NEWMONT
NORTH AMERICA

Hope Bay Mining Ltd.

Incinerator Management Plan

March 2012 (Rev 1.1)

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INCINERATOR MANAGEMENT PLAN

March 2012 (REV 1.1)

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1. INTRODUCTION

1.1 PROJECT LOCATION

The Hope Bay Project, located on Inuit owned land in the West Kitikmeot region of Nunavut, is approximately 125 km southwest from Cambridge Bay and 75 km northeast from Umingmaktok. The various elements of Hope Bay Project are centered at approximately 68°09'N and 106°40'W and extend from the head of Roberts Bay (an extension of Melville Sound) in the north to the Boston Camp located approximately 80 km to the south (Figure 1).

1.2 OBJECTIVES

The Type A Water Licence No. 2AM-DOH0713, Type B Water Licence No. 2BB-BOS0712, and Type B Water Licence No. 2BE-HOP0712 issued to HBML by the Nunavut Water Board (NWB) allows the incineration of approved waste streams. HBML does not currently have an incinerator operating under licence No. 2BE-HOP0712, therefore, any waste generated during clean-up of the Windy Camp or Patch Laydown will be managed at the Doris North waste management facility.

HBML is required, under Part G of 2AM-DOH0713, to submit to the NWB an Incineration Management Plan (Section 5) in conjunction with a revised Landfill Management Plan (Section 9). The Incineration Management Plan, as defined in the Licence shall consider the following:

a) Recycling/segregation waste program.
b) Incineration technology selected.
c) Waste audit (amount and types of wastes to be incinerated or otherwise disposed).
d) Consolidation of wastes.
e) Operational and maintenance records.
f) Operator training.
g) Emission measurements.
h) Incinerator ash disposal.
i) Consideration for disposal of used oil and waste fuel.
j) Monitoring, characterization and disposal of incinerator ash.

This Incinerator Management Plan has been prepared and is being submitted by HBML to address the requirement specified in Part G, Section 5 of Water Licence No. 2AM-DOH0713, and also includes the plan for incineration under the two Type B Water Licences. The plan addresses all relevant aspects of the operation, maintenance and monitoring of the two Westland Model CY-100-CA-D incinerator located at Roberts Bay and the CY-20-20-FA-D incinerator at Boston Camp under the Type B Licence No. 2BB-BOS0712. This includes the management and disposal of all residual ash waste generated by the operation of the incinerator.

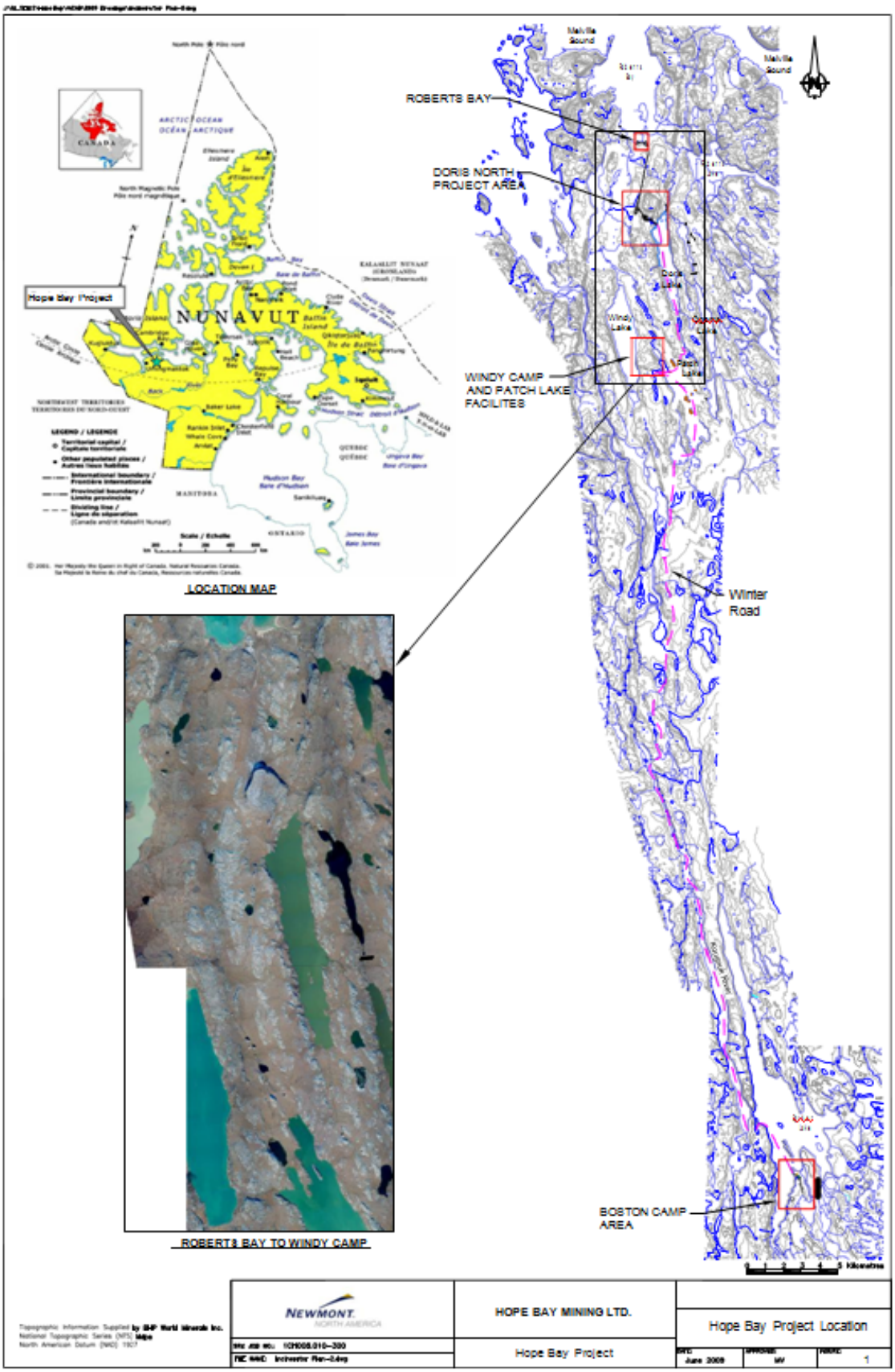

Figure 1. Hope Bay Project Location

The main objective of this Plan is to ensure the incinerators are operated in a safe, efficient and environmentally compliant manner. Consistent with HBML's intent to be a responsible operator, these objectives are described as follows:

- *Compliance with the Environmental Guidelines for the Burning and Incineration of Solid Waste (Government of Nunavut Environmental Protection Division)*
- *Compliance with the Environment Canada Technical Document for Batch Waste Incineration*
- *Compliance with the Canadian Council of Ministers of the Environment Canada-Wide Standards for Mercury Emissions and Dioxins and Furans*
- *Compliance with Project Certificate No. 003, and water licence requirements;*
- *Prevention of public health risk;*
- *Protection of the operator;*
- *Protection of surface and ground water;*
- *Protection of land;*
- *Protection of local flora and fauna species; and*
- *Conservation of resources.*

This Incinerator Management Plan has been developed to ensure that these factors are built into the HBML operational approach at Hope Bay. It discusses the importance of waste management and reduction of specific waste streams to ensure Canada Wide Standards for dioxins, furans and mercury are achieved.

1.4 RESPONSIBILITY

The General Manager of Operations (GMO) has the overall responsibility for implementing this management plan and will provide the on-site resources to operate, manage and maintain all incinerators located in the Hope Bay Belt in accordance with the operation manual and regulatory requirements.

The Facilities Manager is responsible for providing on-site support and resources for the Waste Management Facility, including monetary resources for completing maintenance and repair requests. The Waste Management Supervisor will report to the Facilities Manager.

The Waste Management Supervisor at each facility will maintain waste incinerator records, conduct and record regular inspections of the incinerators, request maintenance or repairs and document completion of the request, provide feedback on operational procedures to improve performance, and will supervise the operation of the incinerators.

The ESR Site Manager is responsible for revising this management plan, coordinating ash characterization analyses to identify appropriate disposal options, conduct workplace inspections and regular audits of the waste management and incineration records.

1.5 INCINERATORS AT HOPE BAY

There are currently two different models of incinerators in operation at Hope Bay. There is the larger volume CY-100-CA-D and the smaller volume CY-20-20-FA-D. The model numbers give insightful information regarding the incinerators specifications. The nomenclature can be explained using the following example:

CY-(xx)-(yy)-(z)

xx = a number denoting the burn capacity of the incinerator in kg/hr

yy = Letters denoting the supplied air to the unit.

CA stands for Controlled Air
FA stands for Forced Air89iio0p9i

z = Letter denoting the auxiliary fuel used

D stands for Diesel
P stands for Propane
N stands for Natural Gas

A dual chamber incinerator, Model CY-100–CA–D is currently situated in Roberts Bay next to the interim Waste Management Facility, and a second CY-100-CA-D was installed on October 15, 2011 next to the existing incinerator. The second incinerator was installed as a back-up unit in the event of failure of the primary unit. These incinerators will be used for management of all permitted burnable waste produced at the Doris North Project (Table 1, Figure 2).

The Boston camp is currently operating a small forced air incinerator Model CY-20-20-FA-D (Table 1, Figure 3).

Burnable waste collected during clean-up and reclamation activities at Windy Camp and Patch Laydown will also be incinerated in the Doris North Project incinerators. The volume of waste handled from Windy and Patch will be tracked separately from the waste handled from the Doris North Project.

