slide gates for each blower are in the open position for free airflow into the **Primary and Secondary Chambers**.



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



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



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

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

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

Sample picture

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

5. Ensure that the **Primary Chamber** has been cleaned out, and the **Primary Chamber** floor is cool (less than 90°C).

If the floor is hotter than this temperature the waste may spontaneously catch on fire during loading.

6. Begin loading the **Primary Chamber** with the waste material, using the Front Loading Door. Make sure that the waste is even without ridges.

NOTE

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

NOTE

Load only the waste stream that the system has been designed for.

NOTE

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

NOTE

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

Breech Opening

Burner port

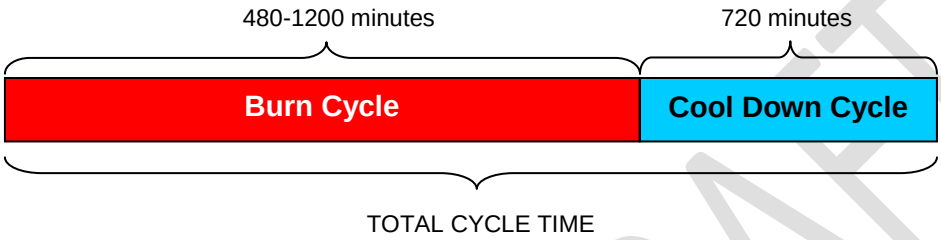
7. Close the **Primary Chamber** access door by clamping each latch until it is tight
8. Lock the **Primary Chamber** Front Loading Door and ensure all latches are properly engaged.
9. Proceed to the **Main Control Panel** on the **PanelView**

NOTE

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

NOTE

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



Hours	Minutes
8	480
8.5	510
9	540
9.5	570
10	600
10.5	630
11	660
11.5	690
12	720

Hours	Minutes
12.5	750
13	780
13.5	810
14	840
14.5	870
15	900
15.5	930
16	960
16.5	990

Hours	Minutes
17	1020
17.5	1050
18	1080
18.5	1110
19	1140
19.5	1170
20	1200

10. Check that the PRIMARY DOOR CLOSED LIGHT located on **Main Control Panel** is on.
11. Check that no alarms are displayed on the **PanelView.**
12. Check that the EMERGENCY STOP BUTTON is out.
13. Ensure that the switch for the waste selection is set for the desired waste processing. Either “SOLID WASTE” or “WASTE OIL” or “BOTH”

Selection	Waste Oil Burner Position
Solid Waste	Waste Oil Burner OUT
Waste Oil	Waste Oil Burner IN
Both	Waste Oil Burner IN

14. On the **Main Control Panel** turn the switch to “START”. The following steps will automatically take place, controlled by the **Main Control Panel**:
    I. The **Primary Blower and Secondary Blower** will purge the system for 2 minutes.
    II. The **Secondary Burner** will purge for safety, and upon completion will ignite.
    III. Once the **Secondary Chamber** temperature reaches 1000°C, the **Primary Burner** will purge for safety and upon completion will ignite.
    IV. The burn time will start counting down when the temperature in the **Primary Chamber** reaches 427°C.

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

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

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

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

Primary Chamber Clean Out Procedures

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

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

Please follow these steps when the cycle is complete:

1. When the internal temperature of the **Primary Chamber** has cooled to less than 90°C, lock out the power to the system on the **Main Control Panel** by moving the main disconnect to the "OFF" position.
2. Unlock all door latches on the access door to the **Primary Chamber.**
3. While standing in front of the **Primary Chamber** door, slowly open the door to allow clear entry. Secure **Primary Chamber** Door in the OPEN position.
4. Clean the **Primary Chamber** by using ash handling tool(s) and proper safety equipment (not provided).
5. Inspect the interior of the **Primary Chamber** for wear and inspect around the door seals to ensure the door will maintain a tight seal upon closure.
6. Check the air inlet holes and remove any obstructions if necessary.
7. Inspect the door seals to ensure there are no gaps between the door gasket and the door jamb.
8. Close the **Primary Chamber** access door by clamping each latch until it is tight.
9. Clean the inspection **View Port** (glass) with a mild soap and water. To clean the view port, unscrew it by hand and re-tighten by hand.

In Case of Emergency

1. Go to manual Slide Gates on the **Primary Chamber**, located just after the blower and close them all the way. This will help to put the fire in the **Primary Chamber** out.

2. Check alarms to see what the problem is.

3. Do not open the door of the **Primary Chamber** unless the temperature inside the chamber is below 90^{o}C.

4. Call a certified technician to fix the problem and/or consult with **Eco Waste Solutions Customer Service Department at 905.634.7022, toll free 1-866-326-2876.**

Start Up After Power Failure

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

Dealing with Warning and Faults

Troubleshooting

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

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

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

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

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

Power is OFF in this position

Power is ON in this position

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

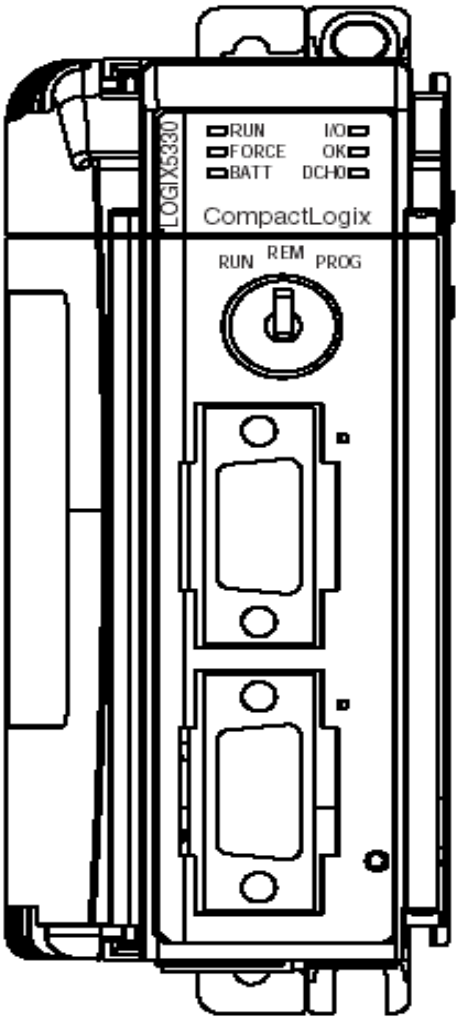
    - The EMERGENCY STOP is pushed in. Twist the EMERGENCY STOP button to unlock, and then push the CONTROL POWER ON button. The CONTROL POWER BUTTON should now be illuminated.

4. If on the “Top View” screen on the **PanelView** the **Primary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

5. If on the “Top View” screen on the **PanelView** the **Secondary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm, if necessary. Check the limit switch and that the wiring is in working order.

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

PLC Processor Problem

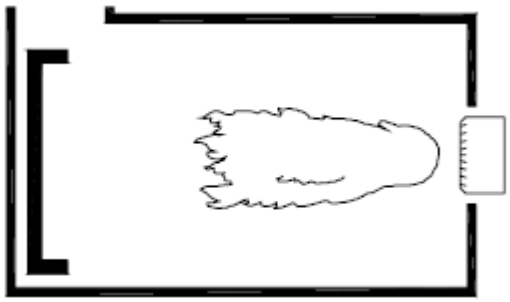
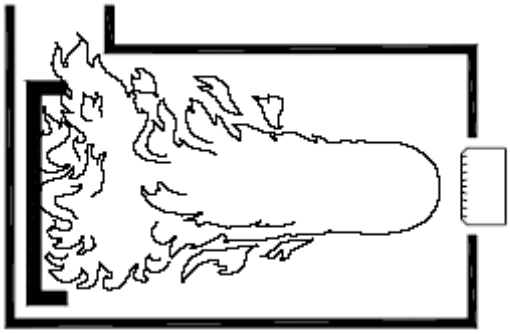
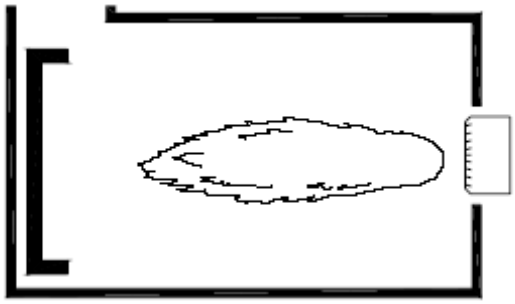


- Check the run light on the PLC processor. If it is on the PLC it is ready.
- "OK LIGHT" is green = Controller is OK.
- "OK LIGHT" is Red Flashing = this is a recoverable fault, check the PLC processor. This fault is very unlikely to occur.
- OK LIGHT is Red = this is a non-recoverable controller fault. Cycle Power. The OK LED should change to flashing red. If LED remains solid red, replace the PLC. This fault is very unlikely to occur.
- DCHO light is green = this indicates the PLC processor has lost the program. The PLC is equipped with a flash card that will automatically load the program back onto the PLC.

Possible Problems, Causes and Solutions

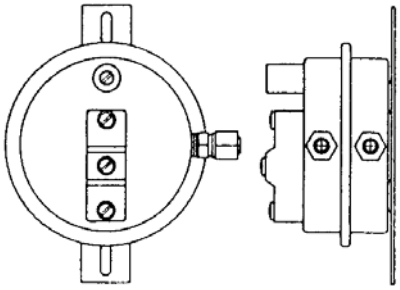
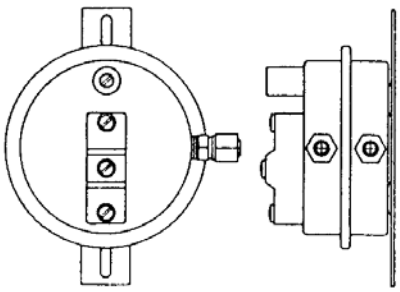
Problem	Causes	Solutions
Blower Fails to start	Over load tripped, blown fuse	Turn power off. Open Panel and reset overload. Check fuse and replace.
	Motor starters or contactor coil is burnt out	Locate contactor for Blower and visually observe if the contactor is pulled in. Use a volt meter to check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

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

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

Possible Alarms (Faults)

#	ALARM (System Fault)	SOLUTION
1	The Primary Chamber Top Thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
2	The Secondary Chamber thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
3	The Secondary Stack Thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
4	The primary burner is faulted	The primary burner has failed to light when it received a signal telling it to start. To reset the burner, press the reset button located on the Burner. If this does not start the burner, refer to Supplier Catalogue (Riello Burner) Section 10 of this manual.
5	The secondary burner is faulted	The secondary burner has failed to light when it received a signal telling it to start. To reset the burner, press the reset button located on the Burner. If this does not start the burner refer to Supplier Catalogue (Riello Burner) Section 10 of this manual.

#	ALARM (System Fault)	SOLUTION
6	The system has shut down due to primary blower low air flow. 	Visually examine the primary blower for any obstructions that may be causing low air flow. Check slide gate located between Primary chamber and blower, ensure it is open. Check damper assembly, ensuring modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air proving switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.
7	The primary blower motor overload is tripped.	Turn power off on Control panel by turning the Main Disconnect to the OFF position. Reset overload.
8	The system has shut down due to secondary blower low air flow 	Visually examine the Secondary Blower for any obstructions that may be causing low air flow. . Check slide gate located between Secondary chamber and blower, ensure it is open. Check damper assembly, ensuring Modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air flow switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.

#	ALARM (System Fault)	SOLUTION
9	The Secondary blower variable frequency drive is faulted	Push fault reset button on the Panel view If fault persist check the error code on the variable frequency drive and check manual for troubleshooting alarm.
10	The burner fuel level is low.	Add fuel to the fuel tank and the alarm should reset itself. If alarm persists, replace the low level switch. Refer to Section 6 of this manual.
11	The waste oil burner is not out.	Check to see if the waste oil burner is pulled all the way out of the Secondary Chamber • Pull waste oil burner all the way out, ensuring it makes contact with the limit switch • If the waste oil burner is all the way out and making contact with the limit switch, replace the limit switch. Refer to Section 6 of this manual.
12	The waste oil burner is not in	Check to see if waste oil burner is all the way in. Push waste oil burner all the way in ensuring it makes contact with the limit switch. Replace limit switch.
13	The waste oil burner is faulted.	The waste oil tank is empty, fill tank. Check that the instrument air is going to the burner check the air pressure gauge on the burner and adjust regulator if necessary. Check that the fuel pump is in working condition. Check that the waste oil breaker is not tripped.

Record Keeping

Using Historical Charts

1. Go to the **Main Menu** screen of the **PanelView Operator Interface.**
2. Select the historical chart you want to view (for example, Temperature History)
3. Once the desired chart appears the “buttons” on the bottom left and right of the screen can be used to scroll through to previous days’ information by selecting them.
4. Once the desired date is selected the graph will be on the screen indicating the time and specific data trends (eg. Temperature, time remaining) of the burn.
5. The historical incinerator data is to be saved on a weekly basis to a USB key located on the front of the Main Control Panel (below the operator interface)
6. The USB key can be inserted into the USB drive slot and the data will automatically be copied to it. The key can then be removed and taken to a computer in order to store the incinerator data.

Storing Incinerator Data

1. The **PanelView** only stores a limited number of data, and then it will start to overwrite these records. **We recommend that the incinerator data be downloaded on a weekly basis onto the USB Key.** This data must be then transferred to a computer immediately for storage and printing purposes. The same USB key will be used to download the next set of incinerator data and so on.

2. Inserting the USB key into a computer will allow the operator to access the file (containing the incinerator data).

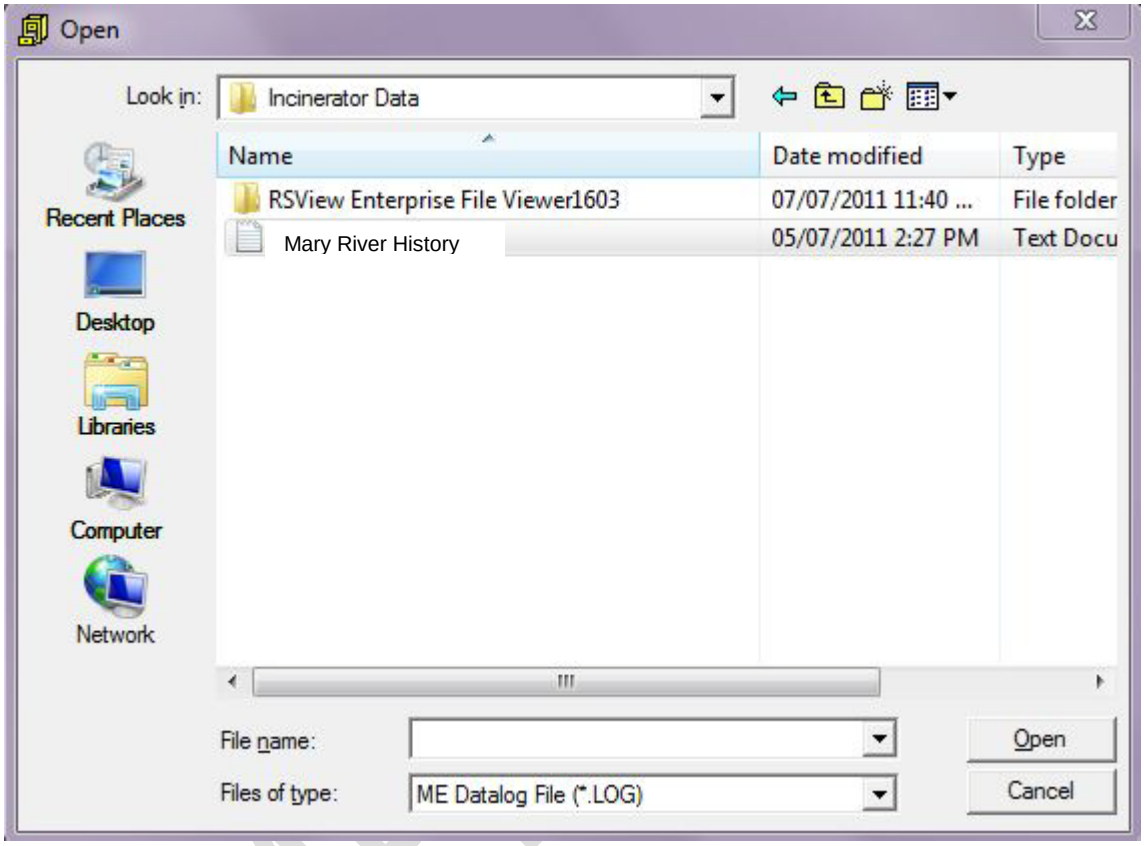
3. It is recommended that a dedicated folder be setup on the destination computer that is used for storing incinerator data.

4. Again, on a weekly basis, copy the data file from the USB Key to this directory and name the file with the date to easily access previous week’s information.

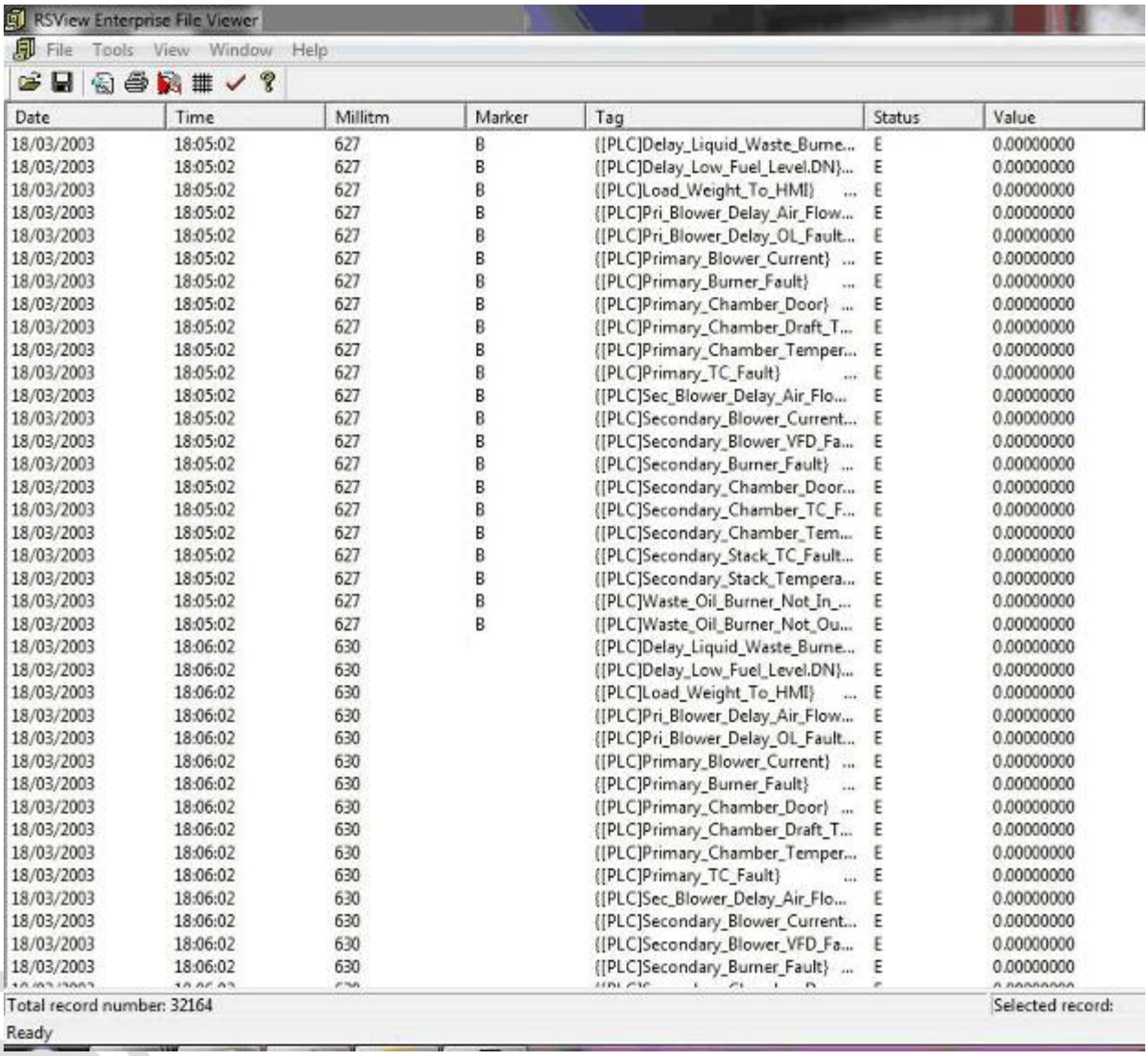
Accessing Historical Information

1. **NOTE The USB Key contains a file called “RSView Enterprise Viewer.EXE”. Copy this file to the destination folder created in “Storing Incinerator Data” above**.
2. To open previous week’s data, double click on the RSView Enterprise Viewer application. From the File menu select Open. Make sure you are searching in the folder containing the historical incinerator data files (as setup in Storing Incinerator Data instructions above).