Table 1. Location, Operational State and Model of Incinerators Currently On Site

Incinerator Model	Location	Status	Installed	Milestones
CY-100-CA-D	Roberts Bay	Operational	June 2008	Moved beside Waste Mgmt area in August 2010, building finished in Nov 2011, underwent major repairs and maintenance overhaul in Spring 2011
CY-100-CA-D	Roberts Bay	Non Operational	October 2011	Back-up unit
CY-20-20-FA-D	Boston Camp	Operational	July 2009	Underwent repair and maintenance overhaul in spring 2011

a

b

Figure 2. a) CY-100-CA-D inside Shelter and b) Back-Up Unit at Waste Management Facility, Roberts Bay

Figure 4. CY-20-20-FA-D at Boston Camp

2. APPLICABLE LEGISLATION, LICENSING AND GUIDELINES

2.1 WATER LICENCE

Incineration and open burning are regulated in the Type A Water Licence No. 2AM-DOH0713 Part G Items:

1. *The Licensee shall dispose of all food waste in an incinerator designed for this purpose.*
2. *The Licensee shall ensure that any on-site incinerator meets the requirements of the Canada-Wide Standards for Dioxins and Furans and Canada-Wide Standards for Mercury Emissions.*
3. *The Licensee shall submit to the Board for review by May 1, 2008 an Incineration Management Plan in conjunction with Part G, Item 9.*
4. *The Licensee is restricted to the open burning of paper products, paperboard packing and untreated wood waste in accordance with the Government of Nunavut Policy Municipal Solid Wastes Suitable for Open Burning.*
5. *The Licensee shall submit to the Board for review by May 1, 2008, a revised Landfill Management Plan. The Plan shall consider the following:*

Recycling/Segregation Waste Program:

a) *Incineration technology selected;*
b) *Waste audit (amount and types of wastes to be incinerated or otherwise disposed);*
c) *Consolidation of wastes;*
d) *Operational and maintenance records;*
e) *Operator training;*
f) *Emission measurements;*
g) *Incinerator ash disposal;*
h) *Consideration for disposal of used oil and waste fuel;*
i) *Monitoring, characterization, and disposal of incinerator ash; and*
j) *The licensee is authorized to dispose of and contain all non-hazardous solid wastes at the landfill or as otherwise approved by the Board.*

In addition, Part D Item 3 of the Type B Regional Exploration Licence (2BE-HOP0712) and the Type B Boston Exploration Licence (2BB-BOS0712) states that *"The Licensee is authorized to dispose of all acceptable food waste, paper waste and untreated wood products in an incinerator."*

2.2 CANADA- WIDE STANDARDS FOR DIOXINS, FURANS AND MERCURY

Canada-wide Standards (CWSs) are intergovernmental agreements developed under the *Canadian Council of Ministers of the Environment (CCME)*. CWS's can include qualitative or quantitative standards, guidelines, objectives and criteria for protecting the environment and reducing risks to human health. Canada has identified dioxins, furans and mercury as emission products that need to be managed as they pose a potentially significant health and environmental threat. Hope Bay's water license states that these emissions must be in compliance with the CWS for dioxins, furans and mercury. Large facilities are generally required to perform stack tests on an annual basis to demonstrate compliance.

The following parameters are required to be monitored based on Hope Bay's water license No. 2AM-DOH0713;

- Dioxin
- Furan
- Mercury
- Volume flow rate (out of stack)
- Stack gas temperature
- Moisture Content

The following parameters are optional;

- SO_2
- NO_2
- O_2
- Particulates

2.3 TECHNICAL DOCUMENT FOR BATCH WASTE INCINERATION

The Technical Document for Batch Waste Incineration was issued by Environment Canada in January 2010 and is intended to act as a guideline for owners and operators of various incinerators. The technical document focuses on batch waste incinerators ranging in size from 50 to 3,000 kg of waste per batch. Batch waste incinerators are those that operate in a non-continuous manner (i.e. they are charged with waste prior to the initiation of the burn cycle, and the door remains closed until the ash has cooled inside the primary chamber). This is the type of incineration that is used in both incinerator models at Hope Bay.

The document recommends and describes a six-step process for batch waste incineration:

Step 1 – Understand Your Waste Stream.
Step 2 – Select the Appropriate Incinerator (or Evaluate the Existing System).
Step 3 – Properly Equip and Install the Incinerator.
Step 4 – Operate the Incinerator for Optimum Combustion.
Step 5 – Safely Handle and Dispose of Incinerator Residues.
Step 6 – Maintain Records and Report.

This guideline addresses proper system selection, operation, maintenance and record keeping, with the goals of achieving the Canada-Wide Standards for dioxins/furans and mercury, and reducing releases of other toxic substances.

3. CONTROLLED EMISSION PRODUCTS (Dioxins, Furans, Mercury)

3.1 DIOXINS AND FURANS

3.1.1 Introduction

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, respectively, are predominantly a result of human activity. These substances are toxic,

persistent, and bio-accumulative. Due to their extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination.

Dioxin and furan contamination found in soil, water, sediments, and tissues are the subject of national guidelines for dioxins and furans. These guidelines outline ambient or "alert levels" which may be used by jurisdictions as benchmarks for the management and monitoring of dioxins and furans already present in the environment.

The CWS guideline shown in Table 2 is a step towards achieving virtual elimination for dioxins and furans. All facilities will have to employ best available pollution prevention and control techniques, such as waste diversion programs and waste reduction initiatives to achieve a maximum reduction in dioxin and furan concentrations from stack emissions.

Table 2. Canada-Wide Standards for Dioxins and Furans

Source	Dioxin/Furan Guideline
Municipal waste incineration	80 pg I-TEQ/m^3
Hazardous waste incineration[1]	80 pg I-TEQ/m^3
Sewage sludge incineration	80 pg I-TEQ/m^3
Medical waste incineration	80 pg I-TEQ/m^3

pg = picogram, I-TEQ = international toxic equivalent, m^3 = cubic metre

[1]Hazardous waste incinerators include all facilities that burn hazardous waste including low level radioactive waste; however they do not include facilities that use waste derived fuel or used oil.

3.1.2 Dioxin and Furan Formation in Incinerators

Dioxins and furans can form through natural processes such as bush fires and volcanic eruptions, but the greatest quantities are produced from human activity. Waste incineration has historically been responsible for a significant portion of the dioxins and furans emitted in Canada. Incineration is the rapid oxidation of material with the formation of heat and typically solid ash and gaseous waste products.

The exact mechanism of dioxin and furan formation in incinerators is poorly understood, but generally they form during the thermal breakdown of organic materials in the presence of transition metals and chlorinated compounds. Dioxin formation takes place as the flue gas cools from the initial 1000°C to about 250°C, with peak dioxin and furan formation occurring in the range of 650°C to 250°C.

Regardless of how dioxins and furans are formed, certain operating conditions increase the potential for formation of these compounds including;

a) Incomplete combustion of fuel
b) An oxidizing atmosphere
c) Presence of a chlorine source
d) Fly ash surfaces (carbon source)
e) Fly ash with degenerated graphite structures
f) Presence of catalytic metals (copper, iron, manganese, zinc, etc)
g) Temperature / time history of at least 1 second at less than 600°C

3.1.3 Control of Dioxin and Furans from Incinerators

Dioxin and furan emissions from incinerators may be reduced by:

- *Waste separation*
  - Reducing or removing certain waste types from the incinerator waste stream;
  - Burning waste in batches according to moisture content and caloric value; and
  - Placement of waste in the incinerator chamber according to manufacturer specifications to ensure optimal burning efficiency of waste.
- *Combustion control*
  - Temperature inside the secondary chamber must reach 1000°C for at least 2 seconds to provide adequate destruction of dioxins and furans;
  - Addition of an electronic data logger to track and record all operations and burn cycles but is only available for the larger CY-100-FA-D model; and
  - Use of Pre-Operational, Operational and Maintenance Checklists and Log Books ensure that the unit is operated in a safe and efficient manner.
- *Flue gas cooling*
  - Optimal time for formation of Dioxins and Furans is after combustion when the flue gas is cooling;
  - The thermal window for dioxin and furan formation is 650°C to 200°C as the exhaust gases cool;
  - Reductions in Dioxins and furans will result if the flue gas can be cooled below 200°C in 30 milliseconds; and
  - Cold ambient temperatures in Nunavut will assist in the cooling of the flue gas however it will likely take longer than the ideal 30 milliseconds.
- *Formation restriction*
  - Sulphur dioxide (SO_2) in the flue gas appears to have an inhibition mechanism in the control of dioxin and furan formation;
  - SO_2 reduces formation rather than destroys dioxins and furans; and
  - Fuel containing low amounts of sulphur is currently being utilized as a fuel source.
- *Flue gas scrubbing*
  - Air Pollution Control Systems (APC) such as cooling towers, dry scrubbers and chemical scrubbers exists however they are not recommended for small batch fed incinerators;
  - They systems are not considered efficient due to large fluctuations in temperature and pressure and the inability to effectively cool the incinerator; and
  - Ensuring good combustion control and exhaust gas temperatures should allow little opportunity for dioxins and furans to form.

3.1.4 Dioxin and Furan Control at Hope Bay

HBML has selected incinerator technology that should reduce the extent to which dioxins and furans can form. This is achieved through the following mechanisms:

- *Burn Control: The site is using double chamber incinerator technology with a clear burn process defined which eliminates spurious burn conditions and operator error.*

- *Temperature and Residence Time: The dual chamber system has a residence time of 2 seconds or greater at 1,000°C. This should allow all the materials to be combusted completely so that no precursors are available for dioxin and furan formation during cooling.*

- *Rapid Emission Cooling: The stack is lined and the exit gas temperature is 1,000°C. The elevated emission point and the velocity of exit into the generally below 0°C ambient air should see the emissions drop through the 650°C to 200°C window for dioxin and furan formation very rapidly. The Arctic climate and cool temperatures are ideal for cooling the emission gas stream rapidly.*

3.2 MERCURY

Waste incineration has historically been responsible for a significant portion of the mercury emitted in Canada; however reductions in emissions have been apparent nationwide since the implementation of the CWS and the requirement to monitor specific emissions. Improved exhaust gas controls can reduce emissions of acid gases and fine particulates in addition to new activated carbon injection systems that decrease emissions of mercury and dioxins and furans.

At the same time, action has been taken by many product manufacturers to reduce the mercury content of consumer goods which could end their life cycle in domestic solid waste (e.g., alkaline batteries) and thus have reduced the mercury available in the waste stream.