3. In the Open dialogue box, in the File of type choose **ME Datalog File (*.LOG)** to view all files. Click on the specific Text Document that you wish to open



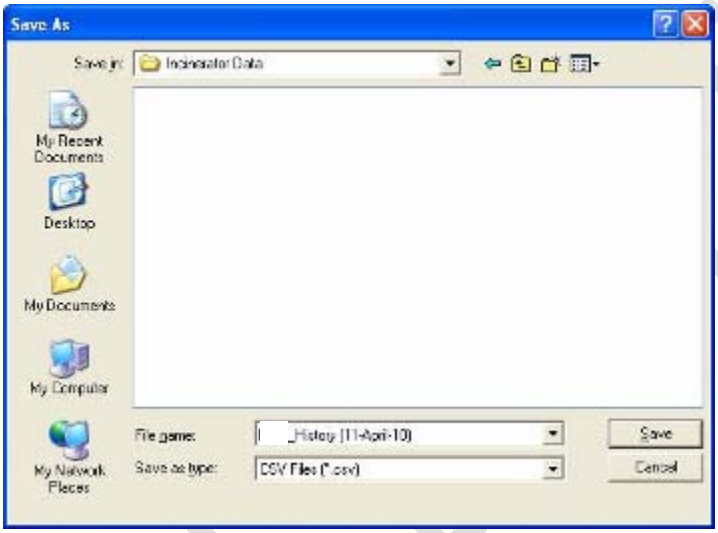
4. Once the data is open, it will look like the following:



Date	Time	Millitm	Marker	Tag	Status	Value
18/03/2003	18:05:02	627	B	{[PLC]Delay_Liquid_Waste_Burne...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Delay_Low_Fuel_Level.DN}...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Load_Weight_To_HMI} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Pri_Blower_Delay_Air_Flow...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Pri_Blower_Delay_OL_Fault...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_Blower_Current} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_Burner_Fault} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_Chamber_Door} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_Chamber_Draft_T...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_Chamber_Temper...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Primary_TC_Fault} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Sec_Blower_Delay_Air_Flo...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Blower_Current...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Blower_VFD_Fa...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Burner_Fault} ...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Chamber_Door...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Chamber_TC_F...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Chamber_Tem...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Stack_TC_Fault...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Secondary_Stack_Tempera...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Waste_Oil_Burner_Not_In_...	E	0.00000000
18/03/2003	18:05:02	627	B	{[PLC]Waste_Oil_Burner_Not_Ou...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Delay_Liquid_Waste_Burne...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Delay_Low_Fuel_Level.DN}...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Load_Weight_To_HMI} ...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Pri_Blower_Delay_Air_Flow...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Pri_Blower_Delay_OL_Fault...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_Blower_Current} ...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_Burner_Fault} ...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_Chamber_Door} ...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_Chamber_Draft_T...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_Chamber_Temper...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Primary_TC_Fault} ...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Sec_Blower_Delay_Air_Flo...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Secondary_Blower_Current...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Secondary_Blower_VFD_Fa...	E	0.00000000
18/03/2003	18:06:02	630		{[PLC]Secondary_Burner_Fault} ...	E	0.00000000

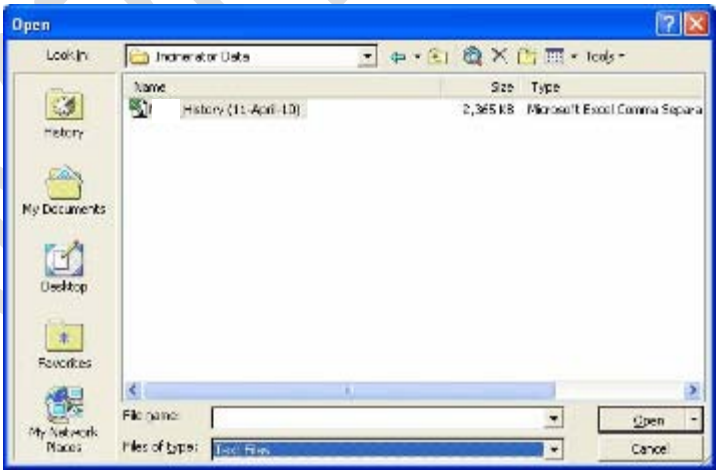
Saving Data to Excel

1. To save the data in a Microsoft Excel format – with the data open (as above) from the File menu select Save As and select the directory where you wish to save the file. Make sure you have a logical name in the File Name field (it will default to the same file name as the TXT file you have opened). Make sure CSV is selected in the "Save as Type" drop down box and select the Save button.



Sample pop up window

2. To view the file in Microsoft Excel, open the Excel application and from the File menu, select Open and then make sure that "Files of Type" is on "Text Files"



Sample pop up window

3. Choose the file you wish to open and select "Open" from the dialogue box. The file is now open in Excel.

ECO WASTE SOLUTIONS

Mary River Project

#H377697-PM406

SECTION 6

MAINTENANCE INSTRUCTIONS

ECO 2TN 1P

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6.1 Zero Mechanical State & Lock Out Procedures

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

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

6.1.1 Safety

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

1. Zero Mechanical State
2. Power Lock Out Procedures

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

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

6.1.2 Zero Mechanical State

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

6.1.3 Zero Mechanical State (ZMS) Checklist:

1. Every electrical power source to the incinerator must be cut off and locked out (to prevent others who may not be aware of maintenance work from turning the power back on inadvertently).
2. Ensure that the mechanical potential energy of the incinerator is at its lowest practical value so that opening of pipe, tubing, hose or actuation of any valve will not produce an unexpected movement that could cause injury.

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

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

6.1.4 Power Lock Out Procedures

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

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

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

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

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

6.1.5 Power Lock Out Checklist

1. Alert the operator of the equipment.

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

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

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

6.2 Instruction Classification

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

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

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

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

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

6.2.1 Daily Instructions

Primary & Secondary Chamber Burners: (01-002.D & 02-002.D)

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

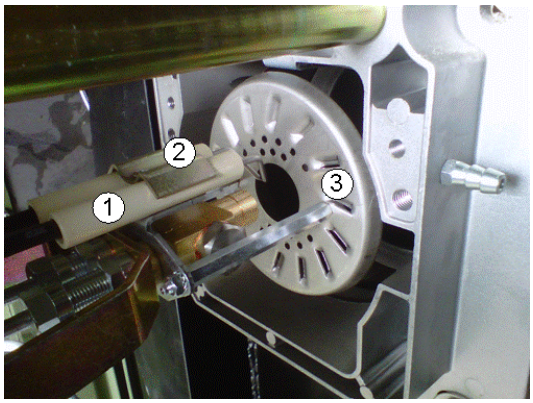
Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

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

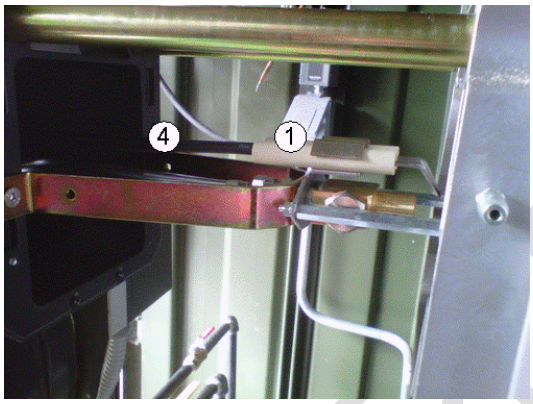
INSTRUCTION 01/02-002.D.01: INSPECTING AND CLEANING ELECTRODES

1. Remove the cover from the Burners as described in 01-002.W.01 and 02-002.W.01.

2. Inspect the electrodes (PN: 3003796) for any soot build-up.



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

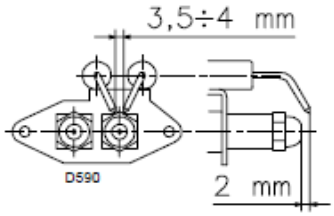


4. HT Leads

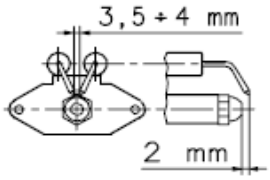
3. Clean/wipe down the ignition electrode with a cloth should there be a build-up of soot.

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

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



Primary Burner



Secondary Burner

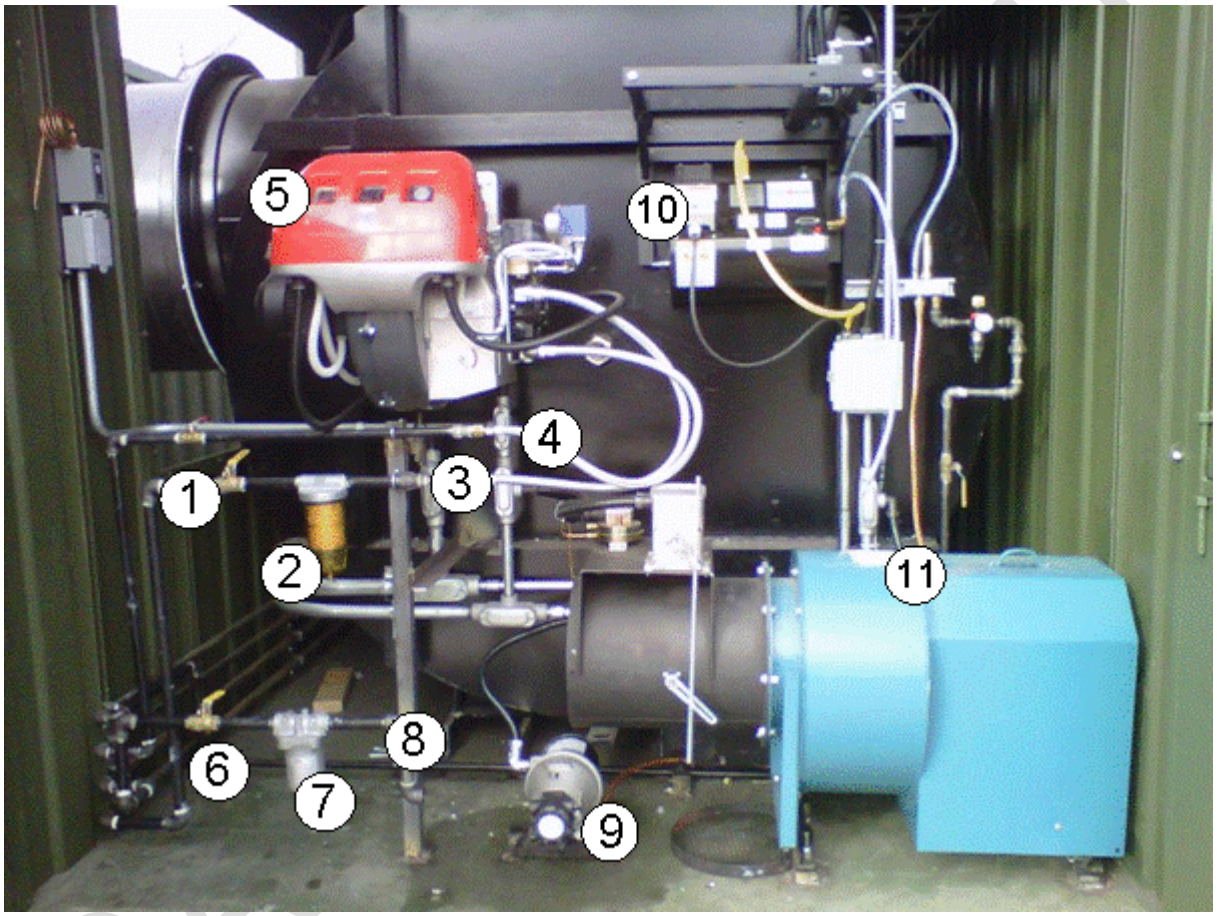
Check the High Temperature (HT) Leads (PN: 3012393) for any heat damage. If HT Leads are severely damaged (ie, you can see the wire beneath the sheathing) then replace. (See *CMI 6.3.3/01-002A & 6.3.3/02-002A)*

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

1. Visually inspect all fuel lines to the Primary and Secondary Burner as well as to the Waste Oil burner for any leaks.

2. The Primary and Secondary Burner have two oil lines, one feed and one return. The Waste Oil Burner only has one feed line.

3. If any leaks are observed tighten or replace the fitting where the leak is occurring



1. Fuel In Ball Valve
2. Fuel Filter
3. Fuel Line In
4. Fuel Line Out
5. Secondary Burner
6. Waste Oil Ball valve
7. Waste Oil Filter
8. Waste Oil Line In
9. Waste Oil J-pump
10. Waste Oil Burner
11. Secondary Blower

INSTRUCTION 01/02-002.D.03: INSPECT AND CLEAN BURNER NOZZLES

Primary Burner:

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

Secondary Burner:

1. Remove the burner cover as outlined in 01/02-002.W.01 REMOVAL OF BURNER COVERS
2. Remove the 4 retaining bolt on either side of the burner.
3. Slide burner out.
4. Check nozzle. If there is carbon remove the nozzle and clean.
5. Reinstall or replace if necessary (PN: C5220102)

Refractory: (05-001.D)

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

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

Ensure power is locked out.

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

1. Open Primary Chamber door by unlatching all four clamps.
2. Tie-off door to open position to ensure that it will not close unintentionally.
3. Enter Primary Chamber and check the refractory for shrinkage, any gap between the modules greater than 2.5 cm should be patched with the blanket refractory
4. Check for any exposed metal between the modules, if metal is exposed make sure to patch area with blanket material (PN: 1" x 24" 8# 2600) or new module (PN: 6" Mod ZR) (*CMI 6.3.2/05-001A & 6.3.2/05-001B)*

6.2.2 Weekly Instructions

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

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

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

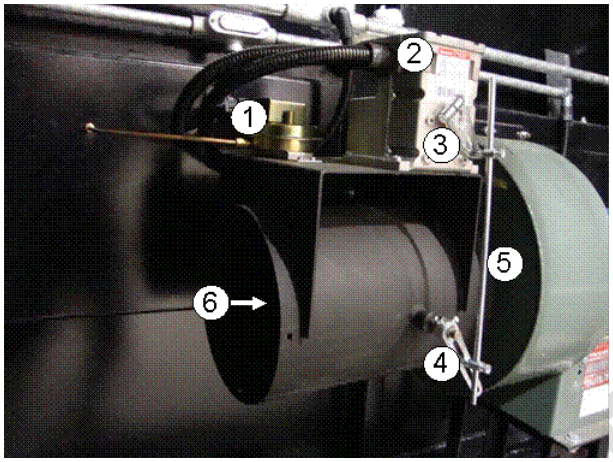
A fan can windmill despite removal of all electrical power therefore, take extra care when working with fans in the system.

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

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

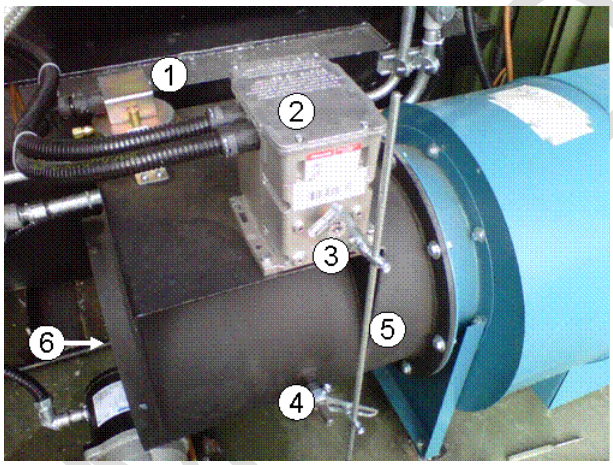
Check to see that the damper crank arm is connected to the damper and the rod.

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



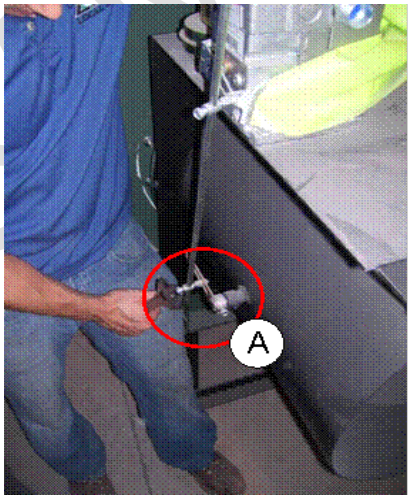
PRIMARY BLOWER

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



SECONDARY BLOWER

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



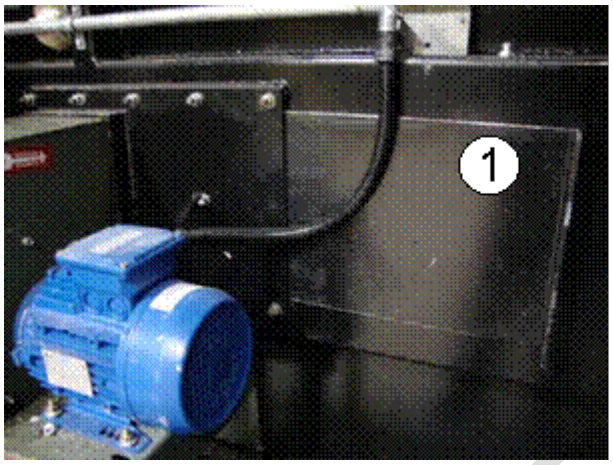
A. Damper Crank arm and connection to Damper and Rod

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

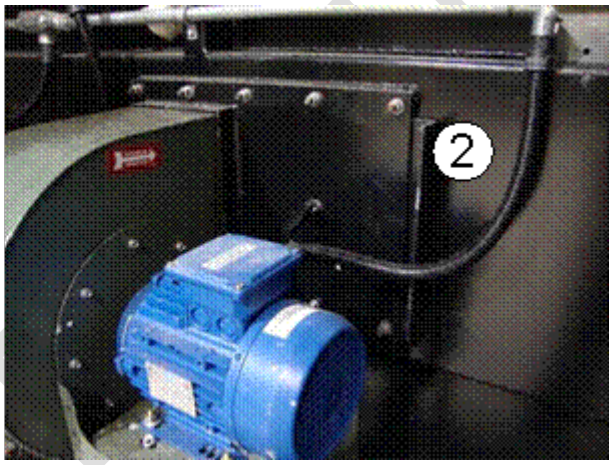
Check to see if slide gates move freely.

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

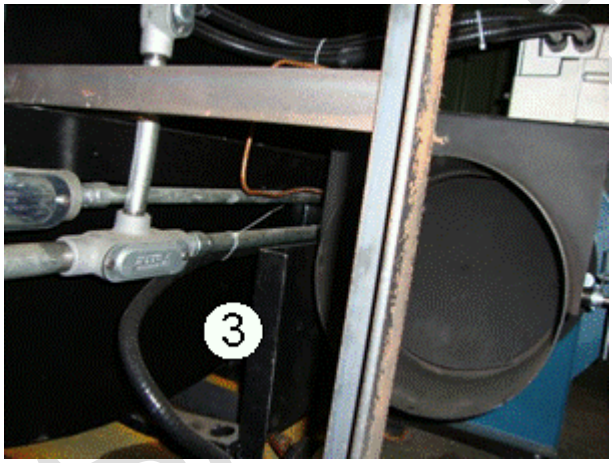
2. Gates must be opened to allow under fire air to enter the chamber. They should only be closed to reduce air in abnormal operating conditions.



1. Primary Chamber Slide Gate Open



2. Primary Chamber Slide Gate Closed



3. Secondary Chamber Slide gate Open

Primary & Secondary Chamber Burners: (01-002.W & 02-002.W)

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

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

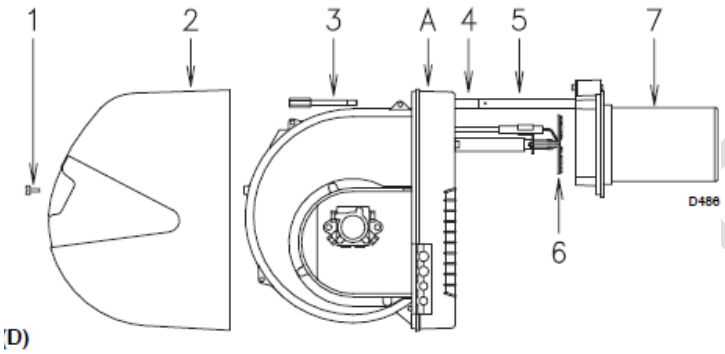
Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

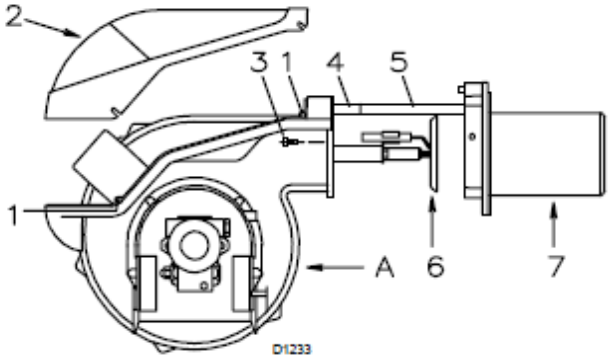
INSTRUCTION 01/02-002.W.01: REMOVAL OF BURNER COVERS

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

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

1. Loosen screw (Item #1, in the following diagrams) and withdraw the cover (Item #2, in the following diagrams)
2. Primary Burner has, one screw to remove the cover. The Secondary Burner has four screws to remove the cover.
3. Remove bolt (Item #3) for the Primary Burner, or screws (Item #3) for the Secondary Burner.
4. Pull (Part A) backwards keeping it slightly raised to avoid damaging the diffuser disk (Item #6).