Emission limits are expressed as the concentrations of specific compounds and elements present in the exhaust gas exiting the stack of the facility. New or expanding facilities are expected to comply immediately with the standard while the limits for existing facilities are capable of being met using generally available technology (or waste diversion). Larger facilities are subject to annual stack testing to verify compliance with the limit.

Table 3. Canada-Wide Standard for Mercury Emissions

Source	Mercury Standard
Municipal waste incineration	20 µg/Rm^3
Hazardous waste incineration	50 µg/Rm^3
Sewage sludge incineration	70 µg/Rm^3
Medical waste incineration	20 µg/Rm^3

µg = microgram, Rm^3 = reference cubic metre

HBML disposes of any waste stream that may contain mercury, including thermostats, thermometers, light bulbs, etc., at an off-site facility. These items are placed in labelled collection containers located throughout the camp and facility. Waste management employees screen for all possible mercury contaminated waste and ensure all TDG regulations are adhered to regarding handling, storage and transport for offsite disposal. For more information regarding the regulations and waste shipment procedures please refer to the Hope Bay Hazardous Waste Management Plan.

4. WASTE MANAGEMENT AT HOPE BAY

4.1 GENERAL

Waste management at Hope Bay has made substantial advances and improvements within the last year. The all-weather facility allows for centralized collection, sorting and packaging of waste for various forms of waste management. This may include on-site incineration or preparing waste for transport to a waste transfer station for further recycling, treatment or disposal. To help reduce handling and transport costs, any waste that meets the requirements for on-site incineration is burned on site. For more information regarding hazardous or non-hazardous waste management at Hope Bay refer to the following documents:

- *Hope Bay Hazardous Waste Management Plan*
- *Hope Bay Interim Non–Hazardous Waste Management Plan*

Under no circumstances does HBML allow personnel or contractors to burn hazardous waste. Hazardous waste and industrial waste are kept separate and temporarily stored according to regulations until shipped off site for disposal or recycling at approved facilities. These incinerators are only approved to burn "domestic" camp waste such as kitchen waste, food scraps, camp room and restroom garbage, cardboard, paper and sewage sludge cake.

4.2 REDUCE, RE-USE AND RECYCLE

HBML has adopted the 3R's of waste management: Reduce, Reuse and Recycle. The objective of these activities is to divert as much material from becoming a waste (hazardous or otherwise) and therefore reduce the total volume of wastes requiring handling, storage, transportation and disposal. Some of the most significant actions in this regard include:

Reduce

- *Purchasing only the required amounts of materials and buying in bulk when the opportunity is available.*
- *Employing inventory control methods in an attempt to ensure that quantities of materials are completely utilized.*
- *Establishing maintenance schedules that are consistent with the equipment manufacturers suggested replacement.*
- *Maintaining and protecting materials to prevent damage and breakage.*
- *Eliminating unnecessary plastic and bulky packaging by buying kitchen supplies in bulk (i.e. ketchup, salad dressings, syrups, etc.).*
- *Providing washable, re-usable lunch kits to cut down on plastic food packaging.*
- *Substituting less hazardous chemicals where possible.*
- *Selecting products that provide the maximum "life-of-material".*

Re-Use

- *If appropriate, collect and return materials to the system (i.e. equipment, operations, etc.) following maintenance or repair.*
- *Waste oil burners will be used to heat the waste management facility.*
- *Oil/water separators are used onsite to reduce the amount of contaminated water requiring shipment off site.*
- *If appropriate, filter and/or use additives to replenish lost properties of material in order to extend its useful life.*
- *Testing to ensure items (i.e. batteries) are "spent" before removing from service.*

Recycle

- *Commercial companies are used to the maximum extent practical to recycle appropriate materials on a fee for service basis.*
- *Collect pop and water cans and deliver them to local charities as a donation from Hope Bay.*
- *Explore waste management options that allow for the recycling of a material or product instead of disposal (i.e. metal is collected from punctured aerosol cans and recycled).*

4.3 WASTE SEGREGATION AND SORTING

Chlorine, in almost any form, is the key component required for dioxin and furan formation. Reducing or removing the chlorinated material that enters incinerators is the first minimization strategy to reduce the formation of dioxins and furans. Removing all chlorine compounds is extremely difficult because chlorine is used in the manufacture of a large variety of products, and in many cases there are no substitutes. PVC containing products are, however, eliminated from the incinerator waste stream to the extent possible. Sewage sludge is being incinerated at this time, and sewage sludge generally contains chlorinated compounds. HBML is investigating alternate disposal options to remove sewage sludge from the incinerator stream.

The following components of the waste stream must be removed before incineration to reduce the presence of potential catalysts and to reduce the presence of materials that may form or act as precursors for the formation of dioxins and furans:

- *Metals: The inorganic component of the waste is largely made of metal-containing materials. During combustion, it is possible for these metals to become catalysts for the formation of dioxins and furans and it is, therefore, important that metal be eliminated from the waste stream destined for incineration. The metals include foils, batteries, nails and screws, painted wood products, aerosol cans, etc.*

- *Plastic: Plastics, particularly PVC, must be eliminated from the incinerator waste stream to the extent possible. The chlorine compounds contained in PVC and plastics are an ideal building block for the formation of dioxins and furans.*

- *Medical Waste: Medical waste can potentially be the biggest source of dioxin- and furan-forming material. Medical waste contains a mix of sharps made of metal, plastics (frequently PVC) and organic material which frequently contain chlorine compounds. This is an ideal mix for forming dioxins and furans. HBML avoids incinerating these materials to the extent possible. Most medical waste from Hope Bay is currently being flown to Yellowknife for disposal at the Stanton Territorial Hospital rather than being incinerated on site.*

- *Sewage Sludge: Although the incinerators are not specifically designed for the combustion of sewage sludge, the material will combust at the right temperatures if it is adequately dry and placed in the incinerator. It is important that plastics and metals are not combusted at the same time as the sewage sludge. Municipal sewage sludge tends to have high concentrations of heavy metals and typically contains chlorine and sulphur compounds. Proper combustion of the sludge is required to ensure that dioxins and furans do not form in the chamber.*

By following these waste separation guidelines the extent of dioxin and furan formation will be reduced.

HBML has taken the initiative of greatly reducing the volume of plastics, metals, glass, and other potential catalysts for dioxin and furan formation from ending up in the domestic waste stream. Examples of current sorting initiatives are listed below.

- **Batteries** (wet cell, alkaline, lithium, nickel cadmium, etc.):
  - Explosive hazard.
  - Containers are set up throughout camp to collect batteries for off-site recycling.

- **Aerosol cans** (hair spray, deodorant, spray paint, etc.):
  - Explosive hazard.
  - Containers are set up throughout camp to collect aerosol cans.
  - Cans are punctured and residuals are bulked and transported off site for recycling; the punctured cans are shipped as scrap metal.

- **Plastic construction debris:**
  - All industrial plastic waste is sorted and segregated for off-site disposal.

- **Non-burnable wood** (treated, or lead-painted):
  - Appropriate sized wood is pulled out for re-use.
  - The remainder is collected and shipped off site for disposal.

- **Food cans and glass containers:**
  - Collected separately and shipped off site for disposal.

- **Domestic plastic containers (food, toiletries, etc.):**
  - Collected separately and shipped off site for disposal.

- **Cardboard:**
  - A majority of the cardboard generated onsite was removed from the incineration waste stream and is dealt with in the burn pan.

- **Cooking oil:**
  - Removed from the incinerator waste stream.
  - Shipped off site for recycling.

- **Refundable cans and bottles:**
  - Containers are set up throughout camp to collect recyclable drink bottles.
  - These are shipped off site and the proceeds are donated to a local charity.

- **Medical waste** (sharps, needles, razor blades, etc.):
  - Containers are set up throughout camp to collect sharps.
  - These are shipped off site for disposal at the Stanton Territorial Hospital.

- **Rags and absorbent pads** (contaminated with fuel, oil, grease, etc)
  - The Incinerator can burn small quantities of rags and absorbent pads.
  - This waste should not comprise of more than 3-4% of the total batch load and should be separated into 4 or 5 bundles weighing no more than 3 kg each.
  - Batch composition and placement must be adjusted to account for the higher caloric value of this waste.

5. MODEL CY-100-CA-D INCINERATOR

5.1 DESCRIPTION

The Westland Model CY-100-CA-D-O incinerator has a manufacturer's stated capacity of 100 kg/h using diesel as the auxiliary fuel. Figures 4 and 5 provide an overview of major components of the Westland Model CY-100-CA-D incinerator. The following diagrams are only intended to familiarize you with the main components. Any personnel operating or performing maintenance on the incinerator must be competently trained before working on the unit. A more detailed discussion of individual components, features and functions of the incinerator can be found in the Westland Operating and Maintenance Manual Model CY-100-CA-D Operating and Maintenance Manual (Appendix A) and the Newmont CY-100-FA-D Standard Operating Procedure (Appendix B).

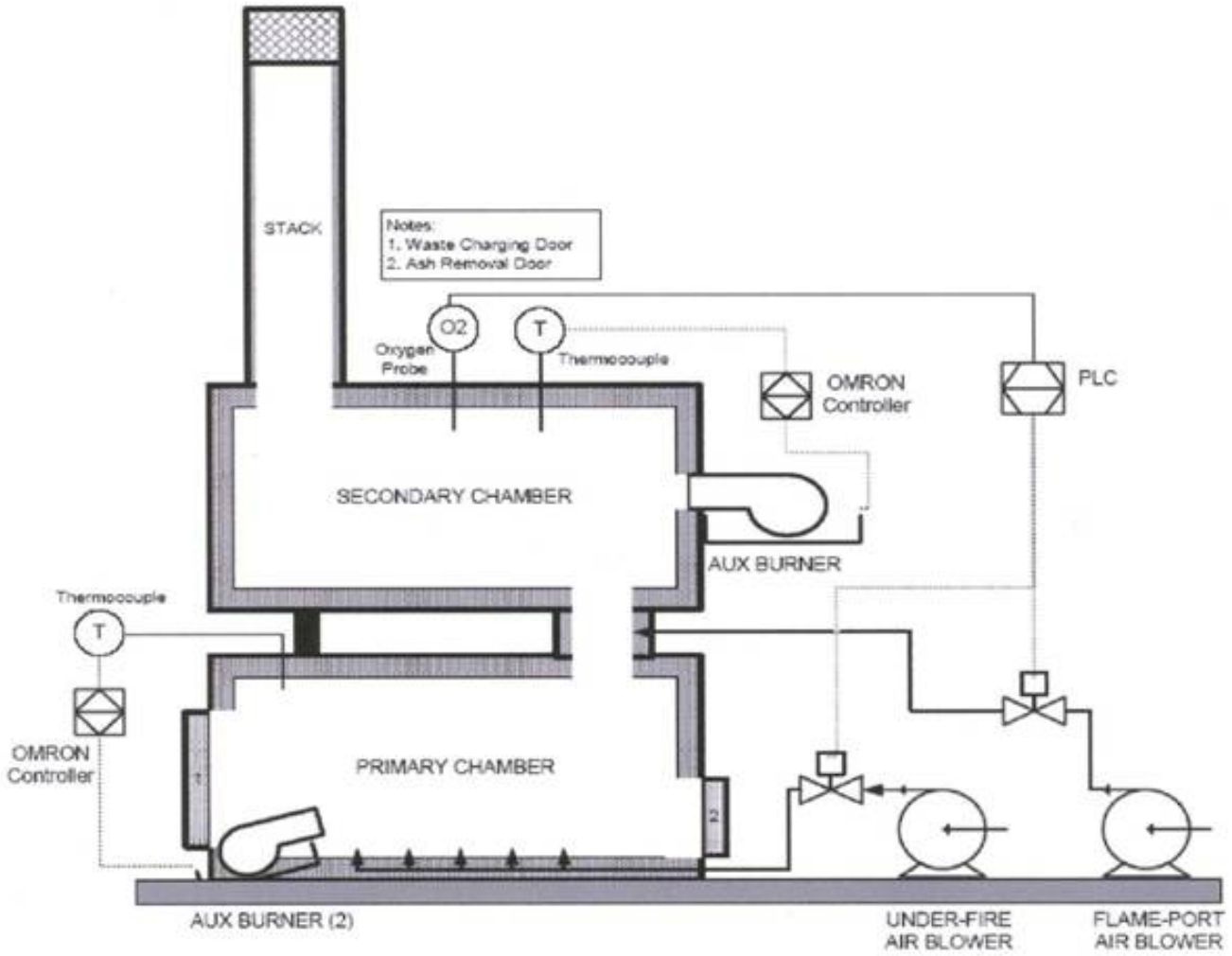

Figure 4. Schematic of Incineration System – Model CY-100-CA-D

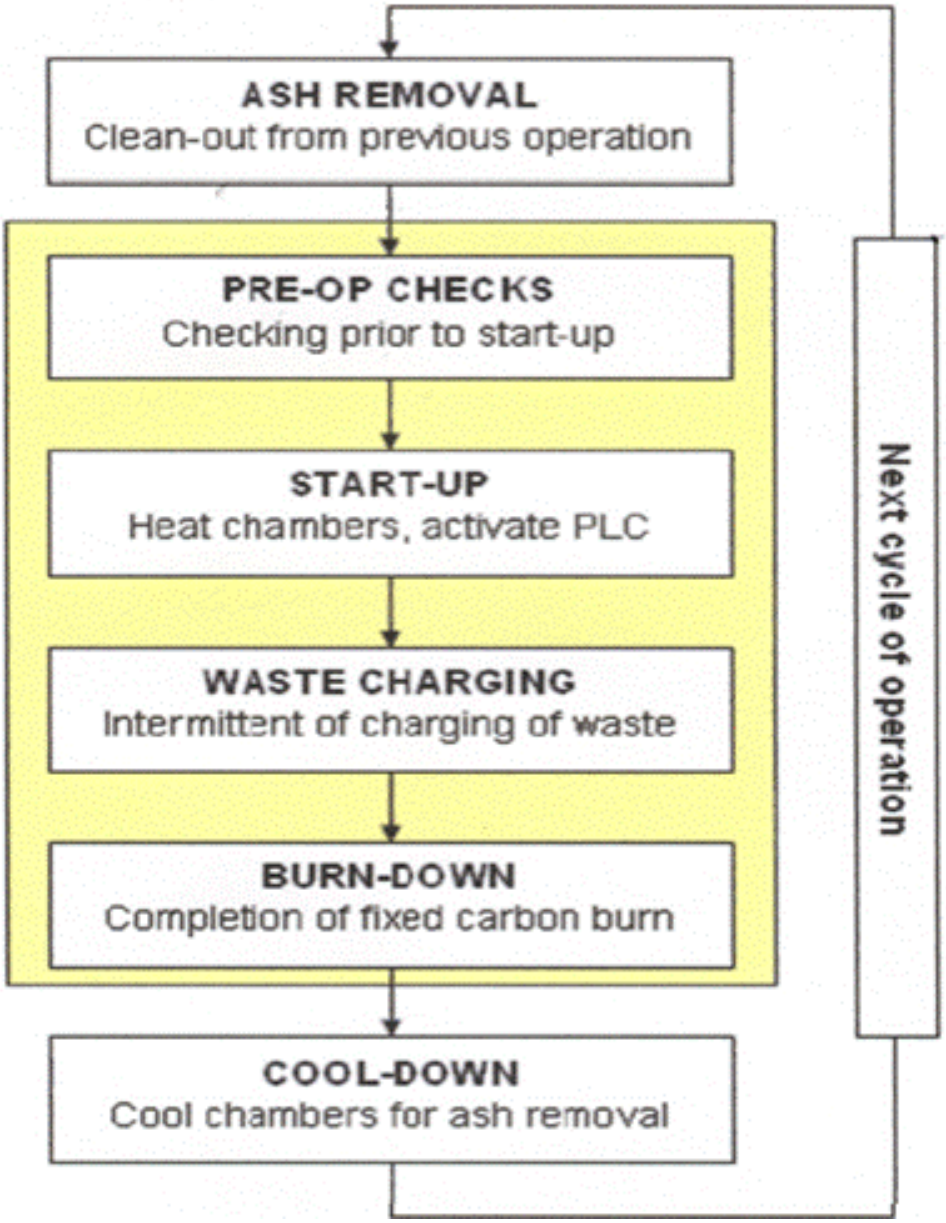

Figure 5. Simplified Incinerator Operations Sequence

6. INCINERATOR MANAGEMENT AT HOPE BAY

6.1 GENERAL

The interim waste management facility and supervisors office is located next to the incinerator building. This allows for close supervision of incinerator operation and ensures personnel are present to monitor the burn and document temperatures and other relevant information.

Employees working within the facility are trained prior to commencement of work so that they are aware of the health and safety risks associated with the incinerator and its operation.

It should be noted that due to a significantly smaller facility size, the CY-20-20-FA-D incinerator at Boston Camp is under the supervision of the Camp Manager. There is currently a similar waste management process at Boston camp, however, there is a few differences including:

- Sewage sludge is not burned at Boston
- Cardboard and small pieces of clean wood are burned

6.2 HEALTH, SAFETY AND GENERAL REQUIREMENTS

There have been many new health and safety updates regarding the safe and environmentally acceptable operation of the incinerator. Changes include safety modifications to the incinerator unit, new PPE requirements and updated Standard Operating Procedures.

In early 2011, the incinerator unit was completely enclosed inside an insulated building to improve burn efficiency and to maintain optimal temperatures in both chambers. This was also an important safety improvement because operators and maintenance personnel can work in and around the unit without being exposed to temperature extremes. The operators can safely stand at the control panel to monitor chamber temperatures, which allows for more efficient incineration and ensures the unit reached the appropriate temperatures to prevent the formation of dioxins and furans.

The CY100-CA-D incinerator at Roberts Bay was outfitted with fire sensors in the spring of 2011. This is an additional safety feature to ensure the burners engage and ignite the fuel at the correct time. If the timing is off, the system will automatically shut down and will require trouble shooting prior to continuing operation. This is a safeguard to ensure that all fuel dispersed into the chamber is ignited immediately, preventing the diesel vapours from building up in the chamber and creating an explosion hazard.

6.2.1 Safety Equipment and Protocol

The following personal protective equipment will be used while operating the incinerator system:

- *Flame retardant coveralls or leather welder's jacket.*
- *Long cuffed, puncture resistant gloves.*
- *CSA approved, Grade 1 safety footwear.*
- *CSA/ANSI approved safety glasses.*

The personal protective equipment related to specific tasks related to the operations of the incinerator are as follows:

- *Ash removal and handling:*
  - *National Institute for health and safety NIOSH N95 respirator*
- *Waste charging:*
  - *heat protective clothing and gloves*
  - *Canadian Standards Association (CSA)/American National Standards Institute (ANSI) approved full face shield*

6.2.2 Possible Hazards

The hazards that could be encountered arise from the following (not in any order of importance):

- *Contact with waste (infectious or toxic components, or sharps).*
- *Exposure to heat, from contact with hot surface or radiation from the primary combustion chamber when the waste charging door or ash removal door is opened.*

The general precautionary actions include:

- *Not opening waste batches to hand sort items already bagged unless you see something that would be dangerous to burn (explosives, aerosols, batteries).*
- *Not touching hot surfaces, and minimum exposure to heat radiation through open doors.*
  - *Do not open ash doors during combustion except when required to stir ash*
  - *No charging waste in mid burn, wait for next cycle*
- *Wearing appropriate personal protective equipment for charging waste and raking the primary chamber, and minimize the time for those tasks.*
- *Waste Technicians have multiple job responsibilities and occasionally involves working with flammable liquids such as jet fuel, gasoline and solvents. Waste Management Supervisors and Technicians need to ensure they do not handle or spill fuel prior to operating the incinerator.*
  - *When possible it is recommended that personal working with flammable liquids that have the potential to spill or get on clothing or gloves not operate the incinerator the same day or while wearing the same coveralls.*
  - *Disposable, impermeable, Tyvek coveralls must be used overtop of PPE if the operator must handle flammable liquids during the same day as operate the incinerator. These coveralls and gloves are to be removed and properly disposed of prior to approaching the incinerator building.*
  - *Check PPE for any possible flammable liquid spills again, prior to entering the facility. If the operator can smell fuel, they are not to enter the incinerator building. They are to contact their supervisor immediately and inform them of the situation.*

6.3 TRAINING REQUIREMENTS

Personnel with the responsibility of operating the Westland Model CY-100-CA-D-O incinerator will be required to read and comprehend this Incinerator Management Plan, the Westland Operating and Maintenance Manual

Model CY-100-CA-D Operating and Maintenance Manual (Appendix A) and the Newmont CY-100-FA-D Standard Operating Procedure (Appendix B).