Primary Burner has 1 screw

Primary

Secondary Burner has 4 screws (2 on each side)

Secondary

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

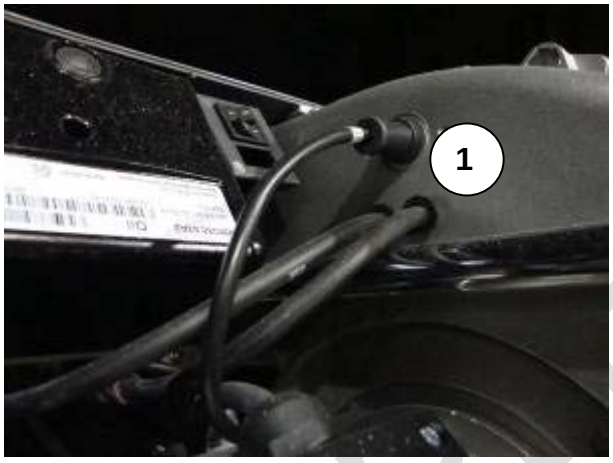
1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.

2. Clean Photo Electric (P.E) cell with a wet cloth (Primary Burner PN: 3006216) and the Photo Electric (P.E) (Secondary Burner PN: 3006216) with a cloth.

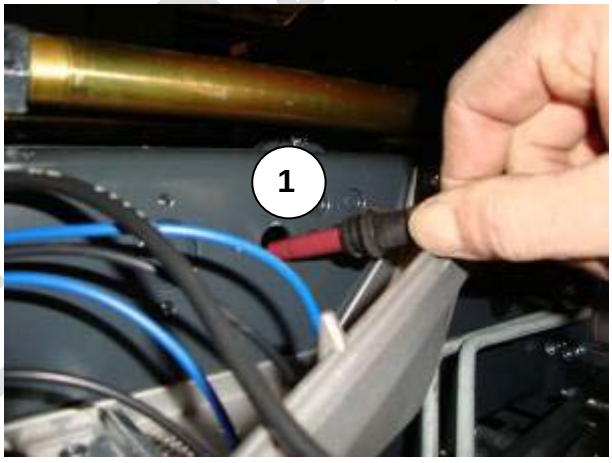
3. P.E. cell (Item #1) can be removed by pulling it outward forcefully. Ensure you take note of the position of the eye while removing, this will help when reinstalling.

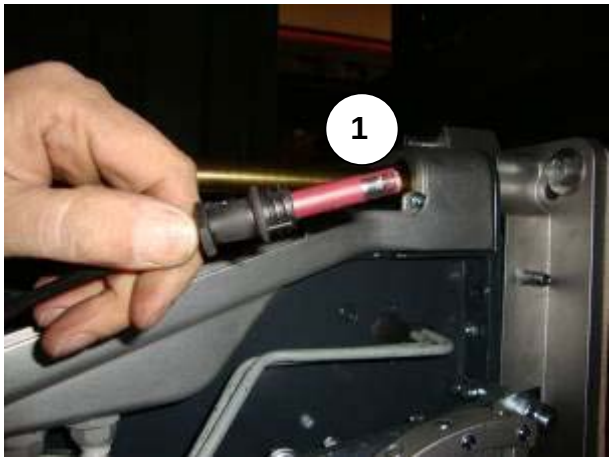
4. Once cleaned insert P.E. cell back into position ensuring the eye is not facing directly into the chamber (where the flame will be) but on the same angle as before it was removed.

5. Replace burner cover.



Primary Burner PE Cell

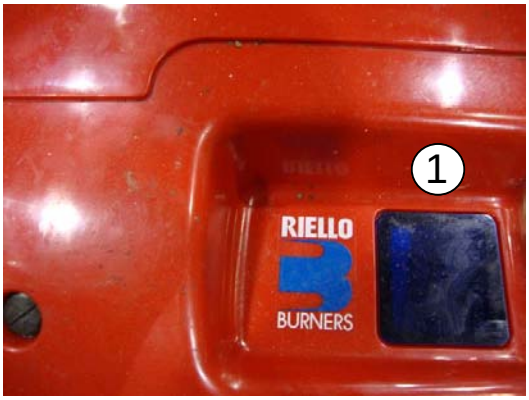




Secondary Burner UV Detector

INSTRUCTION 01/02-002.W.03: CLEANING THE INSPECTION WINDOWS

Clean the inspection windows with a wet cloth.



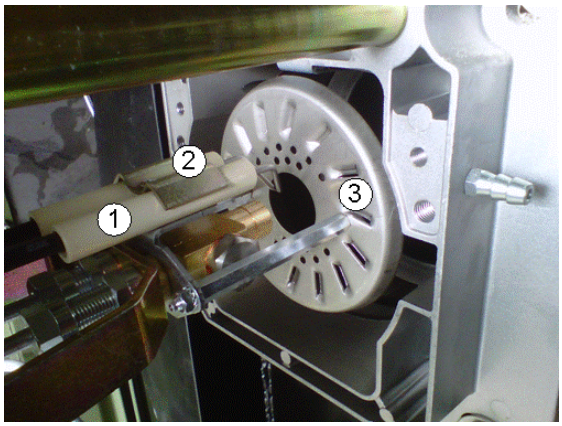
1. Primary Burner Inspection Window
2. Secondary Burner Inspection Window

INSTRUCTION 01/02-002.W.04: INSPECTING THE DIFFUSER DISC ASSEMBLY

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

2. Check the diffuser disc assembly (Primary Burner PN: 3003791) and the diffuser disc (Secondary Burner PN: 3012463) for any heat damage

3. If any heat damage, deformation or excess rust is noted, replace. (*CMI 6.3.8/03-009K)*



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

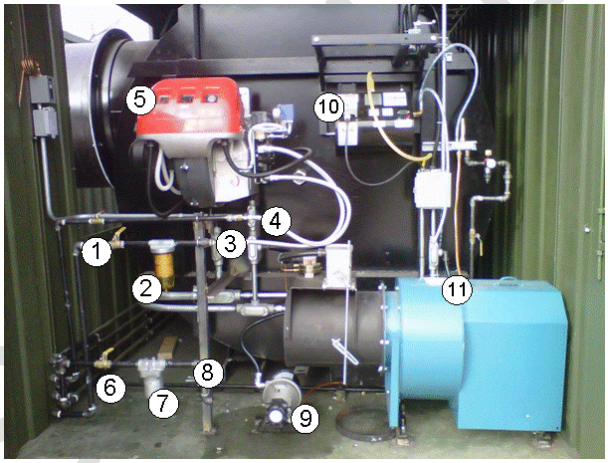
Waste Oil Burner: (02-003.W)

Failure to maintain and/or improper servicing by unqualified personnel will adversely affect the efficient and safe operation of your burner, will reduce the service life and will void your warranty

INSTRUCTION 02-003.W.01: INSPECTING & CLEANING WASTE OIL FILTER

To clean the waste oil filter Item #7, please follow instructions below:

1. Close the ball valve Item #6 adjacent to the filter
2. Position a container under the filter
3. Unscrew the four bolts to drain the oil from the canister
4. Remove the canister bowl
5. Clean the screen and the bowl in a parts washer
6. Examine the filter components as you reassemble them
7. Ensure that the canister filter is 100% airtight by firmly tightening the four bolts
8. Open the ball valve item #6



1. Fuel In Ball Valve
2. Location of Fuel Filter
3. Fuel Line In
4. Fuel Line Out
5. Secondary Burner
6. Waste Oil Ball valve
7. Waste Oil Filter
8. Waste Oil Line In
9. Waste Oil J-pump
10. Waste Oil Burner
11. Secondary Blower

Air Compressor: (03-001.W)

INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application.

HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing.

MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing.

HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not Touch hot compressor or tubing.

HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct the air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.

RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

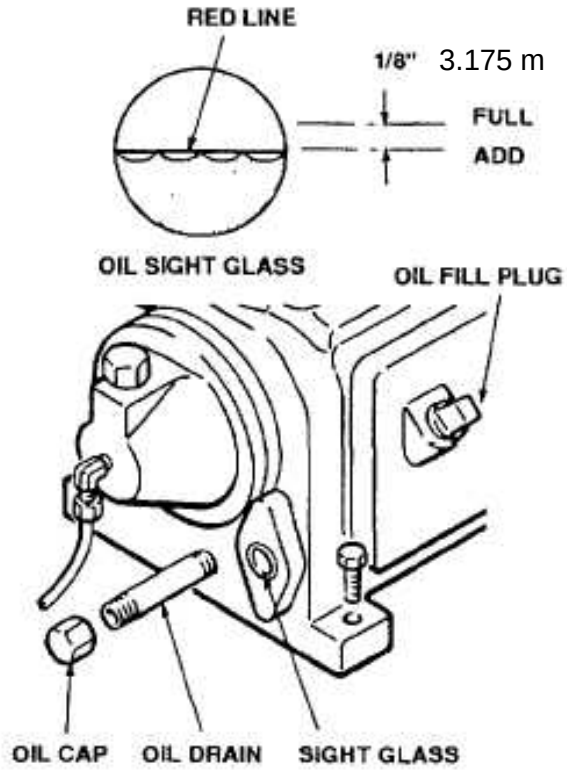
Before maintenance is performed on electrical or rotating equipment make sure that the appropriate electrical disconnects are locked out/tagged out. Before removing the vessel access ports make sure that the equipment is off and cool. If the container of caustic solution (customer supplied) or any associated equipment (pumps, hoses, etc.) needs to be moved to access the components in the Scrubber, make sure the handling precautions that are outlined on the MSDS sheet for the caustic solution (customer supplied) are followed.

INSTRUCTION 03-001.W.01: INSPECTING OIL LEVEL IN AIR COMPRESSOR

1. Check and maintain oil level at centerline of sight glass and add oil as necessary.
2. Compressor Oil PN: V0421-2
3. The oil level should reach 3.175 mm (1/8”) above the red line, on the sight glass. See diagram below.
4. If the oil level is below the red line, remove the oil fill plug and add oil until the sight glass shows the correct level.

NOTA

Too much or too little oil will harm the compressor.



INSTRUCTION 03-001.W.02: INSPECTING AIR FILTERS IN AIR COMPRESSOR

1. Remove the filter cover.
2. Gently grab filter element and remove.
3. Visually inspect filter for damage or dirt.
4. If damaged, replace the filter. If dirty, blow out the filter with compressed air.
5. Reinstall the filter and the cover.

INSTRUCTION 03-001.W.03: CLEANING AIR COMPRESSOR & CHECKING SAFETY VALVE

Cleaning

A dirty compressor will cause abnormally high temperature and result in oil carbonization on valve components.

Clean all external parts of the compressor with compressed air. Concentrate the cleaning on the external fins where dirt can accumulate as cooling air is forced across them.

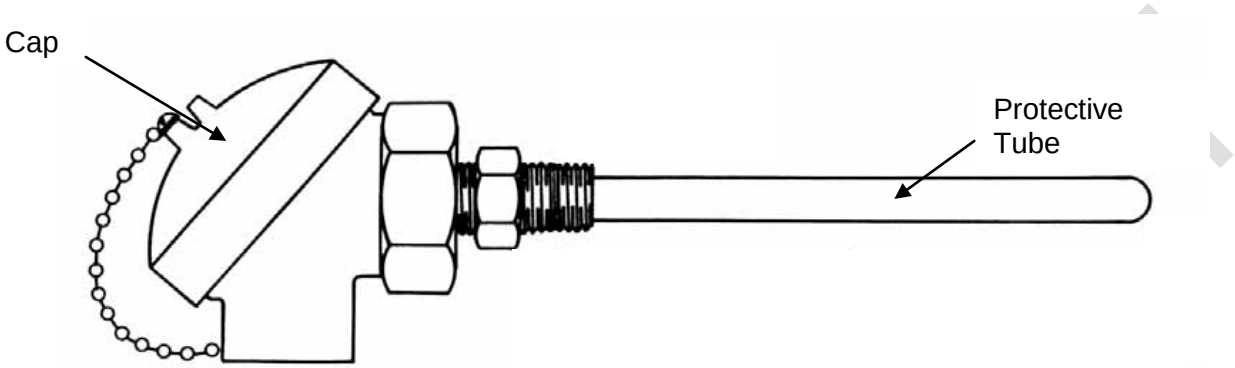
Check Safety Valve

1. Check the safety valve manually by pulling ring or lever to make sure that it moves freely and is not siezed.

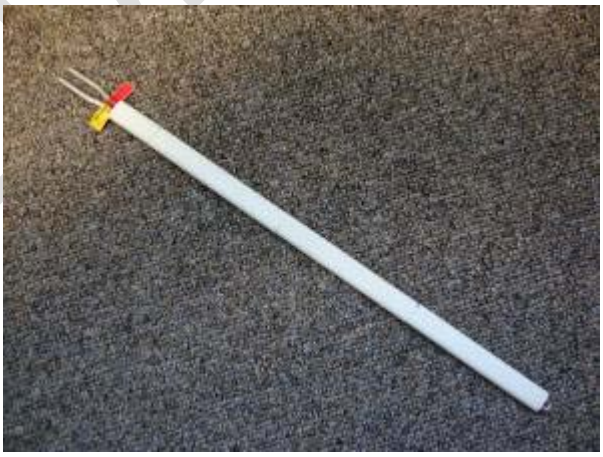
2. Allow the ring to snap back to normal position.

Thermocouple: (05-002.W)

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



Thermocouple Assembly



Thermocouple Element

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

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

1. Primary Thermocouple (TC1)

2. Secondary Thermocouple (TC2) on Secondary Chamber

Stack Thermocouple (TC3) on Stack

6.2.3 Monthly Instructions

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

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

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

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

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures, if left in operation.

2. The wheel can be accessed one of two ways.
   a. Remove the blower assembly from the unit and look down the outlet of the blower.
   b. Remove the damper assembly from the inlet of the blower and inspect by looking through the inlet of the blower.

3. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards.

4. Clean the wheel as required.

5. If replacement is necessary follow these steps:

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

Primary & Secondary Chamber Burners: (01-002.M & 02-002.M)

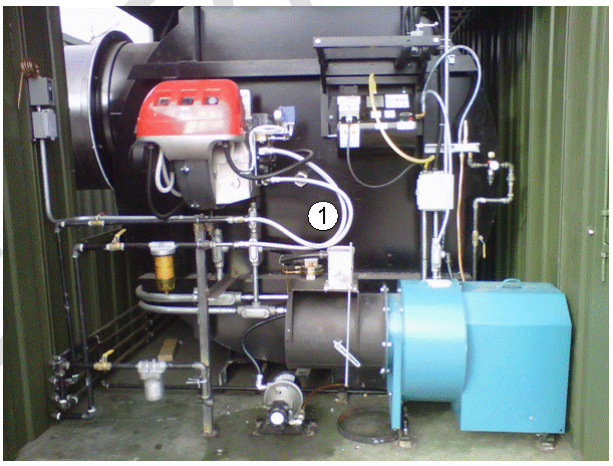
Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01/02-002.M.01: CHECK FLEXIBLE OIL LINE

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

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

Primary Chamber Burner Flexible lines (1 Above)



Secondary Chamber Burner Flexible Lines (1 Above)

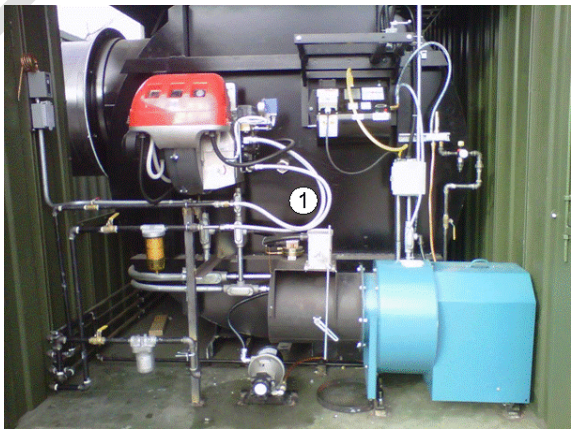
INSTRUCTION 01/02-002.M.02: INSPECT BURNER PUMP DELIVERY PRESSURE

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

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

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

Primary Chamber Burner Flexible lines



Secondary Chamber Burner Flexible Lines

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

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

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

INSTRUCTION 01/02-002.M.03: CLEAN BURNERS OF DUST

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.
2. Check that no dust has accumulated inside the burner fan or on fan blades.
3. If any dust is visible take a clean soft cloth to the fan or the blades and wipe clean.

INSTRUCTION 01/02-002.M.04: CHECK BURNER COMBUSTION HEAD

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.
2. Check that all parts of the combustion head are in good condition, free of all impurities, and that no deformation has been caused by operation at high temperatures.

(Below is an example of burner in good condition)

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

Refractory: (05-001.M)

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

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

INSTRUCTION 05-001.M.01: INSPECT REFRACTORY

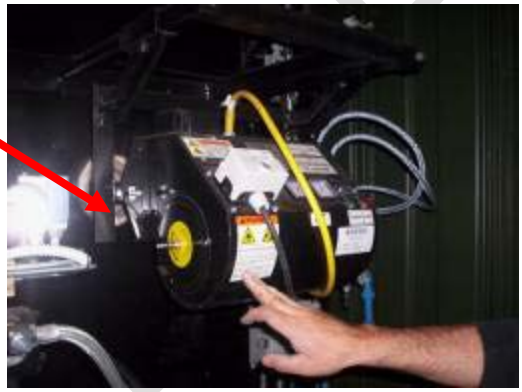
1. Ensure power is locked out.
2. Open Secondary Chamber door.
3. Fasten door open, ensuring it will not close by its own weight.
4. Enter Secondary Chamber and check the refractory for shrinkage, any gaps between the modules greater than 2.5 cm should be patched.
5. Fix gaps with supplied blanket by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

Waste Oil Burner: (02-003.M)

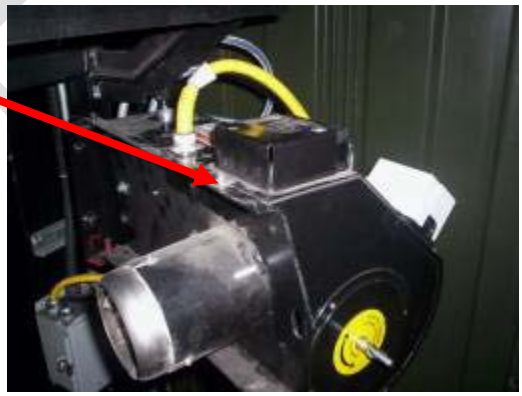
Failure to maintain and / or improper servicing by unqualified personnel will adversely affect the proper, safe operation of your burner, will reduce the service life of your burner and will void your warranty

INSTRUCTION 02-003.M.01: INSPECT ELECTRICAL COMPONENTS

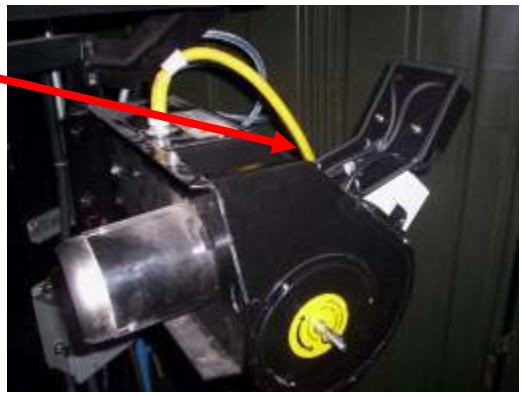
1. Check all electrical components for any heat damage.
2. If heat damage is observed remove and replace.
    1. Slide out burner
    2. Undo Bolt



    3. Loosen Bolt



    4. Open hinged hatch to access front components



INSTRUCTION 02-003.M.02: INSPECT HEATER ELEMENT

1. Remove heater element from casing and inspect for build-up

2. Clean any deposits.

3. If damaged, heater element needs to be replaced. Removal involves the following steps:
   a. Remove all electrical connections attached to the heater block identified in Picture #3 below.
   b. Remove all the bolts attaching the heater to the burner housing.
   c. Remove all fuel line connections.
   d. Remove the heater element and install the new one. (PN: 33173)
   e. Reinstall the heater block.

4. When reinstalling the heater element always ensure the element will be restarted immersed.

⚠ **NEVER use the inline heater dry**

1. Unscrew (yellow) electrical connection

2. Remove cover screw

3. Open hatch cover to expose heater element

Air Compressor: (03-001.M)

 **INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application unless treated in accordance with all applicable codes and regulations.**

 **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Compressor must be connected to properly grounded circuit. Do not operate compressor in wet conditions. Store indoors.**

 **MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.**

 **HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing.**

 **HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.**

RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

INSTRUCTION 03-001.M.01: CHECK FASTENERS FOR TIGHTNESS

1. Check all fasteners for tightness (tighten as required).

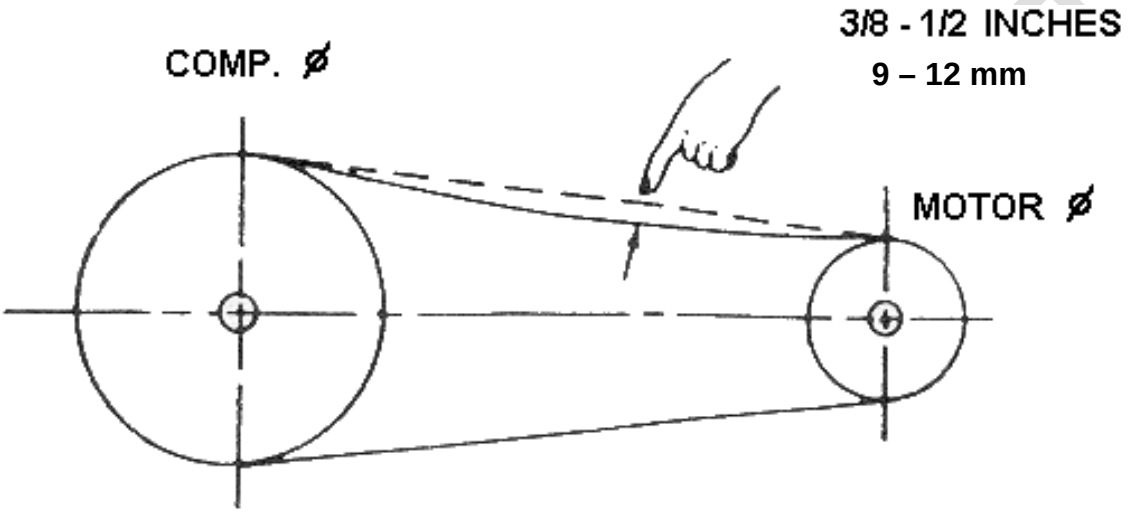
2. Check the safety valve manually, by pulling ring or lever, to make sure that is not stuck. Allow the ring to snap back to normal position

INSTRUCTION 03-001.M.02: CHECK BELT FOR TENSION

Proper belt tension and pulley alignment must be maintained for maximum drive efficiency and belt life.

1. Check all belt tension. If belts are worn or cracked replace as per instructions below.

2. The v-belt(s) should be adjusted so that a declination of about 3/8" – ½" (9-12 mm) will be obtained when it is pushed by a finger at the middle point as shown



Adjusting instructions:

1. Remove the belt guard.

2. Loosen the motor mounting bolts on the base, using a lever if necessary, or by turning the adjusting the bolt at the end of the base.

3. Use a straight edge to ensure pulleys are inline and square to one another.

4. Retighten motor mounting bolts.

5. Check to ensure that the tension remained correct.

6. Reinstall the belt guard. All moving parts must be guarded.

NOTA
Do not over tighten belts.

6.2.4 Quarterly Instructions

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

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

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

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

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

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

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

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

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

INSTRUCTION 01/02-001.Q.02: INSPECT V-BELT

1. Check the V-belt drive for proper alignment and tension as outlined in Instruction 03-001.M.02 Check Belt for Tension.

2. Check for proper alignment.

NOTA Excess tension shortens bearing life. The lowest allowable tension is that which prevents slip-page under full load (3/8").

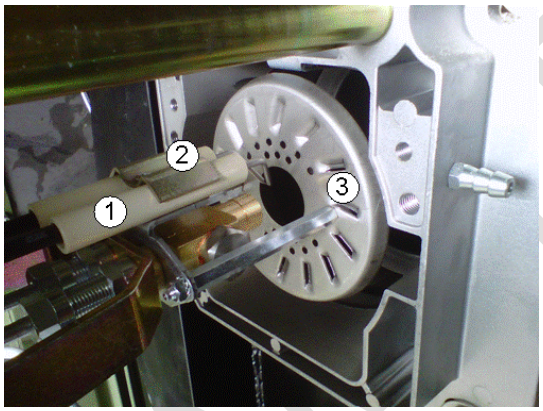
3. If belts are worn, replace.

Primary & Secondary Chamber Burners: (01-002.Q & 02-002.Q)

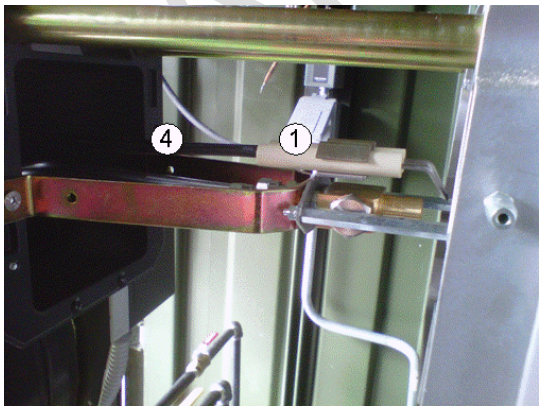
Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01/02-002.Q.01: INSPECT COMPONENTS FOR HEAT DAMAGE

1. Check all components for heat damage.
2. Look for excessive rust, deformation of all the parts including but not limited to the end cone and the diffuser disc.
3. Check to see that the High Temperature Leads (HT leads) are still intact and have not melted from any excessive heat coming back into the burner. If they are damaged replace with new HT Leads (PN: 3012995 Primary Burner & PN: 3012959 Secondary Burner). *See CMI 6.3.3/01.002A and 6.3.3/02-002A.*
    a. The HT leads are attached to the control box and the electrode via a squeeze fitting. Remove the leads from the electrode and control box by simply pulling them out.



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



4. HT Leads

End cone

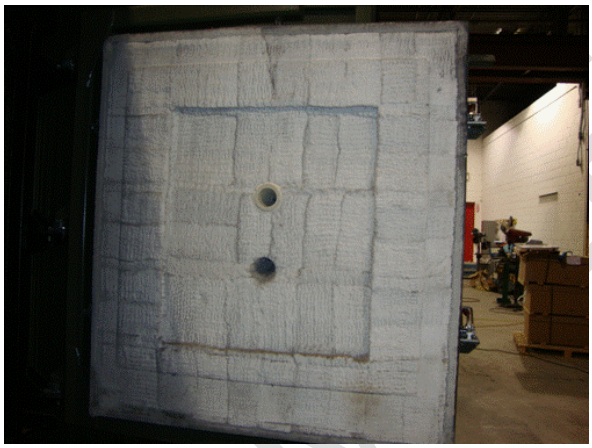
Refractory: (05-001.Q)

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

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

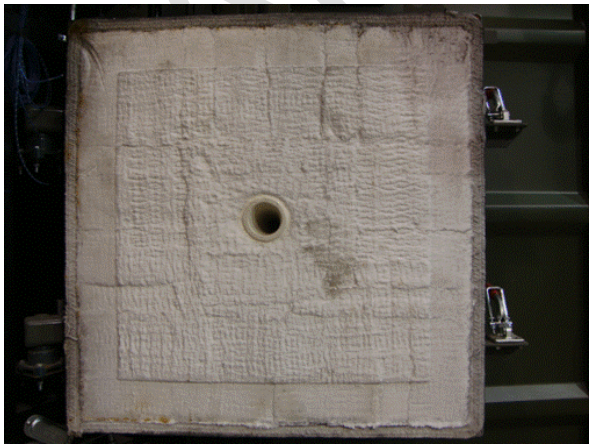
INSTRUCTION 05-001.Q.01: INSPECT DOOR GASKETS

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



Primary Door (refractory lined)

1. Primary Door Gasket



Secondary Door (refractory lined)

1. Secondary Door Gasket

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

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

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

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

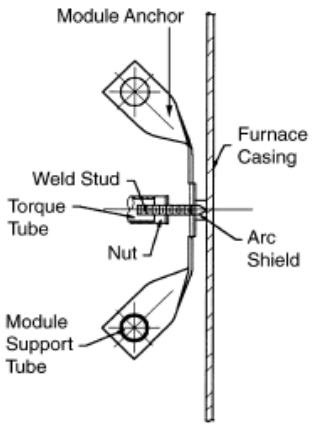


Figure 1: Side view of the Weld Loc Module

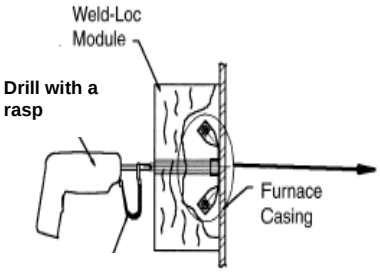


Figure 2: Stud Gun with rasp and Torque Tube.

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

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

Air Compressor (03-001.Q)

 **INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application unless treated in accordance with all applicable codes and regulations.**

 **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Lockout/Tagout machine. Compressor must be connected to properly grounded circuit.**

 **MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.**

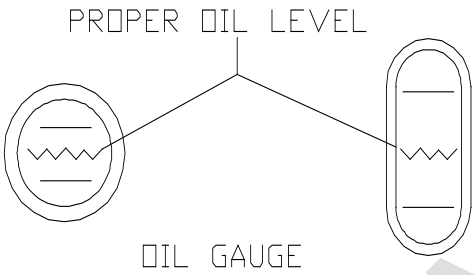
 **HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not Touch hot compressor or tubing.**

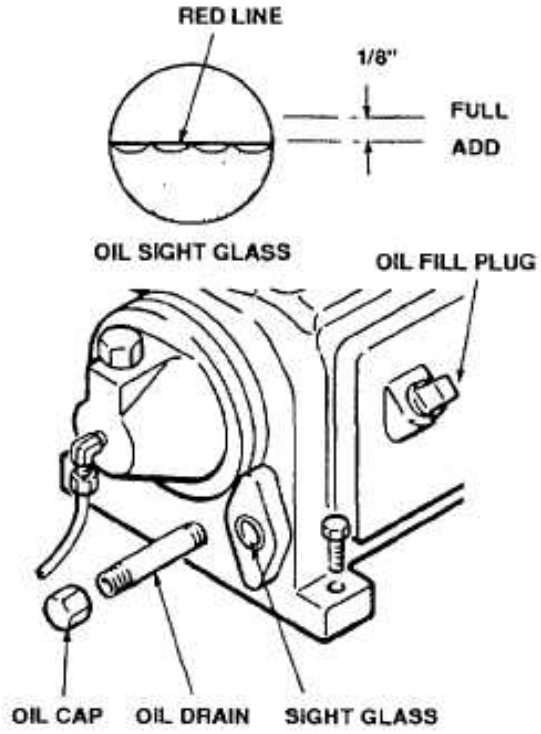
 **HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.**

 **RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.**

INSTRUCTION 03-001.Q.01: CHANGE THE OIL

1. Change the oil - Oil capacity 0.8 litres. Compressor Oil part # V0421-2





2. Remove the oil cap (above) to drain the oil.
3. Replace oil cap.
4. Refill the oil reservoir, using compressor oil, to the fill line as illustrated above.
5. Maintain oil level mid-way between the upper and lower lines of the crankcase sight gauge. See illustration above.

Paint: (05-003.Q)

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

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

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

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

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

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

Paint Specifications:

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

- Primary Chamber
- Secondary Chamber
- Breech Section
- Hot Stack Section (Black)

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

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

6.2.5 Yearly Instructions

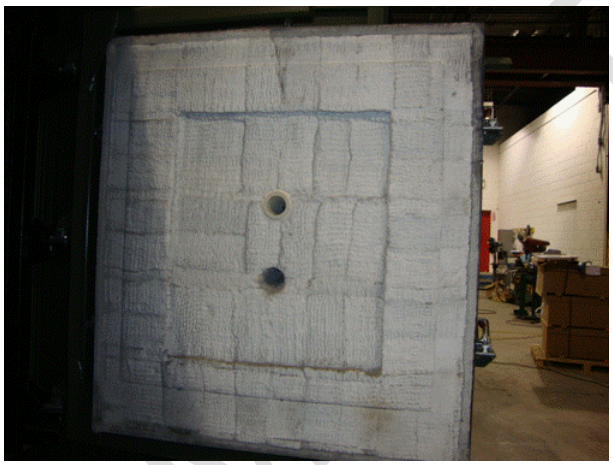
Refractory: (05-001.Y)

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

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

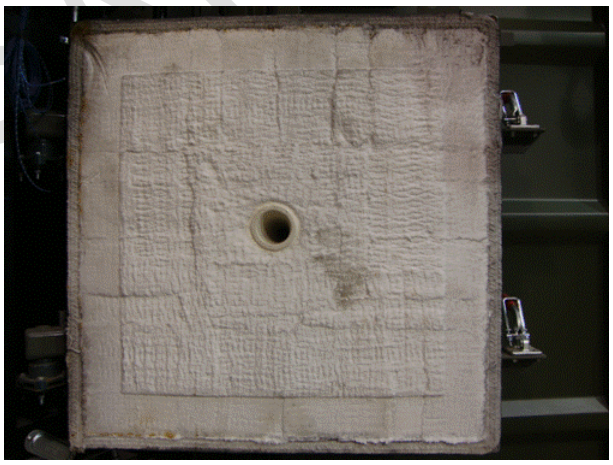
1. If required replace the door gasket. The gasket can last over 2 years but will depend on the careful use by the operator when loading and unloading.

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



Primary Door (refractory lined)

Primary Door Gasket



Secondary Door (refractory lined)

Secondary Door Gasket

Electrical: (05-004.Y)

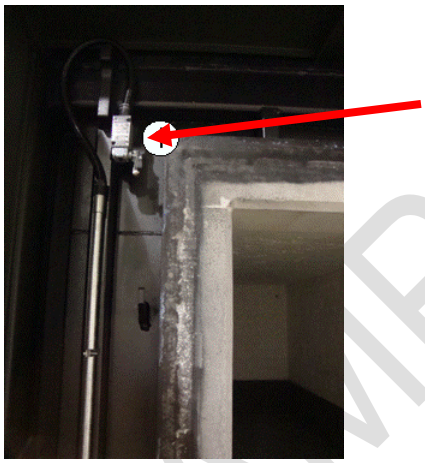
When working with electrical components ensure lock out instructions are being followed

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

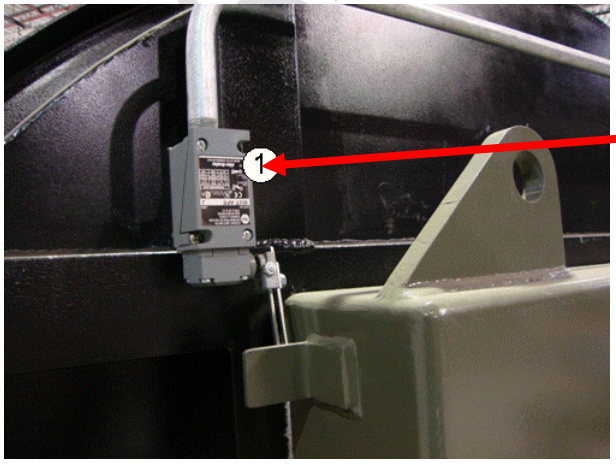
INSTRUCTION 05-004.Y.01: CHECK LIMIT SWITCHES

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

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



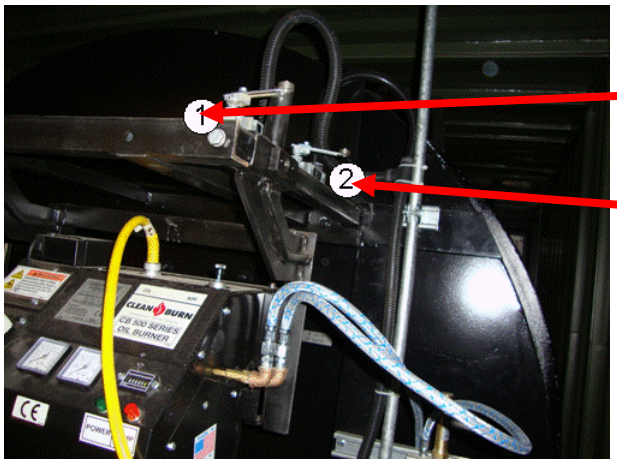
Primary Chamber Limit Switch



Secondary Chamber Limit Switch

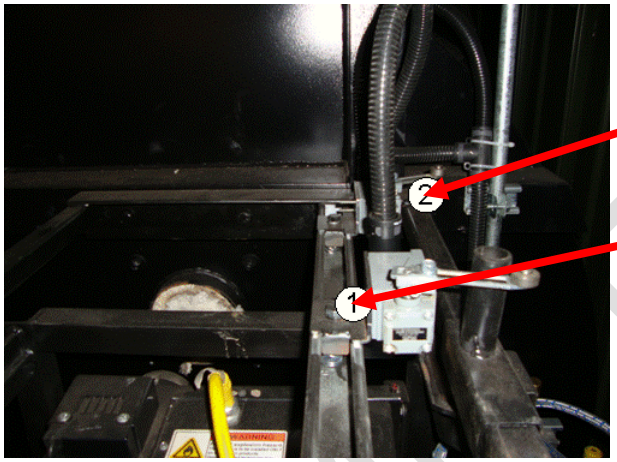
5. See *CMI 6.3.1/05-005A)*.

6. Check all other limit switches in the system. See below for locations:



Waste Oil Burner Out Limit Switch

Waste Oil Burner In Limit Switch



Waste Oil Burner In Limit Switch

Waste Oil Burner Out Limit Switch

6.3 CORRECTIVE MAINTENANCE INSTRUCTIONS (CMI)

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

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

As per the *Preventive Maintenance Instructions Section 6.2* of this *Manual*, the following table is utilized to identify the components of the system that require corrective maintenance.

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

	Burner Fan Motor Replacement		6.3.3/01-002M
Secondary Burner		**02-002**	
	Replacing Fuel Filter		6.3.1/02-002A
	HT Lead & Electrode Replacement		6.3.3/02-002A
	Diffuser Disc Replacement		6.3.3/02-002B
	Nozzle Replacement		6.3.3/02-002C
	End Cone Replacement		6.3.3/02-002D
	Nozzle Assembly Repair or Replacement		6.3.3/02-002E
	Burner Flexible Oil Line Replacement		6.3.3/02-002F
	Low Level Switch Replacement		6.3.3/02-002G
	Inspection Window Replacement		6.3.3/02-002H
	Fuel Pump Replacement		6.3.3/02-002I
	Control Box Replacement		6.3.3/02-002J
	Oil Tube Replacement		6.3.3/02-002K
	Burner PE Cell & UV Detector Replacement		6.3.3/02-002L
	Burner Fan Motor Replacement		6.3.3/02-002M
Refractory		**05-001**	
	Wall Refractory: Gaps between the Modules		6.3.2/05-001A
	Wall Refractory: Replacement of the Modules		6.3.2/05-001B
	Door Gasket		6.3.2/05-001C
	Castable Refractory		6.3.2/05-001D
	Temporary Repair of Castable		6.3.2/05-001E
Waste Oil Burner		**02-003**	
	Waste Oil Burner		6.3.5/02-003A
	Waste Oil Burner Parts Replacement		6.3.5/02-003B
	Waste Oil Burner J-Pump Replacement		6.3.5/02-003C
Air Compressor		**03-001**	
Main Control Panel		**03-010**	
	Main Control Panel		6.3.6/03-010A
	Reboot PLC		6.3.6/03-010B
Limit Switch		**05-005**	
	Limit Switch Replacement		6.3.1/05-005A

6.3.1 General Corrective Maintenance Instructions

LIMIT SWITCH REPLACEMENT (6.3.1/05-005A)

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

REPLACING THERMOCOUPLE (6.3.1/05-002A)

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

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

4. Reinstall on incinerator.

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

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

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

1. Close the ball valve on the supply line.

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

3. Before installing the filter lubricate the seal on the new filter.
4. Install the new filter, and open the supply line ball valve.

6.3.2 Refractory Corrective Maintenance Instructions

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

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

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

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

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

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

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

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

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

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

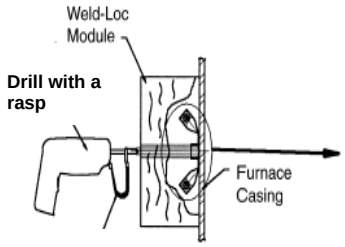
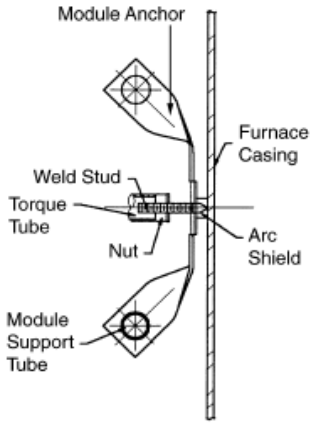


Figure 2: Stud Gun with rasp and Torque Tube (part of module assembly).

Figure 1: Side view of the Weld Loc Module



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

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

DOOR GASKET REFRACTORY (6.3.2/05-001C)

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

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

CASTABLE REFRACTORY (6.3.2/05-001D)

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

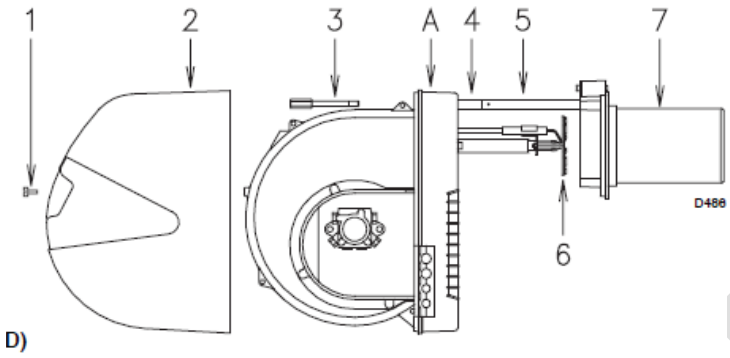
TEMPORARY REPAIR OF CASTABLE (6.3.2/05-001E)

1. Find the pieces of castable refractory that have separated.
2. Clean both the pieces of refractory and the area where the separation occurred.
3. Spread an even amount of high temperature mortar on the pieces and the area of separation.
4. Put the pieces back where they originated and support as necessary for a minimum of an hour while the mortar cures.