In addition, an on-site training program has been developed to cover all aspects of incinerator management including: equipment pre-checks, operation, maintenance, monitoring, and record keeping. The training also includes identification of activity related risks, knowledge and use of job-specific PPE, as well as proper handling, storage, and disposal of all ash generated from the facility.

The training is both job-specific and equipment-specific and is provided to any site personnel assigned the responsibility to oversee, inspect, maintain, or monitor the incinerator. See the Training Outline (Appendix C).

6.4 HOPE BAY'S WASTE COMPOSITION

Using categories defined by Westland Environmental Services, the supplier of the incinerator, the waste composition is provided in Table 5 below. Understanding the typical waste stream composition is important as it leads to key opportunities for waste management generally and specifically for incineration control on site. Westland performed the below audit for Boston Camp and Doris Camp in 2009. Using incinerator logs and operational checklists, totals were prepared to show an estimation of waste stream composition for Doris Camp until an official audit can be performed (Table 4).

Table 4. Hope Bay Waste Stream Composition by Camp Location

Waste Type	Boston Camp (percentage of waste by weight)	Windy Camp (Estimated[1] percentage of waste by weight)
Food Waste	70	62
Paper	25	16
Plastic	3	3
Inorganic	2	1
STP Waste[2]	Not audited	17
Used Rags	Not audited	1

[1]Data was gathered from Incinerator log books

[2] Sewage Treatment Plant (STP) This is the filter cake residual resulting from the waste water treatment process.

Only appropriate domestic camp waste is permitted for incineration. This waste is segregated at the source to ensure non-burnable waste streams do not enter the feed stock for the incinerator. All "burnable" waste is placed in specifically identified waste containers with transparent bags and in bins located throughout the Facility. Prior to loading the waste batches in the incinerator, the feed material will be visually inspected by the incinerator operator to ensure it does not contain inappropriate waste materials. General classes of inappropriate wastes include, but are not limited to:

- *Hazardous Wastes*
- *Mercury-containing materials/waste (fluorescent lamps, thermometers, thermostats)*
- *Asbestos waste*
- *Liquid wastes including petroleum hydrocarbons and sewage*
- *Metal and glass*
- *Materials/wastes containing heavy metals (mercury-containing wastes, pressure or chemically treated wood)*
- *Uncontaminated plastics, including chlorinated plastics*
- *Bulky materials such as machinery parts or large metal goods such as appliances*
- *Radioactive materials such as smoke detectors*
- *Potentially explosive materials such as pressurized vessels, unused or ineffective explosives*
- *Other hazardous materials such as organic chemicals (e.g. PCBs, pesticides)*
- *Electronics, batteries, fluorescent light bulbs, whole tires, rubber boots, etc.*

When encountered, inappropriate waste material shall be removed from the incinerator feed, where possible. If the inappropriate waste is too intermixed with the incinerator feed, the bag should be rejected and not incinerated. Removed inappropriate wastes and rejected batches shall be stored and handled in accordance with the Hazardous Waste Management Plan. The waste feed inspections shall be recorded on the incineration log sheet.

6.5 BATCH PREPARATION OF WASTE

Multiple factors can manipulate or affect a burn cycle, including:

- Moisture content and volume of waste
- Fresh or frozen -frozen waste takes more time/fuel for complete combustion
- Not enough food waste to allow for proper batch preparation – operator must adjust batch volume and composition accordingly. See Table 6 for recommended batch weights.
- Unknown high caloric items such as fuel soaked rags or greasy residues /food
- Bags are not opened and hand sorted for personal safety so classification is limited to what can be seen and identified. Inappropriate items observed, will be removed.

Daily record keeping and operator experience will assist in ensuring batches are prepared consistently and within the capacity of the specific incinerator unit. The weight of the various waste categories loaded into the incinerator determine the proper batch composition for efficient burn cycles.

Depending on burn time required for complete combustion and the above mentioned variables the CY-100-FA-D typically incinerates 2-3 batches during a 12 hour shift. Batches are prepared using the following process:

- *Waste is sorted into the following three categories and placed in labeled crates provided*
  - *paper/cardboard*
  - *kitchen/food*
  - *sewage filter cake bags*
- *The amount of food waste available for each burn will determine the required composition for the other waste streams.*
  - *Note: If the volume of waste to burn is larger than the capacity of the machine, the batch will be broken down and the extra waste will be burned during the next batch.*
- *Food Waste Bags are counted and added to the scale until they are within 25 lbs of the recommended weights in Table 6. The number of bags and weight of food waste are recorded in the daily operations checklist.*
- *This process is repeated for both the paper and cardboard waste and again for the other waste which typically includes Sewage filter cake material.*

Below is an example of a typical full load (S. No 1). For optimal burn, it is recommended to keep weights within 25 lbs of these numbers. For smaller loads, divide these numbers to keep the ratio the same (S.No 2-4). The number of bags is not crucial; it is the weights that will determine a proper burn (Table 5).

Table 5. Typical Full Load Waste Composition

S. No	**Food Waste(lbs)**	# of BAGS	**Paper & Cardboard (lbs)**	# of BAGS	**ANY OTHER WASTE** (specify)
1	275	16	115	17	110 lbs STP (4)
2	250	14	90	13	85 lbs STP (3)
3	125	8	55	6	55 lbs STP (2)
4	75	4	30	3	25 lbs STP (1)

The CY-100-CA-D-O incinerator is designed with a maximum capacity of 100 kg/hour. The incinerator should be operated according to the Operation and Maintenance Manual. See the Westland Operating and Maintenance Manual Model CY-100-CA-D Operating and Maintenance Manual (Appendix A).

The operator shall ensure that every batch can go through the waste charging door easily, regardless to its weight. If others prepare the batches, the operator shall provide the maximum batch sizes.

6.6 LOADING THE INCINERATOR

Once the batch has been prepared, weighed and recorded, the incinerator is loaded with the waste. To ensure the most efficient combustion of all waste streams, despite the difference in caloric value, use the following procedure will be used when loading a batch of waste:

Paper (or small pieces of clean wood): load first and place at the back of the incinerator.
Food: load second and should cover the paper waste.
STP waste: load last and should be placed on top of the food waste and directly in front of the burners.
Rags and absorbent pads: small bundles should be distributed evenly throughout the load

The operator must remain at the incinerator for 15 minutes after loading the waste to monitor and record the primary and secondary chamber temperatures. The operator will return at regular intervals throughout the burn to record temperatures and to rake the waste half way through the burn. If the incinerator was properly loaded the volume of waste should be reduced by up to 90-95% of the original mass.

6.7 RECORD KEEPING AND INSPECTIONS

Routine inspections of the incinerator and associated facilities will be conducted by a qualified individual prior to every use of the incinerator. The inspection will include, but not necessarily be limited to:

- *Inspecting all fuel lines, fuel storage facilities and secondary containment for leaks and check connections.*
- *Inspection of the spark arrestor to ensure no plugging.*

During ash removal, the inspection will include, but not necessarily be limited to:

- *Inspect refractory for large cracks (not expansion cracks).*
- *Check combustion air hole for plugging.*
- *Inspect door gaskets for damages or wear.*

HBML maintains detailed records for the operation of the incinerator. The incinerator manufacturer developed site specific pre-operation, operational, maintenance and monthly checklists. Records will be kept on file for each burn and will be available for audit by HBML management or regulatory agency representatives. Any out-of-specification situations will be raised immediately and the incinerator should not be used until maintenance or remedial measures have been applied. A formal incident report needs to be completed if there are any out-of-specification conditions associated with the incinerator, its performance, waste or any of the emissions, ash or exhaust.

To demonstrate appropriate operation and maintenance of the incinerator, the facility will maintain records containing, at minimum, the following information:

- *A list of all staff who have been trained to operate the incinerator; type of training conducted and by whom; dates of the training; dates of the refresher courses.*
- *All preventative maintenance activities undertaken on the equipment.*
- *Records of operation of the incinerator.*
- *Records of quantities of waste incinerated.*
- *Summarized annual auxiliary fuel usage.*
- *A list of all shipments of incinerator residues, including the weight transported and disposed of by type if necessary, and the location of the disposal site.*
- *Results of any stack emission monitoring and ash sampling information.*

Use of the following checklists will ensure that each operator diligently operates and inspects the unit consistently. These checklists are also a great source of information when trouble shooting or maintenance is required for the unit. All raw data records from the operation of the incinerator will be retained for inspection by the appropriate authorities for a period of at least 3 years.

6.7.1 Pre-Operational Checks

This checklist is to be performed each day prior to start-up of the incinerator. This pre-inspection form ensures good housekeeping and that thorough inspections are completed on various aspects of the unit daily. This form also directs the operator to properly weigh and document the amount of ash produced from the last burn. See the Pre-Operational Checklist (Appendix D1).

6.7.2 Operational Checks

This checklist is done throughout the day as the incinerator is operational to monitor each of the burn cycles. Depending on volume of waste available and collection times, there are usually three burns a day. For each cycle the weight of all streams of waste are documented separately. These waste streams are divided up into the following categories: food waste, paper waste, sewage sludge and other. Non-routine waste streams must be listed and checked with the supervisor in advance to make sure that the new waste is in fact "burnable" according to regulations and guidelines. This Operational checklist also monitors the temperature throughout the burn. This can be important information when trouble shooting a problem. See the Operational Checklist (Appendix D2).

6.7.3 Maintenance Checklists

Maintenance of the unit falls under the Site Wide Services team. This team consists of electricians and personnel trained and certified to work on boilers and burners. This contractor performs monthly and yearly inspections on the various components of the incinerator, including the burners and blowers. Preventative maintenance and repairs are documented accordingly. See the Maintenance Inspection Log (Appendix D3) and the Maintenance Inspection Checklist (Appendix D4). Maintenance requirements are described in the Westland Operating and Maintenance Manual Incinerator Model CY-100-CA-D-O (Appendix A).

6.7.4 Supervisor Inspection Checklist

This checklist is for use by the Waste Management Supervisor. See the Inspection Checklist for Supervisors (Appendix D5). This checklist is periodically performed to ensure that all supplies are readily available and in stock. This sheet is also used as a checklist to spot check operators on the proper selection and use of required PPE and safe handling of waste. Any deficiencies with personnel or the incinerator unit must be documented and rectified immediately.

6.7.5 Monthly Waste Summary

This monthly tracking form tracks incinerator burns per day, the weight of waste prior to the burn and the amount of waste accumulated daily. This information is entered into an excel sheet and a chart compares the volume of waste burned to the amount of ash produced. This is a tracking tool for monitoring volumes of waste and ash. This is submitted once a month to the Newmont Facility Managers for review. See a sample of the Monthly Tracking Trend (Appendix D6).

6.8 FUEL STORAGE

The Westland Model CY-100-CA-D incinerator is fuelled by diesel stored in a tank located outside the incinerator building. Due to the small size of the tank the incinerator must be filled up daily and topped off every night to ensure that it does not run out of fuel mid-burn. The fuel volumes consumed are documented on the daily pre-operational checklist. The fuel storage, secondary containment and fuel delivery lines are subject to regular inspection. There are also spill kits available nearby in the event of a spill or leaking fuel line.

6.9 ASH MANAGEMENT

Once the combustion chamber of the incinerator is cool, the incinerator operator will remove the ash from the previous burn cycle before reloading the incinerator. During ash removal, the operator will inspect and clean the combustion air holes and will inspect the burner tip for damage.

The ash is placed into a metal garbage container to be weighed. Once weighed and documented, the garbage can is transferred into a drum labelled "Incinerator Ash". When full, this drum is sealed and stored to await transport to Yellowknife for safe disposal at a permitted hazardous waste landfill site. See a sample Bill of Lading for waste ash (Appendix E) and Certificate of Disposal (Appendix F).

The Waste Management Facility maintains a tracking report of all ash shipped from Hope Bay. Certificates of Disposal for waste shipped off site are provided by the off-site waste handling facility. This is provided so generators can demonstrate to regulatory authorities that their waste is being handled by an approved facility and that the waste was disposed according to applicable federal and territorial regulations. See a sample Bill of Lading for waste ash (Appendix E) and Certificate of Disposal (Appendix F).

To comply with the Newmont Waste Management Standard (NEM-ENV-S.046), HBML has implemented an ash sampling program. Ash samples are collected from the incinerator each time ash is cleaned out. A composite sample is sent to ALS Laboratory for analysis of:

- Leachable metals
- Leachable mercury
- Leachable benzene, toluene, xylenes, and ethylbenzene
- Paint filter
- Flash point

These are part of the LANDFILL-CLASSII-ED: Class II Basic Landfill w/ Paint Filter package required for disposal at most non-hazardous waste landfills. This will allow HBML to determine if the ash needs to be shipped off-site as hazardous, or non-hazardous waste. The details of this sampling program can be found in HB-WS-OPS-SOP Ash Sampling.

Ash from the incinerators, as well as the burn pan, will be shipped off-site for disposal as either hazardous or non-hazardous waste based on the ash sample analytical results. Hazardous waste shipments will follow the Transportation of Dangerous Goods regulations as well as the Interprovincial Movements of Hazardous Waste regulations. The off-site waste handling facility will be provided with the analytical results, and the ash will be shipped to an appropriate hazardous or non-hazardous waste landfill as required.

7. EMISSIONS MONITORING

HBML has implemented a monitoring program for the operation of the incinerator. A third-party service provider is used for monitoring emissions from the Doris North Project incinerator. The testing will continue annually, unless otherwise approved by Environment Canada.

In October 2009 and September 2011, stack emissions samples were taken from the Roberts Bay CY-100-CA-D incinerator by A Lanfranco and Associates Inc. Mercury samples were below the standard limit but dioxin and furan emissions were above the accepted standard in both years (Table 6).

Table 6. 2009 and 2011 Emissions Test Results

Air Emission	CWS Guideline	2009 Results	2011 Results
Mercury	20 µg/Rm^3	1 µg/Rm^3	0.6 µg/Rm^3
Dioxin/Furan	80 pg/Rm^3	2,170 pg/Rm^3	128 pg/Rm^3

µg = microgram, Rm^3 = reference cubic metre

After the 2009 test, HBML made it a priority to introduce a number of changes that would greatly improve operation of the incinerator. These changes included modifications to the incinerator, new source sorting and segregating standards, a new Standard Operating Procedure and training of operators.

A specially designed building was constructed around the incinerator and the incinerator was refurbished by the incinerator manufacturer. Additionally, a scale has been installed and all waste is weighed prior to loading and all ash is weighed after a burn. These quantities are documented to enable better tracking of incinerator waste streams and volumes.

Although the September 2011 test results indicate that the emissions still exceed the CWS for dioxins and furan emissions, it is apparent that the change in operating practices has had a substantial positive impact on the incinerator emissions.

HBML will continue to refine the waste sorting and segregation practices at the site, and alternate disposal methods for the sewage filter cake are being investigated. By further refining the incinerator feed composition, it is likely that the dioxins and furans standard can be met with the existing CY-100-CA-DO incinerator.

8. REVIEW AND REVISION

These procedures are a component of the overall Environmental, Health and Safety Management Plan (EHSMP) for the Doris North Project and will be periodically reviewed and updated as Doris North moves into operations and final closure and reclamation.

Additionally, the detail in the document will continue to be refined with subsequent revisions (Table 7).

Table 7. Incinerator Management Plan Revision Record

Revision	Review Date	Description of Revisions	Revised By
0	05 2009	Initial issuance of Incinerator Management Plan	Not applicable
1	02 2012	Update and revise Incinerator Management Plan	KBL Environmental
1.1	03 2012	General document revision	Angela Holzapfel, HBML

9. REFERENCES

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- **Westland Consulting. 2011. Incinerator General Operational Plan and Standard Operating Procedure**
- **SRK. 2011. Hope Bay Spill Contingency Plan**

WESTLAND CONSULTING
MEMBER OF KETEK GROUP INC.

Controlled Air Incineration Systems

Dual Chamber Controlled Air Incinerator CY 100-CA-D
At
Newmont, Hope Bay

Operating and Maintenance Manual

(Revised Manual as per Modifications)

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Scope of Current Document

The incinerator system, now designated as CY-100-CA-D, has undergone modifications in its design and operation. This manual describes the changes that have been made. The modifications made in the original equipment include the removal of oxygen probe, the under-fire air blowers, and the PLC controller for combustion air flows and the actuators for the combustion air blowers. The wiring diagrams for the new control panel are included in this manual.

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1 INTRODUCTION

Thank you for selecting Westland Environmental Services Inc. (Westland) to provide you with a reliable, proven and cost-effective system to manage your waste in an environmentally sound manner. This manual has been prepared to allow you to operate and maintain the system safely and efficiently, thereby ensuring its proper operation and continued use for a long period of time.

It also contains information on the combustion process. We believe that understanding the basic principles would make you more knowledgeable, and hence a better operator. Table 1 outlines the contents of this manual, of which Sections 3 and 4 are the required minimum reading.

Table 1 Organization of Manual

Section Number	Title Brief Description
2	**Principles of waste incineration** What incineration or combustion process is, why waste is incinerated and the components of a waste, including heating value, and how waste properties affect incinerator operation.
3	**System Description** The components, their designs and their functions are described
4	**Operation and Maintenance** How to operate and maintain the system, including safety equipment to be used.
5	**Warranty** Terms of the warranty

2 PRINCIPLES OF WASTE INCINERATION

2.1 Combustion

Combustion, burning, incineration, and thermal oxidation all denote the same process, which is the reaction of a "combustible" matter with oxygen that occurs at temperatures higher than the ignition temperature [1] of that matter. The reaction is exothermic, meaning that it generates heat in the form of hot gases.

[1] Below the ignition temperature combustion does not take place. Consider, for example, gasoline or wood: it has to be "ignited" for combustion to take place. That is, the temperature in some portion of the matter must be brought up to the ignition temperature for combustion to start.

In the case of waste, it may also contain non-combustible matter which does not react with oxygen. In waste incineration, the non-combustible component ends up as ash and a small portion of it is also present in the hot gas in the form of particulate matter or dust.

Figure 1 shows schematically the process of waste incineration. The oxygen used comes from air, which contains 21% of oxygen by volume, and the hot gas is typically referred to as flue gas or stack gas.

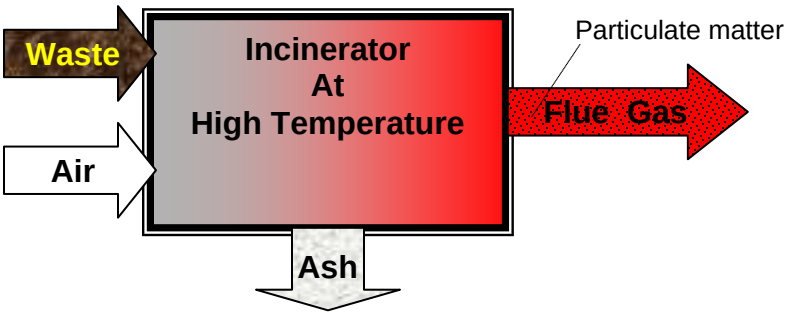


Figure 1 Schematic Diagram of Incineration Process

2.2 Why incinerate waste?

The main purpose is to reduce the mass and volume for final disposal. Another important reason, since the waste may contain pathogenic, infectious or toxic materials, is to "detoxify" it by the high temperature process. In remote areas where wildlife is present, scavenging can be prevented by incineration.