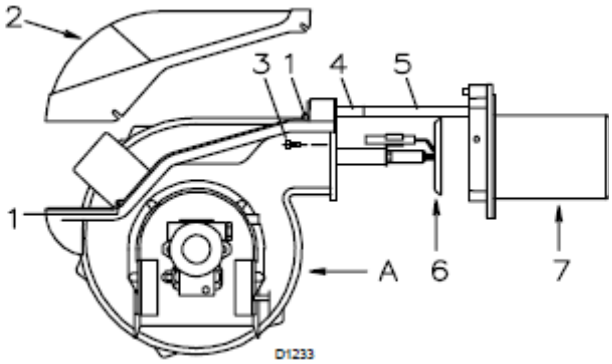
6.3.3 Burner Corrective Maintenance Instructions

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

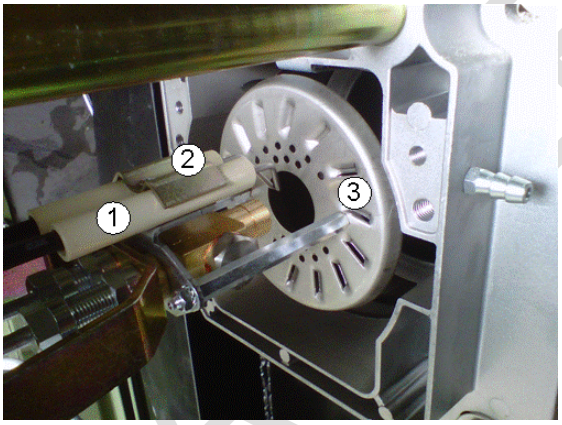
The Burners are pieces of equipment that will require routine corrective and preventive maintenance. Parts within this assembly will need to be repaired or replaced. The most common parts to be repaired or replaced are located at the front end of the burner where the parts are exposed to high temperatures.



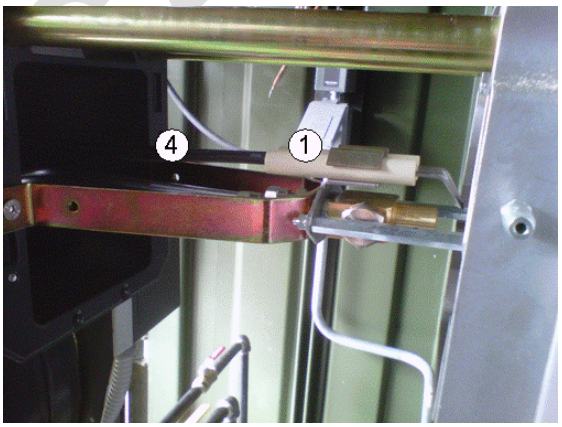
Front End Primary Burner



Front End Secondary Burner



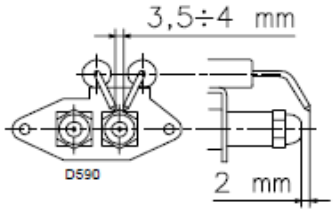
1. Electrode
2. U-bolt
3. Diffuser Disc



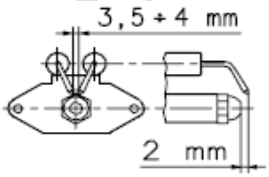
4. HT Leads

HT LEAD & ELECTRODE REPLACEMENT (6.3.3/01-002A & 02-002A)

1. In order to change out the HT leads (PN: 3012995 Primary Burner & PN: 3012959 Secondary Burner) or Electrode (PN: 3003796) the U-Bolt will have to be removed
2. Remove the electrode by pulling the lead out of the white ceramic tube, replace and re-install.
3. To change the Leads the wire will need to be removed from the burner.
4. Pull the wire out of the burner housing through the rubber grommet.
5. The other end is connected to the back of the control box. Pull the wire straight out and the spring fitting will disengage.
6. Replace the lead with a new one reversing the above directions.
7. When reinstalling the electrodes make sure that they are positioned as shown below:



Primary Burner



Secondary Burner

DIFFUSER DISC REPLACEMENT (6.3.3/01-002B & 02-002B)

1. Identify the diffuser disc in the above pictures.
2. The disc assembly is secured to the nozzle housing by 2 hex nuts.
3. Remove these nuts and remove the assembly from the burner.
4. The disc is attached to the assembly with 2 screws.
5. Remove the screws and replace the disc.
   - Primary Chamber Burner diffuser disc PN: 3003791
   - Secondary Chamber Burner diffuser disc PN: 3012463
6. Reassemble.

NOZZLE REPLACEMENT (6.3.3/01-002C & 02-002C)

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

2. Remove the nozzle with a wrench.

3. Install the new nozzle.
    - Primary Chamber Burner nozzle PN: C5222433
    - Secondary Chamber Burner nozzle PN: C5220105

END CONE REPLACEMENT (6.3.3/01-002D & 02-002D)

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

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

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

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

4. Install the new End Cone with the old screws.
    - Primary Chamber burner end cone PN: 3003807
    - Secondary Chamber burner end cone PN: 3012469

5. Reinstall the burner.

NOZZLE ASSEMBLY REPAIR OR REPLACEMENT (6.3.3/01-002E & 02-002E)

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

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

- Primary Chamber Burner nozzle assembly: PN: 3003814
- Secondary Chamber Burner nozzle assembly: PN: 3012097

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

BURNER FLEXIBLE OIL LINE REPLACEMENT (6.3.3/01-002F & 02-002F)

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

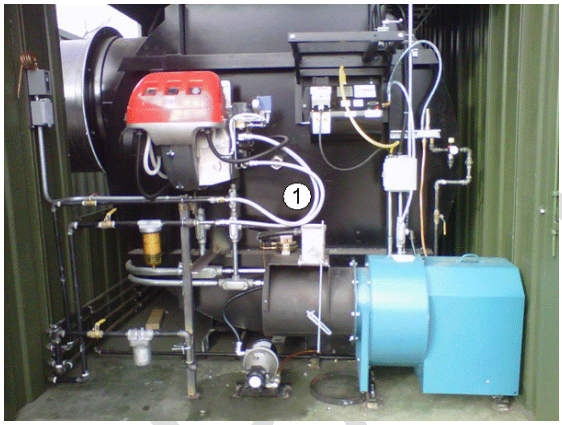
2. Remove flexible lines.

3. Replace with new lines.

- Primary Chamber Burner flexible oil line: PN: 3003769
- Secondary Chamber Burner flexible oil line PN: 3009076

4. Open ball valve.

Primary Chamber Burner Flexible lines
(Item # 1 Above)



Secondary Chamber Burner Flexible Lines
(Item # 1 Above)

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

The level switches are located in the Diesel and Waste Oil Tanks.

NOTA

Tanks do not have to be emptied to replace.

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

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

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

- Primary Burner inspection window PN: 3013728
- Secondary Burner inspection window PN: 3003763

FUEL PUMP REPLACEMENT (6.3.3/01-002I & 02-002I)

Identify the pump on the burner you wish to replace.

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

Reinstall the new pump, and reattach all fuel connections.

- Primary Burner: PN: 3013027
- Secondary Burner : PN: 3006369

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

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

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

- Primary Burner: PN: 3012933
- Secondary Burner : PN: 3012944

OIL TUBE REPLACEMENT (6.3.3/01-002K & 02-002K)

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

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

- Primary Burner Tubes: PN: 3003821
  PN: 3003822
- Secondary Burner Tubes PN: 3012470
  PN: 3012471

BURNER PE CELL & UV DETECTOR REPLACEMENT (6.3.3/01-002L & 02-002L)

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

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

BURNER FAN MOTOR REPLACEMET (6.3.3/01-002M & 02-002M)

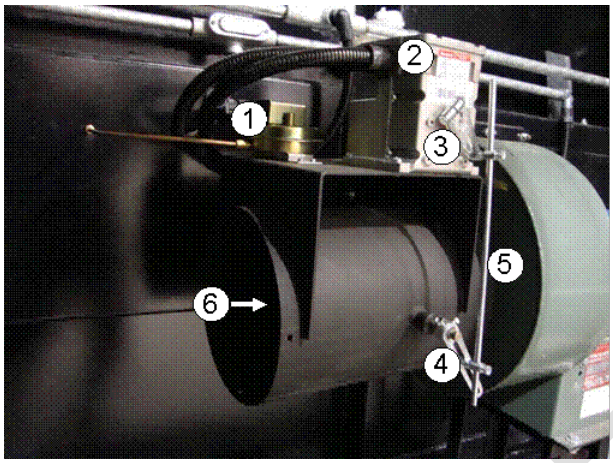
Identify the malfunctioning motor in the affected burner:

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

6.3.4 Primary & Secondary Blower Corrective Maintenance Instructions

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

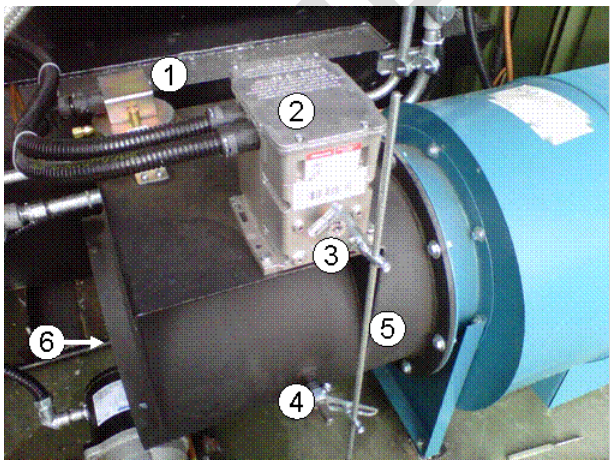
Primary Blower assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



Primary Blower

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

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



*Sample picture of a Secondary Blower and its assembly

Secondary Blower

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Removal

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

Install

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

Terminate all electrical connections the same as the old motor.

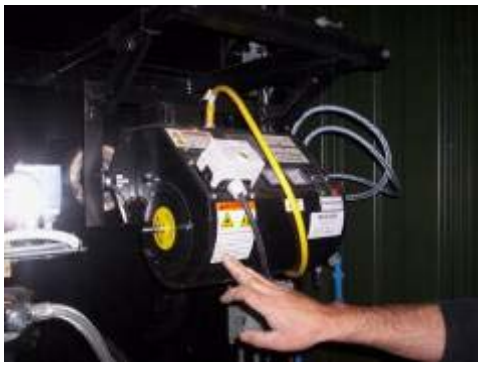
REPLACE THE BLOWER CONTACTOR 6.3.4/01-001G

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

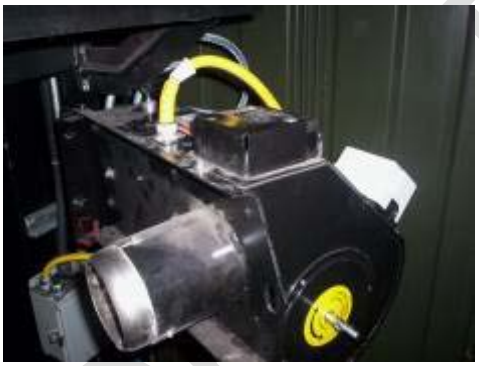
6.3.5 Waste Oil Burner Corrective Maintenance Instructions

⚠ Failure to maintain and/or improper servicing by unqualified personnel will adversely affect the efficient and safe operation of your burner, will reduce the service life and will void your warranty.

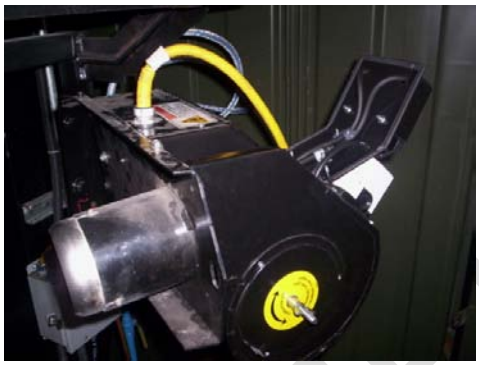
WASTE OIL BURNER HEATER ELEMENT CLEANING / REPLACEMENT (6.3.5/02-003A)



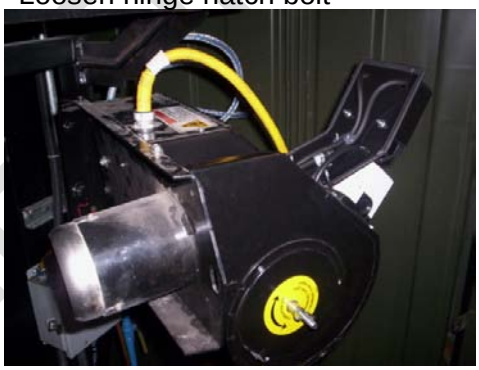
Slide out burner undo bolt



Loosen hinge hatch bolt



Open hinged hatch to access front components



Unscrew (yellow) electrical connection

Remove Cover Screw

Open hatch cover to expose heater element

Remove heater element from casing and inspect for build-up. Clean any deposits.

When reinstalling the heater element (PN: 33173) always ensure the element will be restarted immersed in waste oil. A dry element while in operation will reduce the life of the element.

WASTE OIL BURNER PARTS REPLACEMENT (6.3.5/02-003B)

The waste oil burner has the following parts that may need replacing:

Part Description	Waste Oil Blow up Diagram	Part #	Description of replacement
Primary Control	Item #4	33391	Locate remove and reinstall new one
Igniters Transformer	Item #5	33189	Locate remove and reinstall new one
CAD Cell	Item #6	33116	Locate remove and reinstall new one
Fan Squirrel Cage	Item #15	31113	Locate remove and reinstall new one
Blower Motor	Item #17	33337	Locate remove and reinstall new one
Retention Head	Item #21	11427	Locate remove and reinstall new one
Air Pressure switch	Item #20	33057	Locate remove and reinstall new one
Heater Block	Item #21	26090	Locate remove and reinstall new one
Air / Oil Solenoid	Item #59	32322	Locate remove and reinstall new one

WASTE OIL BURNER J-PUMP REPLACEMENT (6.3.5/02-003C)

Waste Oil Burner Pump (J-Pump)

Removing the pump requires the power to be off to the system. When this is done complete the following step:

1. Open the junction box on the side of the motor of the pump. Disconnect the electrical connections. And remove the conduit connection
2. With fuel containment cloth remove the waste oil connection from the pump inlet and outlet.
3. Unbolt the pump. Remove from the chamber

Install the new pump by reversing the above steps.

6.3.6 Main Control Panel Corrective Maintenance Instructions

MAIN CONTROL PANEL (6.3.6/03-010A)

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

REBOOT PLC (6.3.6/03-010B)

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

Annex 4

Mary River Project Landfill Operating Manual

1. PURPOSE AND SCOPE

The purpose of this procedure is to ensure that non-hazardous solid wastes are disposed of in compliance with the Mary River Project landfill permits, and in an efficient, safe and environmentally sound manner.

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

This procedure does not apply to hazardous and liquid industrial wastes, hauled sewage or domestic waste.

This manual has been designed to be used both as a field reference document and 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 and location at each site. The manual has been divided into two sections: the General Overview; and Standard Operating Procedures. The General Overview contains basic knowledge regarding personnel responsibilities, safety practices, and the overall operations of the landfill. Part B 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. 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 Mary River Project Landfills approval permit are allowed. At landfill sites, the waste is regularly compacted and covered.

Mary River Project Landfills

For the purpose of this document, the Mary River Project Landfill and the Mary River Project Non-Hazardous Solid Waste Landfill are one and the same and refer to the landfill at Steensby Port or the Landfill at the Mine Site.

Non-Hazardous Solid Waste

Non-Hazardous Solid Industrial Waste means a solid waste that is not a liquid and is not hazardous and includes and includes:

a) General Waste (cardboard, treated wood, plastics, etc.)
b) Scrap tires
c) Bulky waste such as heavy equipment, trucks, snowmobiles & 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).
d) Concrete
e) Glass (industrial)
f) Non-toxic incinerator ash
g) Non-Hazardous Solid Spill Clean-up Material
h) Scrap Steel (Non-recyclable)
i) Pallets (Non-recyclable)

A detailed description of these products is contained in the Appendix A

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. Includes all material regulated by the Transportation of Dangerous Goods Regulation and those materials requiring a Material Safety Data Sheet. Examples include paint, solvents, propane tanks, waste oil, batteries, electronic equipment, and fuel drums (205 litter barrels) or other material previously containing fuel or other hydrocarbons are considered hazardous waste. A detailed description of these products is contained in the Appendix A

Recyclable

The ability of a secondary material to be re-used in the manufacture of a new product or to be re-used

Domestic Waste

Domestic waste includes waste such as office paper, lunchroom supplies, washroom supplies, food waste, containers contaminated with food. Domestic waste can be considered all bagged & boxed waste originating from offices, kitchens and camps, generally suitable for disposal in the incinerator. A detailed description of these products in contained in Appendix A

Scrap Steel

Scrap steel includes scrap steel material that contains no other non-steel component.

Liquid Industrial Waste

Liquid industrial waste includes “waste that is both liquid waste and industrial waste”.

Empty Container

A container that has been emptied, to the greatest extent possible, using regular handling procedures, but its content shall not exceed 1% of the container's original capacity or 2 liters, whichever is less. This does not include containers which previously contained:

i. Mercury or other heavy metals
ii. Compressed gas cylinders (TDG Class 2.1-2.4)
iii. Oxidizing substance containers, (TDC Class 5.1)
iv. Poisonous substances containers (TDG Class 6.1)

Part A – Mary River Project Landfills General Overview

I. Responsibilities

Designated Mary River employees & contractors have specific accountabilities that must be met to ensure the Mary River Project Landfills are operated in compliance with this procedure and its permit. The following roles and responsibilities of the various employees who work at the disposal site are described below but are not necessarily inclusive of all duties that may required to safely and successfully operate a non-hazardous solid waste landfill.

1. Site Manager

The Site Manager is accountable for the overall operation of the landfill. Specifically, he/she shall:

a) Organize, oversee and administer the operation of the landfill in accordance with current permits, regulations and all appropriate procedures,
b) Plan and coordinate the most efficient use of landfill areas to conserve landfill space,
c) Help develop, implement and enforce landfill specific safety regulations
d) 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.
    v. Schedule routine work as required, e.g., drainage channel cleaning, landfill surface repairs and litter control, etc,
    vi. Ensure that the need for any special operating conditions have been planned for in advance; e.g., identification of features with steaks in advance of winter and the ground freezing,.
    vii. Handle user complaints or problems that the Site Services Supervisor cannot handle,
    viii. Perform all the duties of the Site Services Supervisor in his absence.

2. Site Services Supervisor

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

a) Regularly brief the Site Manager on the status of routine operations and any special problems,
b) Implement and enforce the landfill safety regulations and operating procedures
c) Install grade control stakes for landfill operators
d) Check grades and contours to ensure that refuse placement and compaction conforms to engineered specifications and designs,
e) Maintain thorough, accurate and detailed records of landfill operations, and other related matters,
f) Ensure through regular inspection that specified fill cover, spill response equipment etc. is present at the landfill,
g) Respond to incidents, complaints and inquiries promptly to ensure the landfill is operated in compliance with this procedure,
h) Inspect waste and direct site users to proper disposal areas according to waste type,
i) Conduct monthly inspection of berm & cover material for cracks & settlement.
j) Set up and monitor traffic patterns to allow maximum traffic flow and safe working conditions.
k) Instruct all contracted crews on critical landfill procedures and areas of concern and monitor progress, keeping records daily & bi- weekly as required this procedure,
l) Perform all the duties of the Landfill Operator/Labourer in his absence.
m) Perform other duties that may be required as determined by the Site Manager

3. Mary River Project Landfill Operator/Labourer

The Landfill Operator/Labours, under the general supervision of Site Services Supervisor, is responsible for executing the following tasks at the landfill. Specifically the Operator/Labourer shall:

a) Work in conjunction with the Site Services Supervisor in executing general landfill operations
b) Perform daily pre-use equipment checks on landfill mobile equipment ,
c) Maintain a level landfill base at the working face dumping area,
d) Cut, maintain and finish grades as indicated on grade stakes or as directed by the Site Services Supervisor,
e) Construct landfill cells according to this procedure,
f) Spread and compact refuse according to this procedure,
g) Cover refuse efficiently according to this procedure, have area covered walked in tight and surface smooth using no more fill than necessary. Leave surface area smooth with no refuse exposed,
h) Inspect waste and direct site users to proper disposal areas according to waste type,

i) Assist in site maintenance work as required; e.g. grade roads, drive water trucks, resurface roads, construct refuse lifts, and other duties as assigned,

j) Ensure the landfill is maintained free of litter, including the relocation of portable litter fences as necessitated by operational requirements and wind conditions,

k) Complete daily report forms as required, know how to respond appropriately to all emergencies utilizing the emergency procedures listed in Section B of this manual,

4. HSE Manager – Landfill Waste Designated Inspector

On occasion when a Mary River Project has a large quantity of waste destined for the landfill, the HSE manager may be provided with specific training to allow he/she to become a designated Mary River Project Landfill waste inspector to facilitate the source segregation, improve the productivity of the project resources and meet the landfill requirement for waste inspection prior to dumping.