In some cases, typically in large-scale operation, incineration is used to recover the energy contained in the waste in the form of electricity, steam, hot fluids or hot air. In other cases, valuable materials can be recovered from the ash, or the ash as a whole can be used for soil amendment or as a construction material.

2.3 Waste components

There are different ways of characterizing waste, depending on the purpose for doing it. Here, it is sufficient to characterize the components as follows: [2]

A. Water is an important component because in incineration it has to be evaporated first, which requires a lot of energy, [3] which in turn, has the effect of lowering the temperature of the flue gas.

[2] This is referred to as proximate analysis. Another method is elemental analysis, which produces the elemental composition (C, H, O, N, S, Cl …) of the waste.

[3] It takes ~ 2.3 MJ (2200 BTU or 90 cc of propane or 60 cc of diesel) to evaporate 1 L or 1 kg of water. This is referred to as the latent heat of evaporation.

B. Combustible is the component that reacts with oxygen and releases heat in the process. [4] The higher the combustible content in the waste, the more air per kg of waste is needed for incineration.

This component can be further classified as:

(i) Volatile, which is released to the gas phase when the combustible matter is heated without the presence of oxygen, and
(ii) Fixed carbon which remains in the solid waste after the volatile has been released. This is often referred to as charcoal.

C. Non-combustible is the component that does not react with oxygen. [5] As previously mentioned, this forms ash, and some of it is entrained in the flue gas in the form of particulate matter or dust. The higher the non-combustible content in the waste, the less quantity of waste that can be incinerated without removing ash from the combustion chamber. Note also if the waste contains metals, such as lead and cadmium, these metals will be present in the ash as well as in the flue gas, in the form of particulate matter and vapour.

2.4 Heating Value

Heating value, calorific value and heat of combustion are synonyms that quantify the heat released by the combustible component in the waste upon complete combustion. An understanding of the concept can be gained from the hypothetical processes shown in Figure 2.

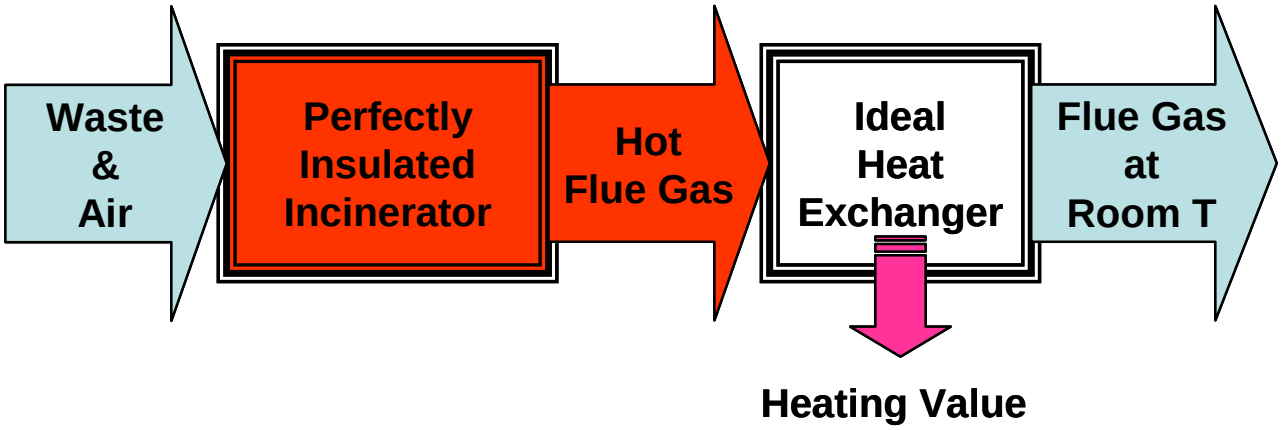


Figure 2 The Concept of Heating Value

[4] The term "organic" is also used, which is strictly incorrect in that some "inorganic" elements or compounds are combustible, such as carbon, sulphur, ammonia and carbon monoxide.
[5] The terms "ash" and "inorganic" are also used. Note that the latter is inaccurate as explained previously.

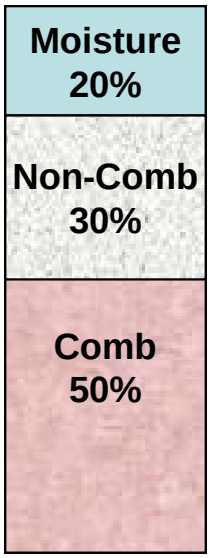
A measured mass of dry waste and a sufficient amount of oxygen, at room temperature, are ignited, and the resulting hot flue gas is passed through a heat exchanger, where heat is extracted until the flue gas is brought back to room temperature. Let M be the mass (kg) of

the dry waste fed, and H (MJ) the heat extracted from the heat exchanger. The heating value of the dry waste is H/M (MJ/kg).

2.5 Different Expressions for Heating Value

Two different values are reported in the literature (a) "high" or "gross", and (b) "low" or "net". The former corresponds to the case where the moisture in the flue gas is condensed, and hence the high or gross heating value *includes* the latent heat of evaporation of the water formed in combustion (see Footnote 3). The latter excludes the latent heat evaporation. The low or net heating value thus represents the maximum available energy that can be recovered from the flue gas without condensation.

To be noted also is the basis on which the heating value is expressed, which can be (a) as fired, (b) dry basis or (c) ash free. The distinction is illustrated in Figure 3. An understanding of the different bases can be gained by noting that heating value is a property of only the combustible component in the waste. Water and the non-combustible component simply "dilute" the heating value. In terms of incinerator operation, the relevant basis is "as fired".



*** HV as measured:**
15 MJ/kg "Dry Basis"

*** HV of whole waste:**
= (30 + 50)/100 * 15 = 12 MJ/kg "As Fired"

• HV of combustible component:
= (30 + 50)/50 * 15 = 24 MJ/kg "Ash Free"

Figure 3 Different Bases for Expressing Heating Value (HV)

2.6 Examples of waste characteristics

Proximate compositions and heating values of commonly found wastes are given in Table 2.

Table 2 Classification and Properties of Common Wastes

Type*	Description	Components	Weight %			MJ/kg
			Moist	Comb	Non-C	HHV (A/F)
0	Trash	Paper, cardboard, cartons wood boxes and combustible floor sweepings from commercial and industrial activities. Up to 10% by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags and plastic or rubber scraps.	10%	85%	5%	19.7
I	Rubbish	Trash + Type 3 (up to 20%)	25%	65%	10%	15
2	Refuse	Rubbish and Garbage	50%	43%	7%	10
3	Garbage	Animal and vegetable wastes, restaurants, hotels, markets, institutional, commercial and club sources	70%	25%	5%	5.8
4	Animal/ Pathological	Carcasses, organs, hospital and laboratory, abattoir, animal pound, veterinary sources	85	10	5	2.3

Notes:
Moist = moisture, Comb = Combustible, Non-C = Non-combustible, HHV = High Heating Value, A/F = As Fired
* In some cases Roman numerals are used. That is Types 0, I, II, III and IV

2.7 Incinerator Capacity and Load Size

Incinerator capacity is dependent on waste composition. For a given mass, the amount of air required for complete combustion increases with increasing heating value. Hence, for a given incinerator which delivers a given flow rate of combustion air, its capacity for waste burning in kg/h decreases with increasing heating value of the waste, or to put it in opposite way, it, increases with decreasing heating value.

Another important consideration is the size of the batch loaded to the incinerator. The higher the heating value, the smaller (lighter) the load should be. Otherwise, the insufficient amount of air will generate black smoke.

Unfortunately, waste composition is usually not known. Nevertheless there may be indications on the basis of the components present. To assist in getting a qualitative estimate of the heating value of a batch of waste, the heating values of common "generic" waste components are shown in Table 3.

Table 3 High Heating Values (Approximate) of Common Waste Components

Component	MJ/kg A/F *	Component	MJ/kg A/F *
Kerosene, Diesel …	44	Leather	16
Plastics	46	Wax paraffin	44
Rubber, Latex	23	Rags (linen, cotton)	17
Wood	18	Animal fats	39
Paper	17	Citrus rinds	4
Agricultural waste	17	Linoleum	25

* A/F: As Fired

Another important waste component is the volatile content in the waste. Table 4 shows the proximate components of various materials and wastes.

In general, this component is responsible for smoke generation. Therefore, as in the case with heating value, the higher the volatile content, the smaller the load that should be charged to the incinerator.

Table 4 Proximate Composition of Various Materials

Material	Volatile	Moisture	FC	Ash	FC/V
	%wt	%wt	%wt	%wt	-
Coal (bit.)	30	5	45	20	1.5
Peat	65	7	20	8	0.3
Wood	85	6	8	1	0.1
Paper	75	4	11	10	0.15
Sewage sludge	30	5	20	45	0.66
MSW	33	40	7	20	0.21
RDF	60	20	8	12	0.13
PDF	73	1	3	13	0.04
TDF	65	2	30	3	0.46
PE,PP,PS	100	0	0	0	0
Plastics + Colour	98	0	0	2	0
PVC	93	0	7	0	0.08

Notes: **FC** : Fixed Carbon; **FC/V**: Ratio of Fixed Carbon to Volatile
(bit: bituminous; MSW: municipal solid waste; RDF: refuse derived fuel; PDF: packaging DF: TDF: Tire DF; PE: polyethylene; PP: polypropylene; PS: polystyrene; PVC: polyvinyl chloride)

3 SYSTEM DESCRIPTION

3.1 Nomenclature for Different Models

This series of incinerator is designated by

CY-(nn)-CA-(x)-O

where **nn :** a number denoting the nominal capacity of the incinerator in kg/h;
x : a letter denoting the auxiliary fuel used, denoted as follows:
D for diesel; **P** for propane and **N** for natural gas

For example, **CY-100-CA-D-O** denotes a 100 kg/h unit using diesel as auxiliary fuel.