Specifically, the HSE Manager - Landfill Waste Designated Inspector shall:

a) Be provided with the necessary training to allow him/her to properly segregate waste by type at the source and pre-inspect waste destined for the landfill

b) Inspect waste and direct site users to proper disposal areas according to waste type,

c) Complete daily report forms as required, know how to respond appropriately to all emergencies utilizing the emergency procedures listed in Section B of this manual,

d) Correct any waste management deficiencies related to the project as identified by landfill staff.

II. Landfill Operations

The Mary River Project non-hazardous solids landfills area permitted area method modified landfill as described in the Guidelines for the Planning, Design and Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories. The landfill has a design life of approximately 20 years and its operation and maintenance is based on the Guidelines to ensure protection of the environment and the health and safety of individuals. The estimated capacity of the current landfill design is 53,000 m^3 of waste and cover material at Mary River and 30,000 m^3 at the Steensby Port. If additional capacity is required in the future, an extension to the current design capacities will be developed. The extension(s) will be submitted for approval as required at the time.

A. Area Method 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. Basic instructions for

constructing waste cells with the materials accepted at the Mary River Project Landfills are described below in Figure 1.

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 and productively work; 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. For control of the waste exposure to wind, the width of the face should not exceed 12m at any time.

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 3m separation between the trucks and the dozer. The unloading area is to be maintained level and clear of waste materials.

3. Spreading Waste on a Slope

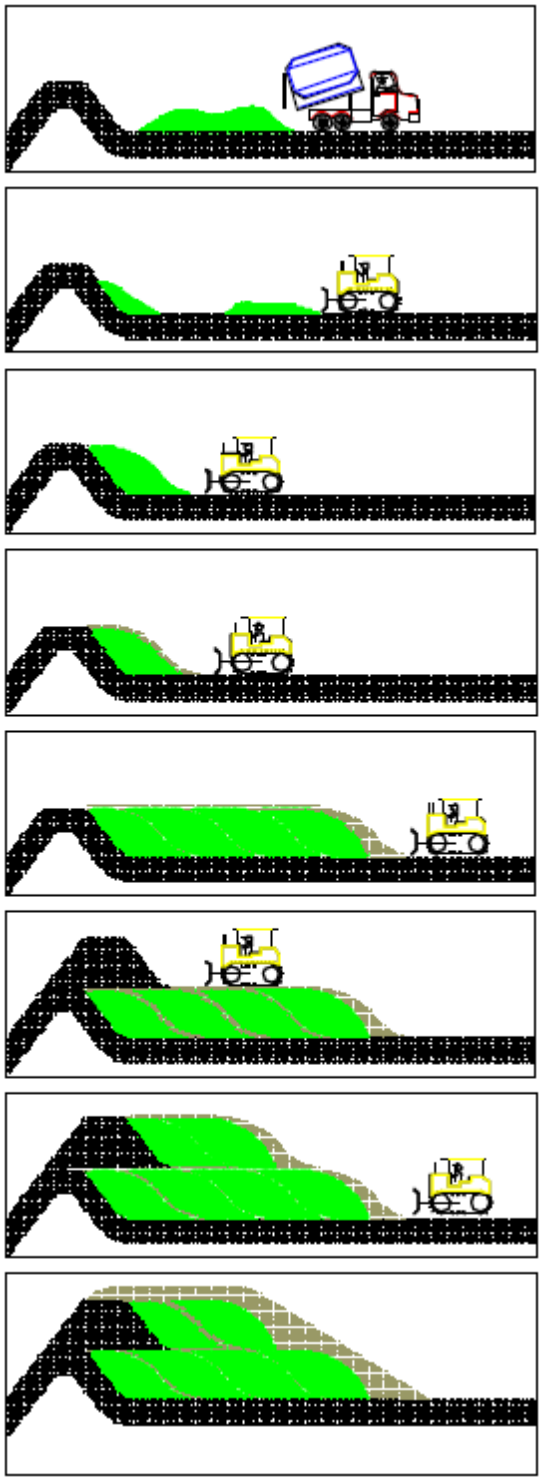
To maximize compaction, and to provide an optimal weight distribution of the dozer, the waste should be spread up a 3:1 slope in 0.3-0.6 meter layers. Fill in any holes that develop in the face with loose waste.

4. Using Grade Stakes

Use grade stakes to aid operators in keeping the slope of the final top fill surface of at a grade of 0.5%, the slope of the cell face 3:1 and the grade of the landfill base to 0.5%. Grade stakes should be set according to instructions given by the Engineering Staff. Stakes should be checked frequently enough to allow operators to make sightings to them as required.

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 the dozer up and down the working face between 3 and 5 times on 0.3-0.6 meter layers of waste until no further compaction occurs. The top deck of the cell must also be compacted by running the landfill compactor dozer across the top, keeping it as level as possible. Compaction of the waste will be undertaken if required, depending on the nature of the waste. This will typically occur once per week or in combination with collection frequency and nature of the waste.



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 12m

2. Drive over the garbage 3 to 5 times with a dozer. 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

4. When garbage at the working face is 3 m wide, cover garbage with 0.3m of granular material over the deck of the cell and 0.1m between cells to complete a partial cell. Repeat steps 1 to3 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 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 Mary River Area Method Landfill

6. Cell Completion

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

B. Cover Soil

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.

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 filling of cell or portion of the cell has reached the final planned grade and width, a final cover of compacted soil should be placed. A minimum of 0.3m of cover shall be placed over the deck and 0.1 meters over the slope of the cell. Use no more fill than necessary.

C. Hard to handle Wastes

Certain wastes acceptable at the Mary River Project Landfills require special handling. The following are basic methods to be used when managing hard-to-handle waste:

1. Bulky Waste

a) Crushable Items – such as furniture and appliances

Such items 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 into the toe of the fill. 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) Rubber Tires

Place rubber tires at the toe of the fill, spread them out, and cover them with other wastes. Tires are less likely to work their way to the surface if placed at the bottom of the cell. Do not try to compact unreduced rubber tires.

e) 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.

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.

3. Powdery Wastes

Wastes such as sawdust and other dusts 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.

D . Maintenance of Completed Areas

1. Inspection of Completed Areas

A bi-weekly inspection of the berm walls and completed cell will be completed each month for signs of cracks and depressions due to settlement. Cracks and settlement will be filled and compacted back to the original grade

2. Groundwater Protection System

Due to the permafrost in the area, no groundwater protection system has been included.

3. Landfill Gas Assessment

Landfill gas is not expected as the deposited waste will be non-hazardous, non-organic and inert. Also, all chemicals will be diverted for proper hazardous waste disposal. Therefore a landfill gas collection system will not be installed in the landfill site.

4. 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.

E. Traffic Control and Unloading of Waste

1. Proper Spotting and Traffic Control

a) Traffic Flow

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

b) Aids to Traffic Control

Directional signs, pylons and barricades are to be provided to help control traffic and direct customers to unload the waste at the base of the cell and have them drive their vehicle straight out when unloading is complete. 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.

c) 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.

d) Logging of Unloaded Wastes

A waste unloading logging station will be located in proximity of the working face. The operator of every vehicle that unloads any quantity of waste is required to log the specifics of the load – Date, time, waste type, vehicle type, approximate quantity, etc....

e) 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 working face. All site personnel should be familiar with procedures for handling such loads. Refer to the Emergency Work Instruction in Section B of this manual for proper response procedures.

f) 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

g) Site User Rules

Landfill staff should know all site user rules and watch for violations. User rules (Appendix C) 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 land fill user rules shall be recorded in the daily log by landfill staff and reported to the Site Manager.

h) Emergency Procedures

Site personnel shall be familiar with proper fire and accident procedures and are expected to know their role in all possible emergency situations. See the Emergency Work Instructions in Section B of this manual.

F. Landfill On-Site Roadways

1. Road Construction

On-site access roads for use as a thoroughfare for transporting waste to the working face shall only be constructed under the approval of the Camp Manager and according to engineered design specifications. Landfill maintenance access roads are only to be constructed under the approval of the Site Manager.

2. Road Maintenance

a) Maintenance of Gravel Roadways

Roadways that are made in native or filled soil and are heavily travelled required 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 appear in a road or cause the slope of a road to change. Cracks should be filled with material that is compatible with the roadbed. For an area of a sloped road, where the slope has changed drastically, it 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 winter such 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.

G. Inclement Weather

1. Preparation for Weather Conditions Affecting Landfill Operation

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

a) Wind

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

b) White Out Conditions Caused by Winter Storms

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

c) 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:

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

H. 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 to 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.

I. Inspections and Reporting

a) Reporting

The *landfill daily unloading volume & operations log (see Appendix C)* is completed daily and logs waste volumes, compaction and cover application.

b) Routine Inspections

Records of all site operations, including inspections, maintenance, and monitoring will be recorded on designated forms and kept together in the Baffinland office (or

other on-site facility used for such purposes). This will be performed and maintained by the landfill Operator.

Routine visual inspections will be completed every two weeks on the *Mary River Project Landfills bi-weekly Inspection form* (See form attached below) by the Site Services Supervisor or designate for various components of the landfill, including:

- General site area
- Landfill berm and cover survey
- Litter control
- Storm water runoff control
- Vector attractants
- Wildlife observations
- Wildlife signs.

III. Landfill Safety Practices

A. General Safety Practices

1. Know Procedures

   All employees at the landfill are responsible for knowing the proper procedures for reporting accidents, injuries, and fires. Employees must know the procedure to be followed for each type of emergency and be aware of their particular role. Work Instructions for various situations are documented in the Work Instructions section of Part B of this manual.

2. Signage for Traffic Control and Direction

   Road boundaries and speed limits on each road shall be clearly posted.

3. Site User Rules

   Site user rules are available at the entrance to the landfill and at the working face. Employees are to watch for violations of site user rules and indicate those rules to violators, stressing that the rules are imposed to ensure the safety of people & equipment. Site User Rules are attached in Appendix C.

4. Level Dumping Area

   For safe operations, the dumping area shall be kept as flat as possible at all times and kept clear of debris.

B. Safety Precautions for Equipment Operators

1. Heavy Equipment Operation

   All mobile equipment in use at the landfill is to be operated in accordance with general Baffinland procedures associated with light truck and heavy equipment.

2. Keep Debris from Cab

   Keep operator's compartment, stepping points, and hand holds free from oil, grease, mud, loose objects, and trash.

3. Look in All Directions before Moving

   The landfill is a high traffic area - Protect personnel and other equipment in the area by looking to the front, rear, and sides before moving equipment. If the operator is unsure of surrounding conditions, he/she shall dismount and inspect the area.

4. Safety Devices

   Proper safety devices, such as safety belts and roll over protection systems, must be installed on all equipment and maintained or replaced to original equipment manufacturer specifications.

5. Carry Blades Low

   Equipment attachments such as loader buckets and tractor blades should be set low to improve visibility and enhance breaking capability. Otherwise, collisions may occur, the vehicle may go over an embankment, or it may roll over.

6. Check Blind Areas

   Never push waste until you are sure that no person or equipment is in the blind area ahead of the refuse. If the operator is not sure of surrounding conditions, he/she shall dismount the equipment and personally inspect the area.

7. Maintain Adequate Clearance

   When pushing waste, maintain adequate clearance from ground personnel, patrons and other vehicles or obstructions to ensure that objects will not strike other equipment or persons. As a rule of thumb use 5 meters as a minimum safe distance to keep away from all people, vehicles, and equipment.

8. Constantly Check Work Area

   The operator must constantly check the work area for the location of other persons or equipment. Be especially cautious when several private vehicles are in the area. Remember that many site users are not familiar with the dangers of heavy equipment.

9. Operate Up and Down Slope

   Operate up and down slopes. Avoid side hill travel whenever possible to reduce the chance of rolling over.

10. Avoid Excessive Speed

    Operating conditions generally determine the speed of heavy equipment. Under no circumstances should heavy equipment be driven at excessive speeds or operated recklessly. Heavy equipment is difficult to control at high speeds and must only be operated at a speed that is safe for existing conditions.

11. Move Cautiously Over Bulky Objects

    When compacting or traversing bulky items, such as vehicles and utility poles, the operator must proceed with extreme caution to avoid tipping or sudden lurching movements.

12. No Scavenging

    Scavenging will not be permitted. Scavengers are subject to a number of potential injuries and possible death.

C. Personal Protection Equipment

Landfill staff is required to wear the standard Mary River Project personal protective equipment, including:

a) Hard hats,
b) Eye protection,
c) Work boots,
d) Work gloves,
e) Reflective vest

D. Emergency Contact Information

All emergencies shall be reported to the site services supervisor and Site Manager immediately.

Appendix A

Classification of Refuse

1. Acceptable Wastes

Non-Hazardous Solid Waste means a solid waste that is not a liquid and is not hazardous The following wastes are examples of Non-hazardous solid wastes acceptable for disposal at the Mary River Project Landfills:

a) Wood products (Clean untreated wood should be diverted to the Burn Area)
b) Plastics
c) Cardboard
d) Scrap Tires
e) Bulky waste such as heavy equipment, trucks, snowmobiles & 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).
f) Concrete
g) Glass
h) Metal
i) non-toxic incinerator ash
j) Non-Hazardous Solid Spill Clean-up Material
k) Empty Container (as defined in this procedure)

2. Inert Wastes & Recyclable material

The following are examples of inert wastes that the Mary River Project Landfills will accept for disposal. However, these types of materials can generally be recycled and/or reused and it is better to divert this waste stream for reuse when applicable:

a) Clean fill dirt
b) Rock
c) Steel (suitable for reuse)
d) Pallets (suitable for reuse)

3. Hazardous Material / Unacceptable Wastes

There are six general types of materials that are unacceptable for disposal at the Mary River Project Landfills. They are:

a) Chemicals
b) Liquid Wastes including sewage
c) Radio-nuclides (Radioactive waste)
d) Batteries
e) Infections or medical waste
f) Electronic waste – TVs, computer CRTs (screens) and computer hard drives

In addition, Hazardous Wastes, including household hazardous wastes, are NOT accepted at the Mary River Project Landfills. The following list of waste, though not all inclusive, is considered hazardous:

a) All material regulated by the Transportation of Dangerous Goods Act,
b) All material requiring a Material Safety Data Sheet,
c) Paint,
d) Chemicals,
e) Solvents,
f) Propane tanks,
g) All pressurized gas cylinders,
h) Fuel drums (205 liter barrels) or other material/container previously containing fuel or other hydrocarbons,
i) Acids,
j) Waste oil,
k) Cleaning solvents,
l) Gasoline, diesel, Jet A and other Petroleum products,
m) Insecticides,
n) Lube Oil,
o) All heavy metals such as Beryllium, Cadmium, Mercury, etc.

Appendix B

Potential Pollutant Source 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 & cover areas experiencing settling or erosion - No cuts permitted in to the tundra during landfill civil construction or operation - Silt fences installed at any drainage experiencing sediment from soil erosion
Landfill	Fuelling of heavy equipment	Diesel fuel	Diesel fuel	- Fuelling is completed in accordance with Baffinland fuelling procedure. - Personnel are trained on the procedure for fuelling
Landfill	Unloading waste at landfill	Improper segregation or direction of non-permitted wasted	Hazardous waste or non-permitted waste	- Baffinland Waste management system includes waste type source segregation - Landfill operations procedure contains requirement for waste inspection prior to unloading.
Landfill	Unloading waste at landfill	Hazardous material spill	Hazardous waste	- Baffinland Spill Response Plan in place to respond 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 C
Bi- Weekly Inspection Log Table

Mary River Landfill Bi-Weekly Inspection

Date: **Inspector:** **Role:**

Time:

Inspection	Y N N/A	Comments
General Site		
Access Roads in good condition?	Y N N/A	
Unloading area at working face is level?	Y N N/A	
User rules & classification of waste signs in good condition?	Y N N/A	
Is the tundra around the outside perimeter of the landfill berm stable?	Y N N/A	
Landfill Berm & Cover Survey		
Visible signs of settlement (low spots or poolling water)?	Y N N/A	
Visible cracks?	Y N N/A	
Visible signs of erosion from wind or runoff?	Y N N/A	
Does the most recent cell cover have 0.1 m on the face & 0.3 m on the deck	Y N N/A	
Cover material is stockpiled?	Y N N/A	
Litter Control		
Working face length is as small as practical & <12m?	Y N N/A	
Perimeter litter fences established	Y N N/A	
Working face litter fence established (at end of day operation)?	Y N N/A	
Are the litter fences capturing the litter?	Y N N/A	
Has the site been cleaned of litter in the last two weeks?	Y N N/A	
Storm water Runoff Control		
Is general water drainage working?	Y N N/A	
Are Culverts draining?	Y N N/A	
Are water flows silt free?	Y N N/A	

Inspection Description

Circle Y or N as appropriate, or N/A for any questions that are not applicable.

A “yes” answer generally denotes compliance with that requirement.

A "No" or "N/A" should be explained further in the comments

Survey of Vector Attractants at the Working Face

Attractants	Attractant Levels (cirlce one)				
Food	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Food Packaging	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Oil products containers	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Oil contaminated waste	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Aerosol cans	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Batteries	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Other _____	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces
Other	None	1 piece	2-5 pieces	6-10 pieces	>10 pieces

Wildlife Observations

Species	#	Comments

Wildlife Signs (tracks, scats, borrow holes or chews)

Species	Type of sign	#	Comments

Additional Comments: _____

Daily Unloading Log Table

Baffinland Iron Mines Corporation

Baffinland Iron Mines Corporation

/ River Non-Hazardous Solid Waste Landfill Daily Unloading & Operations Log

Working Face - Status at End of Day
WF – Working Face, CW – Compacted Waste, C - Cover
Admin Use Only

Day of the Week: _____ **Date:** _____

			Volume Estimate								
			Vehicle					Other			
Time	**Source Location of Waste**	**General Description of Waste**	**Light Truck**	**Kenworth**	**Kenworth +Pup**	**%Full**	**Volume**	**Other Vehicle**	**Volume Estimate (m3/Cubes)**	**Driver's Name**	**Waste Unloading Approver's Name**
9:40 AM	Mary River Laydown Area	Scrap Wood			√	80%				John Smith	Site Services Supervisor
					Daily Totals:						

General Description Of Waste: Wood, Plastics, Cardboard, Scrap Tires, Bulky waste such as heavy equipment, trucks, snowmobiles & appliances, Concrete, Glass, Metal, non-toxic incinerator ash, Non-Hazardous Solid Spill Clean-up Material

Daily Grand Total:

Appendix D

Mary River Non-Hazardous Solid Waste Landfill

User Rules

1. All waste is to be inspected prior to dumping – Contact the Site Services Supervisor prior to delivery

2. No liquid or hazardous waste is accepted at this landfill

3. Vehicles shall follow posted speed limits and directions to unloading area - Unloading in other areas is strictly prohibited

4. Dump waste immediately behind the vehicle as close to the toe of the working face as possible

5. No Unloading by Rapid Acceleration or Deceleration

6. Each vehicle operator is to complete the unloading log for each load

7. No Scavenging is permitted

8. No open fires or the burning of waste is allowed on the site

9. All spills are to be stopped if safe to do so, and immediately reported to the Site Services Supervisor.

10. PPE required to be worn at landfill area

11. In case of Emergency – Immediately contact the Site Services Supervisor or Site Manager

Part B – Mary River Project Landfills Work Instructions

Part B focuses on work instructions and has been formatted to provide supervisors and their employees with a user-friendly method for access, training, and implementation of these procedures

Specific work instructions concerning landfill operations and emergencies and have been documented in order to establish standard policies and practices for the Operations staff. These topics will be reviewed periodically in 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.

Work Instructions

General Site Maintenance
Work Instructions

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

Guidelines:

1. Access roads on the site are to be maintained and graded to eliminate ruts and repaired to eliminate cracks and settling.

2. Maintain drainage, keep road culverts and landfill drainage free of debris.

3. Define critical landfill perimeter and spot locations with stakes and signs prior to winter to facilitate identification

Off-Road Vehicular Traffic
Work Instructions

"Off-Road" refers to any vehicle traveling off of any defined roadway or access-way or landfill pad, regardless of the road surface. Permitted roads are identified on the attached landfill plan and include the gravel access road and the landfill berm perimeter road.

- All off-road vehicular traffic is strictly prohibited without clearance from Mine Manager
- Prior approval is required for any vehicles engaging in off-road activities while on site
- New road construction is not permitted without approval from the Mary River Project Operations Manager

Benefit of Compliance to Instruction:

- Avoid disturbances and impacts to sensitive tundra

Dust Control
Work Instructions

1. Place dusty loads at the toe of the face of the trash and bridge over as quickly as possible.

Benefit of Compliance to Instruction:

- Creates a cleaner, safer work environment
- Ensures compliance with permit requirements and reduces the impact on the natural environment

Landfill Equipment Fluid Releases
Work Instructions

1. Complete a visual “walk around” inspection of all landfill motive equipment prior to starting. Inspect for damaged hoses and for puddles or stains from leaking fluids under your machine. If fluid leaks are evident, do not start equipment. Notify your Supervisor and the mechanic.

2. Periodically scan the equipment management system on the dashboard of the machine for flashing lights and warning horns that may indicate a system failure. Move to a safe area, stop and inspect the machine systems for leaks and malfunctions as necessary.

3. Routinely glance through the windows at the machine components that are susceptible to damage, for example, lift cylinders, hydraulic hoses, grease and oil seals. Listen as you operate your machine for unusual noises that may be an indication of a mechanical failure. If so, move to a safe area, stop the machine and notify your Supervisor and the mechanic.

4. As you make a “pass” in a forward direction and prepare to change direction, look over your shoulder and inspect the ground for streaks of oil or anti freeze. If leaks are observed, move machine to a safe area, shut machine down, contain spill using a bucket or pan and notify supervisor and mechanic.

5. All discharges of fluids from heavy equipment in the landfill are to be treated as a spill. All spills are to be addressed as per the Spill Response Plan. Key points are:
   - If safe to do so, stop the source of the spill.
   - Immediately report the spill to your supervisor.
   - For large spills initiate the Spill Response Plan.
   - Initiate cleanup of the spilt material using the emergency spill kits
   - Document the spill by the end of shift with a Spill Report Form – these are available from the Operations Department or your supervisor, provide spill report to Environment Department within 12 hrs.

Benefit of Compliance to Instruction:

• Regulatory Compliance

• Operator safety

• Environmental protection

Litter Control
Work Instructions

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:

1. 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 shall not exceed 12 meters at any time.

2. Keep waste well confined at the working face to reduce the amount of waste susceptible to wind.

3. Deposit waste at the toe of the fill slope face and spread it upward.

4. Cover the compacted waste as soon as possible to minimize blowing litter

Control with Litter Fences

1. Position fences near the working face as wind and fill operations change.

2. Move or lengthen semi-permanent litter fences that are strung around the area to conform to filling operations and prevent migration of litter off the site.

Litter Pickup

1. Litter crews are to pick any litter off the fences to prevent the fence from being clogged and subject to overturning by the wind.

2. Promptly pick up any litter not trapped by the fences to prevent off-site migration.

Litter in Heavy Wind Conditions

1. Install litter fences prior to windy weather and relocate as required.

2. If lightweight material cannot be contained within the site, place intermediate cover over the material to prevent it from blowing.

Benefit of Compliance to Instruction:

- Compliance with operating permit
- Reduction in amount of litter migrating out of waste cell
- Minimize impact to native habitat
- Reduce the rework for picking up litter

Vector Control
Work Instructions

Vectors (any animals 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 unloading waste will safeguard against vector problems. Well-compacted wastes and cover material effectively prevent vectors from emerging or burrowing into waste materials. The following are basic guidelines to ensure proper vector control on site:

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

Benefit of Compliance to Instruction:

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

Building and Equipment Fires
Work Instructions

Fire

1. Attempt to extinguish a small, controlled fire with equipment on site *WITHOUT* endangering yourself or other personnel. When in doubt, evacuate area and notify your supervisor & security immediately, providing all the required information (Your name, fire location, type, size etc…).

2. Keep all unauthorized people away from the area on fire.

3. Report the details of the fire in the *Special Occurrence Log* and, if applicable, complete an investigation report form (see your supervisor for these materials).

Benefit of Compliance to Instruction:

- Safety of all employee's is protected

Fire in Load
Work Instructions

Fire in Load refers to a vehicle load of wastes that are either on fire and/or smoldering or smoking prior to discharge to the landfill. All site personnel are expected to be familiar with the following procedures for handing such loads:

1. Direct the driver to dump the material in a clear area that is away from the fill face and clear of any vegetation and/or debris.

2. Notify your immediate Supervisor or the Site Manager of the fire.

3. Spread out the load and extinguish the fire with water or soil

4. Once fire is determined to be completely out, allow the material to remain in the cleared area for the remainder of the working day.

5. If no fire is detected at the end of the working day, place the load into the fill.

6. If fire is discovered after the load has been dumped at the working face, the equipment operator will push the material away from the face (if it is safe to do so) to a cleared area where it can be covered with soil or extinguished with water.

Benefit of Compliance to Instruction:

- Health & safety of employees is protected
- Reduce the risk of a landfill fire

Hazardous Materials Spill Response and Reporting Work Instructions

The responsibility for implementing this procedure begins with the person(s) responsible for the chemical spill (spill) or the first person(s) to discover the spill. They will be responsible for reporting the spill and completing cleanup actions (small spills) or requesting assistance for large spills.

Spill Reporting:

1. Report all spills of hazardous materials to your supervisor and the camp manager as soon as possible, regardless of the quantity of spilled material.

2. Be sure to provide the following information:

    • Type of spilled material
    • Quantity of spilled material
    • Location where spill occurred
    • Time and date the spill occurred
    • Description of the actions taken to contain and clean up the spilled material

3. The Site Services Supervisor will record the above information in the Log of Special Occurrences.

Spill Response:

All spills are to be addressed as per the Spill Response Plan. Key points are:

- If safe to do so, stop the source of the spill. Employees may attempt to contain the spill, provided their personal safety or the safety of others is not jeopardized by their actions
- Immediately report the spill to your supervisor.
- For large spills initiate the Spill Response Plan.
- Initiate cleanup of the spilt material using the emergency spill kits
- Document the spill by the end of shift with a Spill Report Form – these are available from the Operations Department or your supervisor, provide spill report to Environment Department within 12 hrs.

Benefit of Compliance to Instruction:

- Employees are trained to safely respond to spills, minimizing the potential impact to personnel or the environment
- Spills documented in accordance with regulatory requirements
- Regulatory Agency notified in a timely manner

Subsurface Landfill Fires
Work Instructions

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 burning may have created large voids underground.
*Fumes may be toxic!

Safety Procedures

1. If an area is suspected of having an underground fire, block further access to the area and keep people away. Make sure anyone near the suspected fire is notified and/or vacated as may be necessary. If flames are present above ground, immediately notify the site services supervisor and camp manager through radio dispatch. (Note: Pumping water into the ground may not stop the smoldering and will not prevent future fires. Smothering with dirt is the preferred option).

2. Try to stay upwind of any smoke and not breathe fumes, if any.

3. Secure the site with cones, barricades, survey ribbon, etc. If voids are suspected the ground may be unstable – Do not walk or use heavy equipment on the waste pile.

4. The site services supervisor, camp manager and other staff will evaluate the conditions and develop a plan to safely deal with the fire (almost always smothering with dirt).

5. Notify the Baffinland environment department to evaluate the incident and confirm the repair plan is in compliance with permits

6. 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).

7. Complete repairs to the landfill structure. Note completion of work in site log along with fire location for future reference.

Benefit of Compliance to Procedure:

- Employee's safety protected
- Environment is protected

Annex 5

Landfarm Operation Information

- Hydrocarbon Impacted Soils Storage and Landfarm Facility Operations Maintenance and Monitoring Plan (EBA, 2010)

BAFFINLAND IRON MINES CORPORATION

PRELIMINARY HYDROCARBON IMPACTED SOILS STORAGE AND LANDFARM FACILITY
OPERATIONS, MAINTENANCE AND MONITORING PLAN
MILNE INLET, MARY RIVER PROJECT, NUNAVUT

SEPTMEMBER 2011
EBA FILE: E14101092
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FIGURES

APPENDICES

1.0 INTRODUCTION

Baffinland Iron Mine Corporation (Baffinland) retained EBA, a Tetra Tech company (EBA) to evaluate hydrocarbon-impacted soils within the Milne Inlet lined bladder farm at the Mary River Project located in the Qikiqtani Region of Nunavut.

The original scope of work included post-decommissioning characterization of the hydrocarbon-impacted protective layer of sands in the bladder farm and the development of a soil remedial action plan. It was anticipated that the fuel-impacted soil would be treated with a landfarm to be constructed at Milne Inlet. Baffinland's requirements changed after the original work scope was developed, and the bladder farm remained in service through 2010. For this reason, the bermed soils were not characterized in 2010.

EBA's work scope for the 2010 period was modified to develop a preliminary landfarm design concept for Milne Inlet along with an operations and monitoring manual. A soil sampling and ground truthing program was conducted in the summer of 2011 to determine the volumes and concentrations of soil requiring treatment, to confirm the location of the facility, and to finalize the design details required to issue construction drawings. Preliminary design is based on the assumption that the petroleum hydrocarbon remediation objectives will be met within two to three treatment seasons.

The Milne Inlet landfarm will initially be used to treat sandy soils that were impacted by petroleum hydrocarbons when a fuel bladder ruptured in 2008. An estimated 8,000 L of Jet A diesel fuel was released into the lined containment berm. Contact water within the berm has been collected and treated since 2008, although no soil remediation has yet been conducted.

As per the Nunavut Water Board renewal of Baffinland's Licence No. 2BB-MRY0710, soils affected by hydrocarbons from normal fuel transfer procedures require treatment to meet the objectives included in the 2010 Government of Nunavut's Environmental Guideline for Site Remediation. Also, the Mary River Project Draft Environmental Impact Statement (December 2010) NIRB File No. 08MN053 indicates that a description of how petroleum-impacted soils will be handled on the site is required. Documents provided within the future application to amend the current Nunavut Water Board (NWB) license will consider the relevant Mining and Milling and Industrial Undertaking Hydrocarbon Impacted Soil Storage and Landfarm Treatment Facilities Supplemental Information Guidelines (2010, draft).

2.0 SITE DESCRIPTION

2.1 Project Location

The Milne Inlet facility is located on the northern end of Baffin Island, Nunavut at approximately 71 53' 03" N and 80 54' 12". The nearest communities are Pond Inlet, to the east of the site, and Arctic Bay, to the west. A key plan showing the location of the Milne Inlet Facility is Figure 1. Marine access and shipping through the construction phase and periodically during operation occurs seasonally through Milne Inlet and the existing Milne Inlet Tote Road provides access to the proposed Mary River mine site.

The current facilities at Milne Inlet include an airstrip with tarmack, docking facilities, fuel farm (75 fuel bladders with 113,560 L capacity each), temporary bulk sample ore stockpiles, Shanco Camp, an incinerator, a wastewater treatment facility, a polishing/waste stabilization pond, and laydown areas.

There are currently two alternative locations proposed for the landfarm facility (Figure 2). Both proposed locations are situated south of the camp, within till veneer areas along the tote road from Milne Inlet to Mary River. Proposed Site A is within an existing quarry area approximately 3 km along the tote road. Site A is advantageous because it is within a pre-disturbed area. Proposed Site B is closer, about 1 km from camp along the tote road, and offers an advantage of being less likely to accumulate large quantities of snow that would require treatment after melting in the spring.

Based on aerial photo interpretation, it appears that the aggregate materials in both locations would be suitable for the construction of a landfarm.

2.2 Authorizations

Much of the Mary River site and the land between Mary River and Milne Inlet is located on Inuit-owned land administered by the QIA. Existing permits include Type B Water License number 2BB-MRY0710 issued by the Nunavut Water Board (NWB), valid from February 20, 2007 to February 28, 2010, and extended by amendment to December 31, 2010. The Nunavut Impact and Review Board (NIRB) file number is 08MN053. NIRB is conducting ongoing review of the Mary River Project including the application for pre-development work planned for 2012, including the construction and operation of landfarm facilities.

3.0 MILNE INLET PRELIMINARY LANDFARM DESIGN

3.1 Design Intent

Sandy soils used as a protective layer over the liner system were affected when a fuel bladder at the Mine Inlet fuel facility ruptured on June 16, 2008 (Spill Report # 2008-347), spilling an estimated 8,000 L of Jet A fuel into the containment area. The concentrations of F1 to F4 fractions is unknown, but based on the nature of the fuel spill (Jet A), it is anticipated that the soils require treatment for the F2 and F3 petroleum hydrocarbon fraction.

Figure 3 provides the preliminary plan and sections of the purpose-built facility to treat these designated soils. The preliminary design will be finalized to accommodate the actual construction site topography, borrow material properties, and landfarm sizing requirements.

3.2 Landfarm Dimensions and Components

The landfarm is sized to accommodate an approximate 2,000 m^3 of soil, assuming a treatment soil depth of 0.3 m. Using these assumptions, the preliminary inner dimensions of the facility are 70 m by 100 m. The assumed berm height ranges from 1.3 m to 2.1 m above the natural ground, with a liner keyed in to the soils with at least 1 m of soil, as shown on Figure 3. The crest of the berms maintain a width of 3 m, and slopes will be 2H:1V or less, as shown on the drawings.

Depending on actual site conditions, the foundation base may be constructed directly by grading the natural ground. The proposed liner system consists of 60 mil textured HDPE between two layers of 12 oz. non-woven geotextile. The protective sand layer over the liner is 0.3 m. The less-impacted materials from the bladder farm may be re-used as the protective layer in the newly-constructed landfarm facility.

The final location, shape and overall size of the landfarm will be determined following the site characterization fieldwork to be completed during the summer of 2011. The landfarm access will be selected during the construction works.

3.3 Contact Water Containment

The foundation base will be sloped at 2% towards a sump with preliminary dimensions of 10 m by 70 m. The sump is designed to contain approximately 245 m^3 water, or approximately half the expected snowmelt volume. Based on the landfill dimensions and precipitation assumptions, a narrow strip of soils undergoing remediation adjacent to the sump may be saturated or have free standing water after the freshet. On this design basis, the maximum head on the liner is 1.0 m.

4.0 OPERATION AND MAINTENANCE PROCEDURES

4.1 Safety and Environmental Protection

In addition to adherence to Baffinland's Heath and Safety Plan, staff in charge of operating the landfarm must have valid WHMIS and TDG training and be trained in the procedures associated with landfarm operation, including the use of safety equipment (first aid supplies, eyewash station, fire extinguisher, spill response materials etc), emergency response procedures, soil tilling, record-keeping, soil and water sampling, and groundwater monitoring. It is recommended that activities involving contaminated soils be conducted under the supervision of site staff having a 40-hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) or Canadian Hazardous Waste Workers Program.

Before work starts, personnel must be provided with a clear explanation as to the nature of the contamination and the specific personnel protective equipment required to complete the assigned tasks. Personnel should be trained how to decontaminate equipment and personal protective equipment. Personal hygiene, including showering at the end of the day and washing prior to eating, smoking, etc. is important after handling contaminated soils. Workers should be encouraged to watch for and immediately report any unsafe conditions, or to report any damage to the facility, especially any tears in the liner that could occur during operations such as tilling.

If the nature/degree of contamination is such that respiratory protection is required, the workers must be properly fit-tested prior to starting work at the facility. The selection of personal protective equipment is the responsibility of the site Occupational Hygienist, Corporate Safety Officer, or equivalent.

The facility must have warning signs posted in English and local dialect, both to prohibit the dumping of soil materials without the permission of the Site Manager, and to warn personnel of the dangers and risks posed by the facility (slip/trip, hydrocarbon-contaminated material, open water). The sump area should be clearly demarcated to avoid any personnel from breaking through ice at the start and end of the season, when snow cover may conceal the underlying thin ice.

4.2 Soil Acceptance Procedures

Rock fragments and cobble exceeding 100 mm in diameter should not be accepted in the landfarm. The soil originating from the bladder farm is anticipated to consist principally of sand and gravel.

Chemical acceptability criteria include the following parameters:

- Total petroleum hydrocarbons 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.

4.3 Landfarming Operations

Landfarming is an ex situ bioremediation treatment that uses naturally-occurring microorganisms to metabolize or breakdown petroleum hydrocarbons in impacted soils. This is achieved by spreading contaminated soil in a thin layer across the landfarm area.

End products of bioremediation are microorganism protein, carbon dioxide and water. Stimulation of microbial growth and activity for hydrocarbon removal is accomplished primarily through the addition of air and nutrients. In a landfarm, the metabolism of hydrocarbon is mediated predominantly through aerobic microbes.

The effectiveness of landfarming depends on three main parameters:

- Soil characteristics; grain size, soil texture, bulk density, moisture content and permeability;
- Type of petroleum hydrocarbon; and
- Climatic conditions.

Climatic conditions including rainfall, snow, wind effects and temperature influence landfarm efficiency. Rain and snow melt will change the moisture content of the treated soil. Runoff and wind also has the potential to cause soil erosion.

The anticipated operational period of the landfarm will depend on the weather conditions, but it is anticipated to be from June to the end of September.

After excavation and transport of contaminated soil to the landfarm area, the soil should be dumped and spread with a front-end loader or bulldozer. The soil should be tilled as it is spread, continuing until all of the soil has been deposited to ensure that the material is well-mixed and aerated. Material placement should maintain a minimum 2 m offset from the inside berm toe.

Soils will be placed in a layer of approximately 0.3 m and should not exceed 0.45 m in any location. At the start of season, the soils should be evaluated for optimal nutrient, moisture and pH conditions. Microorganisms that degrade hydrocarbons require optimal quantities of water, oxygen, and macronutrients (carbon, nitrogen, hydrogen, oxygen, sulphur, phosphorus, potassium, and magnesium), and the soil pH should be between 6 and 8. In addition, excessive salt compounds reduce the osmotic

potential and can slow or even halt biodegradation. Salts that are harmful to biodegradation in excessive concentrations include sodium chloride as well as fertilizer amendments.

Most soil microorganisms that breakdown petroleum hydrocarbons on a landfarm require an aerobic environment. Tilling is conducted to aerate the soils and enhance microbial degradation. The landfarmed soil should be loose and moist. During the summer months, the soils should ideally be tilled every week.

Optimizing the moisture content will enhance biodegradation and to avoid dust generation. Very dry soils should not be tilled. If soils are excessively dry, the landfarm should be irrigated prior to tilling to increase the soil moisture content to 40% to 85% of the water-holding capacity.

Soils that are wet also do not benefit from tilling. Passing equipment over wet soils could compact the material. If the soil appears muddy, or sticks to the tires of the tilling equipment, it is too wet to process.

Tilling could damage the underlying liner so it should be carried out with care by an experience operator. Only tilling equipment should be permitted on the landfarm soil, and only during tilling. Trucks or other vehicles should not drive on the landfarm soil as this will pack the soil down making it difficult to handle, and may prolong the soil remediation timeframe.

During the winter months, soil can be stockpiled to minimize contact with freshet water, although the piles should be no higher than 5 m.

5.0 WATER MANAGEMENT PLAN

5.1 Plan Considerations

All irrigation water, precipitation and snowmelt that collects in the landfarm sump is considered contact water. Average monthly temperatures that are above 0°C occur between July and September, so it is expected that runoff will need to be managed for these three months of the year. Based on historical climate data for Pond Inlet, it is expected that 190 mm of precipitation will fall annually, approximately 50% of which will accumulate as snow. The preliminary landfarm design could accommodate over 4,000 m^3 of water while maintaining a minimum 0.5 m of freeboard.

The yearly monthly wind speed averages are between 5 and 6 m/s during the frost-free months, and the average monthly relative humidity is between 70% and 80%. Ignoring losses (evaporation) or gains to the landfarm (snow drifts), it is expected that approximately 1,150 m^3 of precipitation (snow and rain) will collect annually in the landfarm. The annual quantity of contact water may be higher depending on whether external irrigation water is required to maintain optimal soil moisture conditions during the period of active treatment. The sump is designed to contain approximately 245 m^3 of water, or approximately half the volume of the expected snowmelt.

5.2 Contact Water Recycling and Water Use Minimization Procedures

During the treatment process, contact water that accumulates in the sump may be recycled as irrigation water to add nutrient amendments, to increase soil moisture or to supress dust within the landfarm area during dry periods. Recycled water from the sump should preferably not contain any petroleum

hydrocarbon sheen, which could be removed by using absorbents, or avoided by drawing water from beneath the water surface.

Should external water inputs be required during the landfarm soil treatment operations, consumption of fresh water at Milne Inlet could be minimized by recycling water from other processes, such as waters from the sewage lagoon polishing cell or sewage sludge. Treated wastewater and/or sludge is potentially a valuable source of nutrients (especially nitrogen), and reclaimed water irrigation of the landfarm could reduce or possibly eliminate dry chemical nutrient amendment requirements. In addition to reducing freshwater consumption, recycling nutrients already available in treated sewage use benefits the environment by offsetting greenhouse gas emissions that otherwise would have been generated in the production and shipment of dry chemicals to site.

Such use of reclaimed water would require authorization from the NWB and other stakeholders, and is contingent on the chemistry of the proposed amendment (especially with respect to metals loadings) as well as the effectiveness of the amendment to achieve the remediation targets, such as through a bench-scale or plot tests. The proposed amendment would need prior characterization for suitability, including the COD:N:P ratios, metals, and routine chemistry parameters.

5.3 Contact Water Discharge

To maintain adequate freeboard and avoid flooding the soils undergoing treatment, the landfarm sump contact water should be removed prior to freeze up in September. Water that does not meet the discharge requirements provided in the amended Water Licence 2BB-MRY0710 requires treatment or off-site disposal. Nunavut Water Board (NWB) landfarm discharge limits for mine sites are provided in Section 7.3, as well as monthly testing of chemical parameters.

If reclaimed wastewater is used during the treatment process, the contact water discharge parameters may need to include BOD_5 and faecal coliforms in addition to the standard Water Licence discharge requirements.

After water analyses confirm the water is suitable for release and the AANDC Inspector has been notified of the intended discharge, the water will be released to a nearby Monitoring Station, the location of which will be confirmed on the as-built drawing. The landfarm Monitoring Station discharge point should be at least 30 m away from any surface waterbody, and water discharges should be conducted in a manner that avoids soil erosion.

6.0 SOIL QUALITY REMEDIATION OBJECTIVES

Remediation objectives for the F1 to F4 hydrocarbon fraction will depend on the subsequent use of the treated soils. As per the Nunavut Water Board renewal of Baffinland's Licence No. 2BB-MRY0710, soils affected by hydrocarbons from normal fuel transfer procedures require treatment to meet the objectives included in the 2010 Government of Nunavut's Environmental Guideline for Site Remediation. Industrial criteria are suitable if the treated soils are to remain in place until the landfarm is decommissioned or the term of the commercial lease expires. Without a site-specific risk assessment, agricultural/wildland Tier 1 F1 to F4 hydrocarbon criteria must be met if the soils are to be returned to the environment, or at such time that the commercial lease expires.

Soils that do not respond to bioremediation treatment may be disposed of off-site or, with prior approval, the materials could be used as intermediate fill within an engineered on-site facility (landfill).

7.0 MONITORING PROGRAM

7.1 Soil Sampling

Soil sampling will be conducted to determine acceptability criteria, to monitor the progress of soil remediation, and to verify that soils meet the remediation objectives at the end of treatment.

Chemical analyses for soil acceptance at the landfarm were listed in Section 4.2. For the designated soils, analysis of F1 to F4 hydrocarbon fractions will not be required if sufficient data density is obtained during the soils characterization. Soil bulk density, moisture content, field capacity, and nutrients (nitrogen, phosphorus) are also required testing parameters.

Unless the soils are chemically unsuitable for bacteriological growth, it is highly unlikely that there will not be sufficient microorganisms in the accepted soil to initiate effective bioremediation. For this reason, heterotrophic plate count analyses are generally not necessary.

Soil sampling to verify interim treatment includes the CCME F1 to F4 soil fraction and soil nutrients. Periodic measurement of hydrocarbon vapour emissions by measuring headspace, using a small quantity of soil and a photoionization detector (PID), is a useful indicator of the progress of remediation but should not be substituted for remediation verification sampling.

Soil sampling to verify the completion of the treatment process includes the CCME F1 to F4 soil fraction. Testing for metals is not required at the end of remediation since soils will be tested prior to acceptance at the landfarm, and any landfarm treatment inputs will have known chemistry.

Other soil sample parameters may be added, such as poly-aromatic hydrocarbons (PAH), if the landfarm is retained after the two-year remediation program, or for treatment of other types of hydrocarbon-impacted materials.

7.2 Contact Water Sampling

During the frost-free months, and only if contact water is present in the sump, one or two sets of water samples will be collected and submitted to an accredited laboratory and for the analysis of the following parameters:

- Oil and grease and visual observations of sheen
- F1 and F2 hydrocarbon fraction and BTEX
- Phenols
- Dissolved nutrients: ammonia, nitrate, nitrite, phosphate
- Total nutrients: total phosphorus, total kjeldahl nitrogen
- Solids: total suspended solids, total dissolved solids

- Major Ions/Anions: calcium, magnesium, sodium, potassium; hardness, chloride, sulphate
- Routine chemistry pH, alkalinity, conductivity
- Metals: CCME list including As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Sb, Se, Ag, Tl, Sn, V, Zn, Hg
- Routine Physical : turbidity, temperature

Parameters including temperature, pH, TDS, and electrical conductivity are to be measured in the field as well as the laboratory.

Other water sample parameters may be added, such as PAH, if the landfarm is retained after the remediation program, for treatment of hydrocarbon-impacted materials that do not originate from the fuel bladder farm.

7.3 Contact Water Discharge Limits

Contingent on the acceptance proposed landfarm and future amendment of the Water Licence, the proposed contact water discharge limits at the additional Monitoring Program Station are as follows:

Parameter	Maximum Concentration of any Grab Sample (mg/L)
pH	6.0-9.5
Total Suspended Solids	15
Oil and Grease	15 and no visible sheen
Total lead	0.001
Benzene	0.370
Toluene	0.002
Ethylbenzene	0.090

Depending on the design life of the landfarm, the installation of permanent groundwater monitoring facilities may be warranted. Alternately, temporary drive point (sand point) wells may be installed in the unconsolidated material using a hardened drive point and a screen (perforated pipe). The point is hammered into the ground, usually with a tripod and "driver" (weighted pipe that is repeatedly dropped).

Experience in similar latitudes in the Arctic indicates that free water will not be available for sampling until mid to late August. Groundwater will be monitored once per year in two downgadient and one upgradient location.

Water samples are to be collected and submitted to an accredited laboratory for the analysis of the following parameters

- F1 and F2 hydrocarbon fraction and BTEX
- Dissolved nutrients: ammonia, nitrate, nitrite, phosphate
- Total nutrients: total phosphorus, total kjeldahl nitrogen
- Solids: total suspended solids, total dissolved solids

- Major ions/anions: calcium, magnesium, sodium, potassium; hardness, chloride, sulphate
- Routine chemistry: pH, alkalinity, conductivity
- Routine physical : turbidity, temperature

Parameters including temperature, pH, TDS, and electrical conductivity are to be measured in the field as well as the laboratory.

7.4 QA/QC

The general quality assurance and quality control are to follow *QA/QC Guidelines for Use by Class "B" Licensees in Meeting SNP Requirements* (INAC, 1996). All samples are to be collected using best industry practices and shall be submitted under a Chain-of-Custody protocol. Sampling protocols adhered to include the following:

- Disposable sampling gloves to be worn during the collection of samples, and discarded between sampling events. Sampling tools are to be decontaminated between sampling points.
- Any sampling and inspection events should be documented in field notes including identification of the person conducting the work. It is beneficial to photograph any work that is conducted.
- For small batches of soil samples (less than 10 samples), at least one blind duplicate should be analyzed per batch of samples. For larger batches of soil samples (greater than 10 samples), 10% duplicates should be analyzed. For groundwater samples, a blind duplicate and field blank sample should be collected and analyzed with each batch of samples tested.
- Samples collected for laboratory analysis are to be placed in coolers and transported to the laboratory via courier.
- Sample holding times are to be adhered to, and water samples are to be preserved for specific analyses.
- All water and soil samples are to be collected in laboratory-supplied bottles and jars, and analyzed at a Canadian Association of Environmental Analytical Laboratories (CAEAL) accredited laboratory. All analytical reports are to include QA/QC reports.

7.5 Summary of Inspections and Reporting

Table 2 provides a summary of inspections and reporting associated with the operation of the landfarm:

Table 2: Monitoring Summary and Documentation

Item	Purpose	Frequency	Type of Record(s)
Landfarm Treatment Operations Inspection	Record keeping of treatment operations and berm performance for due diligence.	Once per day during spring freshet and after rainfall events. Weekly at other times.	• Inspection checklist and field notes including date, weather, facility condition including, any repairs required, odour noted, quantity of water in sump and amount of freeboard. • Record of berm performance with emphasis on observations of cracking or any signs of instability. • Check soils to see if they are too dry or too wet to till. • Record of any unauthorized discharges and follow-up action taken. • Photographic record.
Soil Sampling for Soils Acceptance at Facility	To determine if soils are acceptable for treatment at facility.	For this purpose-built facility, only one time per year at the start of season. Otherwise as circumstances require.	• Soils origin and associated spill report number, • Field notes including frequency of sampling, soil texture, moisture content, colour, odour. • Laboratory-issued reports including QA/QC • Summary tabulation of results. • Documentation of fate of rejected soils. • Record of any treatability tests done.

Table 2: Monitoring Summary and Documentation

Item	Purpose	Frequency	Type of Record(s)
Soil Sampling for Remediation Progress Monitoring	To provide interim indications of how remediation is progressing.	Monthly during the frost-free months.	• Field notes and sketch of location/depth of samples taken. • Photographic record. • Laboratory-issued reports including QA/QC and chain of custody. • Summary tabulation of results. • Analysis of percent removal of hydrocarbon constituent treated and treatment time, evaluation should include weather information, soil texture and soil moisture.
Soil Sampling for Verification of Remediation	To determine if remedial objectives have been met.	For this purpose-built facility, only one time per year at the end of season. Otherwise as circumstances require.	• Field notes and sketch of location/depth of samples taken. • Photographic record. • Laboratory-issued reports including QA/QC • Summary tabulation of results. • Analysis of percent removal of hydrocarbon constituent treated and treatment time. • Documentation of fate of treated soils. • Annual quantities in cubic metres of all soil and types of contaminants.
Contact Water Sampling During Remediation	Due diligence operations monitoring.	One or two times per treatment season	• Field notes and observations made at time of sampling. • Laboratory-issued reports including QA/QC and summary tabulation of results.
Contact Water Sampling prior to Discharge	To conform to Water License Requirements.	As required prior to discharge.	• Document notification of INAC Inspector (written notification at least 10 days prior to discharge). • Record depth of water in sump. • Calculate approximate water volume to be discharged. • Laboratory-issued reports including QA/QC and summary tabulation of results.
Groundwater Monitoring and Sampling	Date, time, weather, water level, in-well parameters (temperature, pH, electrical conductivity), visual observations of water colour and turbidity, odour.	Water sampling one time per year, between mid-August to mid-September.	• Laboratory-issued reports including QA/QC and summary tabulation of results, trend analysis (after a minimum of four years of data, if applicable).

Table 2: Monitoring Summary and Documentation

Item	Purpose	Frequency	Type of Record(s)
Construction Summary Report	As-built and construction report as per Water Licence.	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.
Site Safety Inspections	To identify any new or previously unnoticed physical/chemical hazards.	Monthly, or when conditions change, or when an unsafe condition is reported by a worker.	• Any unsafe condition/near-miss/incident reports and records. • Any unsafe conditions reported by workers must be reported to the Site Manager immediately for prompt action.
Geotechnical Inspection	To ensure facility has not been degraded or damaged, and to identify any maintenance requirements.	Annually	• Inspection of geotechnical performance of facility. • Document recommendations of any repair/maintenance work. • Record of any repair work made to the facility.

8.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

EBA, A Tetra Tech Company

REGISTERED PROFESSIONAL ENGINEER
W. T. HORNE
LICENSEE
Sept 13, 2011
N.W.T.

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/dlm

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date Sept 13/2011
PERMIT NUMBER: P 018
The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU

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FIGURES

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BAFFIN BAY

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BYLOT ISLAND

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ARCTIC BAY

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NANISIVIK

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ECLIPSE SOUND

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POND INLET

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MILNE INLET

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MILNE INLET CAMP AND PORT

ᑭᓚᒪᐊᓂᑦ ᐊᖏᕐᑎ
MILNE INLET TOTE ROAD

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MARY RIVER SITE

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MID RAIL CAMP

ᓄᓇᓕᐅᑎᓪᓗᑦ ᐊᖏᕐᑎᓂᐊᓕᕆᓕᖅ
PROPOSED RAIL ALIGNMENT

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STEENSBY INLET CAMP
AND PROPOSED PORT

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STEENSBY INLET

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CLYDE RIVER

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IGLOOLIK

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KOCH ISLAND

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ROWLEY ISLAND

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HALL BEACH

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FOXE
BASIN

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BAFFIN ISLAND

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CANADA

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LEGEND:

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WATER

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CAMP LOCATION

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COMMUNITY

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SCALE (APPROX.) km

NOTES
BASED ON DRAWING PROVIDED BY BAFFINLAND IRON MINES CORPORATION

CLIENT
Baffinland Iron Mines Corporation

Hydrocarbon Impacted Soils Storage and Landfarm Facility

Site Location Plan

PROJECT NO.	DWN	CKD	REV
E14101092	RH	DF	0

OFFICE	DATE
EDM	September 13, 2011

eba A TETRA TECH COMPANY

Figure 1

NOTES
BASED ON 2005 AERIAL PHOTOGRAPH

0 250
Scale: 1: 5 000 (metres)

CLIENT
Baffinland Iron Mines Corporation

eba A TETRA TECH COMPANY

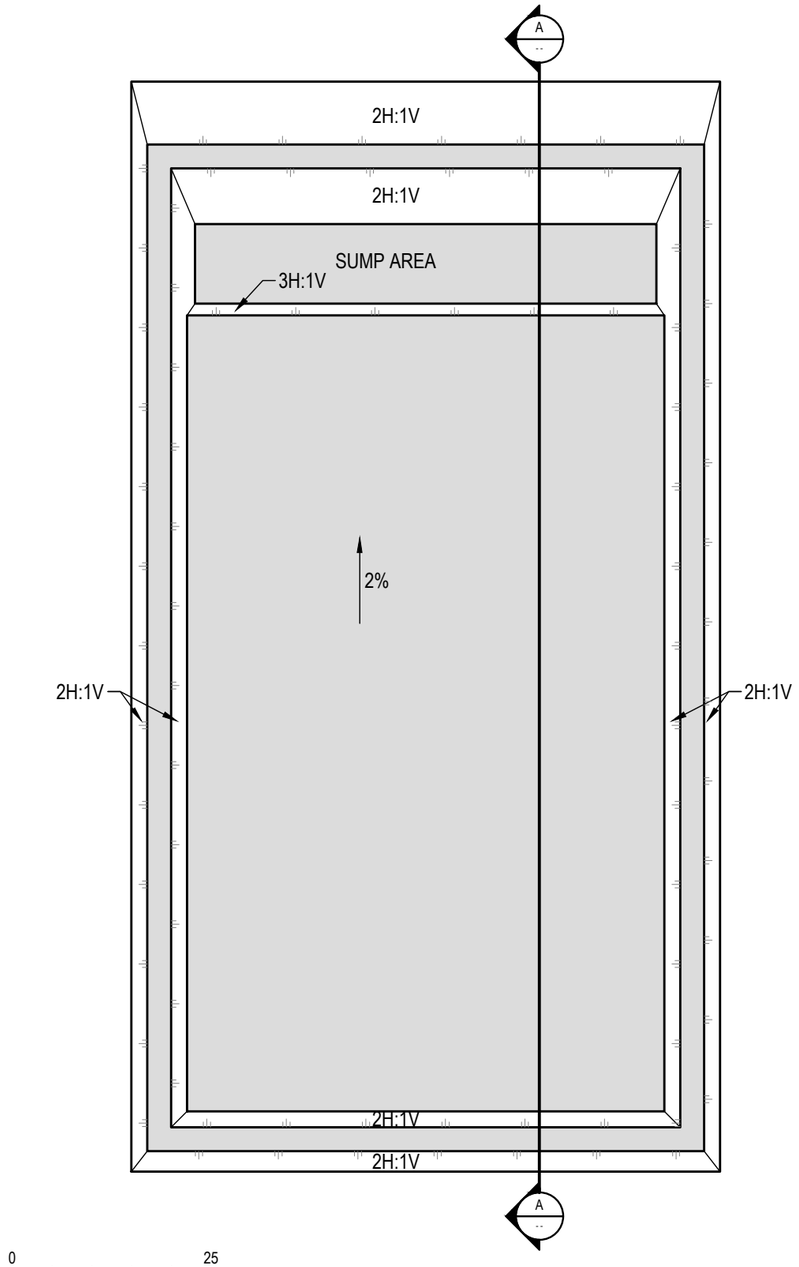
Hydrocarbon Impacted Soils Storage and Landfarm Facility

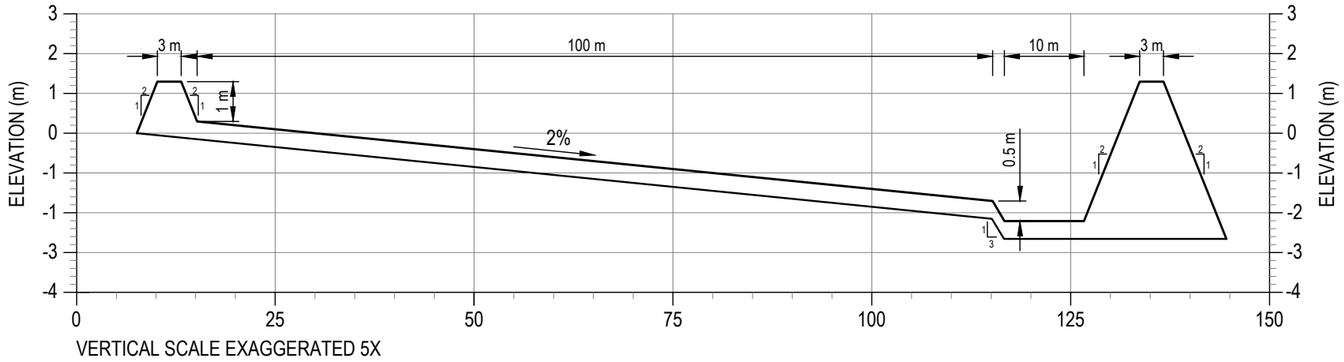
Proposed Landfarm Locations

PROJECT NO.	DWN	CKD	REV
E14101092	RH	DF	0

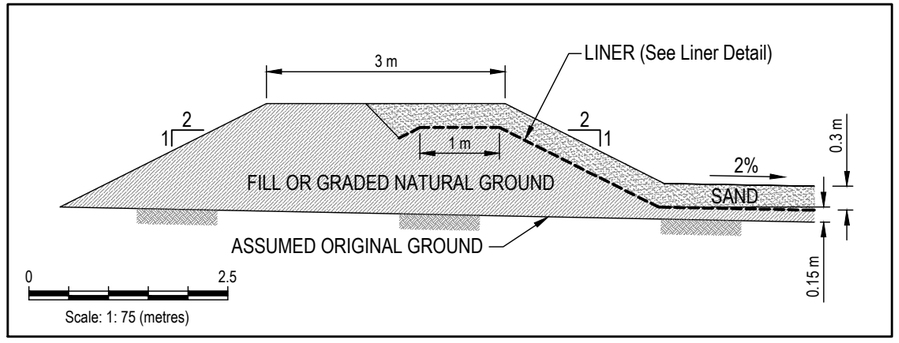
OFFICE	DATE
EDM	September 13, 2011

Figure 2

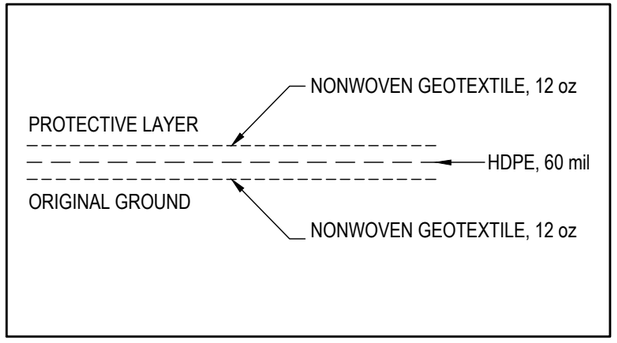




SECTION A



TYPICAL SECTION DETAIL



LINER DETAIL

NOT FOR CONSTRUCTION

NOTES
BERM HEIGHTS AND GRADES TO BE ADJUSTED BASED ON ACTUAL TOPOGRAPHY

CLIENT
Baffinland Iron Mines Corporation

Hydrocarbon Impacted Soils Storage and Landfarm Facility

Preliminary Design of Landfarm Facility

eba A TETRA TECH COMPANY

PROJECT NO.	DWN	CKD	REV
E14101092	RH	DF	0

OFFICE	DATE
EDM	September 13, 2011

Figure 3

APPENDIX A

APPENDIX A EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA’s Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA’s Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA’s instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

Annex 6

Waste Sorting Guidelines

Baffinland
Iron Mines Corporation

WASTE SORTING GUIDELINES

Why sort waste?

To protect the health and safety of site personnel.

To minimize contamination, wildlife attraction, and other adverse environmental impacts.

Where to sort waste?

Workplaces and the Waste Sorting Area, located next to the incinerator.

Who should sort waste?

Everyone.

All who manage, handle, store and/or dispose of any of the materials mentioned in these guidelines.

- ➡ *All employees and contractors generating the waste are responsible for ensuring that it is labelled and sorted correctly.*
- ➡ *Employees and contractors are also responsible for contacting Site Services Manager on channel 2 when waste containers are full and ready for pick-up.*
- ➡ *For unusual or hard to segregate waste types, please contact the Environment Office.*

INCINERATOR WASTE

Disposal Instructions

Indoors: Black garbage bags in rubbermaid waste bins.

Outdoors: Black garbage bags in 45 gal. drums, consolidation in steel containers with lid.

Acceptable Waste

Cardboard
Food Scraps
Oily Rags
Paper
Scrap Wood
Small Plastic

LANDFILL WASTE

Disposal Instructions

Outdoors: Steel Containers.

Access to the landfill is for Authorized Personnel Only. Landfill Operators should refer to the landfill user rules for more information.

Acceptable Waste

Concrete
Corrugated Cardboard
Empty Clean Container
Glass
Metal
Bulky Wastes (after approval by Environment Office)
Wood Products

HAZARDOUS WASTE

Waste Type	Disposal Instructions
Absorbent (used)	White Quatrex or overpack drums
Aerosol Cans	Labelled bins outside bathrooms; overpack drums outdoors
Antifreeze	Cubes or drums (closed top)
Batteries (AA, 9V, etc)	Labelled bins outside bathrooms
Batteries (vehicle)	Black Quatrex
Contaminated Soils	White Quatrex or overpack drums
Contaminated Water	Drums (closed top)
Electronic Waste	White Quatrex
Fluorescent Bulbs	20L pails outside bathrooms
Mixed Waste Containers	White Quatrex (antifreeze, grease, oil and polymer)
Waste Fuel	Drums (closed top)
Waste Grease	Overpack drums
Waste Oil	Cubes or drums (closed top)
Waste Oil Filters	Drums (open top)