3.2 Overview [6]

Regardless of the model of your incinerator, the main components are similar. Figure 4 shows a schematic diagram of the incineration system. It consists of a **Primary Chamber** and a **Secondary Chamber**, which are connected by a "flame-port". Combustion air to the fame-port is delivered by the **flame-port air blower**. **Aux**iliary **burners** are provided for start-up and to maintain the minimum temperatures set in the primary and secondary chambers.

Thermocouples are used to measure the temperatures in the primary and secondary chambers, the outputs of which are used by on-off **Omron controllers** which regulate the operation of the auxiliary burners.

Waste is charged manually and intermittently via the **waste charging door (1),** and ash is removed manually and batch-wise after previous operation via the **ash removal door (2).** This door is also used to rake the waste in the primary chamber after several loads have been charged, which is necessary to expose the fixed carbon component in the waste to the air.

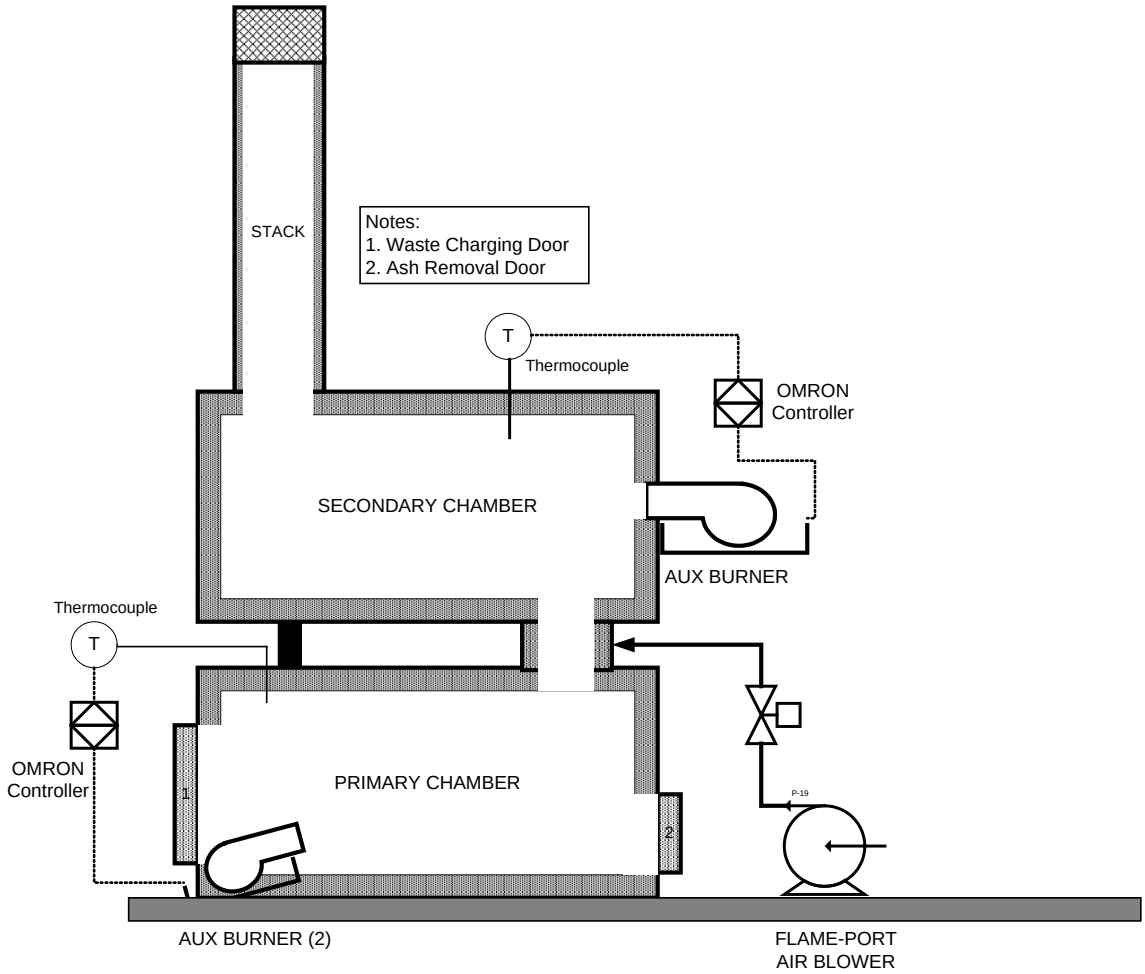


Figure 4 Schematic of the Incineration System

[6] **Bolded words** correspond to those used in Figure 4

3.3 Description of system components

For convenience, the system has been grouped into sections, as shown in Figure 5. In each section, the components are shown in subsequent photographs. Each component is coded with a number and a prefix corresponding to the section to which it belongs. *These codes are unique and will be used in later sections on operation, maintenance and trouble shooting.* The following Tables contain all the components in the system, their codes and brief descriptions of their functions.

Information on components that are not manufactured in-house, such as blowers and burners, is given in the accompanying binder. Please consult the corresponding manuals for details of operation and maintenance.

Figure 5 Overall View showing the Sections (Typical CY 100-CA-D incinerator)

3.4 Primary Chamber Section

The components are listed in Table 5, and the photographs are shown in Figure 6 to Figure 8.

Table 5 Components in the Primary Chamber Section

Code	Component	Description	Function
PC1	Primary Chamber	In-house made. Inside Vol: 2.8 m^3 Refractory: 10 cm; Insulation 7.5 cm	Pyrolysis and gasification Combustion of fixed carbon
PC2	Charge Door	In-house made. Door opening: 89 cm x 69 cm	Load waste to primary chamber
PC3	Ash Door	In-house made. Door opening: 48 cm x 38 cm	Raking and ash removal
PC4a	Contact Switch	SquareD ZCKJ1H7	Turn off primary chamber burner when charge door is opened
PC4b	Same as PC4a for ash door		
PC5a	Auxiliary Burner	Becket WIC-201; 700,000 Btu/h; 5 USG/h Flame Detection for fuel shut-off added	Start-up and maintains a minimum temperature
PC5b	Same as PC5a		
PC10	Thermocouple	Wika (sheathed)	Measure temperature in primary chamber

3.5 Secondary Chamber Section

The components are listed in Table 6, and the photographs are shown in Figure 6 to Figure 8.

Table 6 Components in the Secondary Chamber Section

Code	Component	Description	Function
SC1	Secondary Chamber	In-house made. Inside Vol: 2.8 $m^{3,}$ Refractory: 10 cm; Insulation 7.5 cm	Combustion of combustible gases and soot generated in primary chamber
SC2	Flame-port Plenum	In-house made.	Mixing of combustible gases and flame-port air
SC3	Flame-port Air Blower	4C 108 Dayton; 1 HP; 3600 rpm	Combustion air supply to flame-port plenum
SC4	Butterfly Valve	V51E-1075	Regulate under-fire air flow
SC6	Thermocouple	Wika (sheathed)	Measure temperature in secondary chamber
SC8	Auxiliary Burner	Becket WIC-301; 1.6 million Btu/h; 12 USG/h Flame Detection for fuel shut-off added	Start-up and maintain minimum set temperature
SC9	Sight glass	In-house made	Observation of secondary chamber
SC10	Stack	In-house made	Dispersal of flue gas

Figure 6 Components in the Primary and Secondary Chamber Sections (1)

Figure 7 Components in the Primary and Secondary Chamber Sections (2)

4 SAFETY INTERLOCKS FOR AUXILIARY BURNERS

The following additional safety features were installed:

- Pre-purging of the chamber(s) for (10) minutes prior to the introduction and ignition of the fuel;
- Flame detector to shut off fuel delivery in case of ignition failure or flame being extinguished.

These safety interlocks are incorporated in the new control panel.

5 MODE OF OPERATION AND CONTROL PANEL

The operation is no longer done in the intermittent mode of waste loading, but in the batch mode, as shown in Figure 2. The control panel is shown in Figure 3.

The new operation and maintenance protocols and the operation logs are described in detail in Section 5. Note that these protocols should be mastered during the training and hence in this manual they should serve only as reminders and models for record keeping, *not* as learning tools.

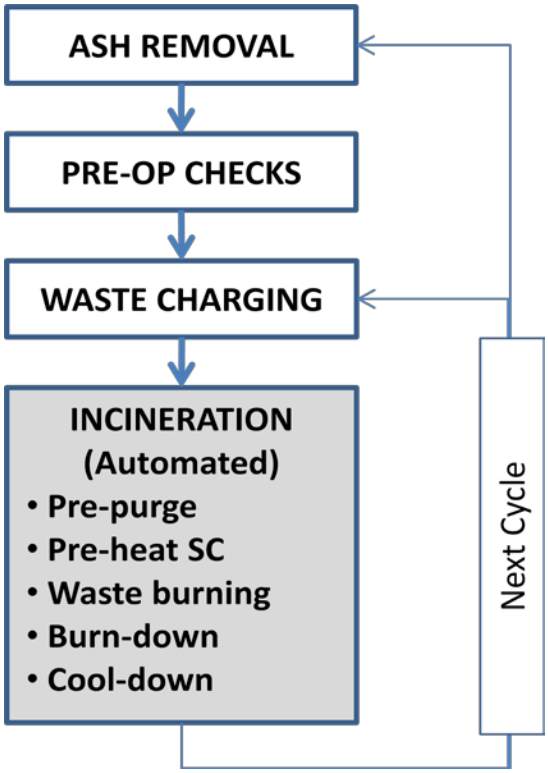


Figure 8 Steps in the Operation of the Incinerator

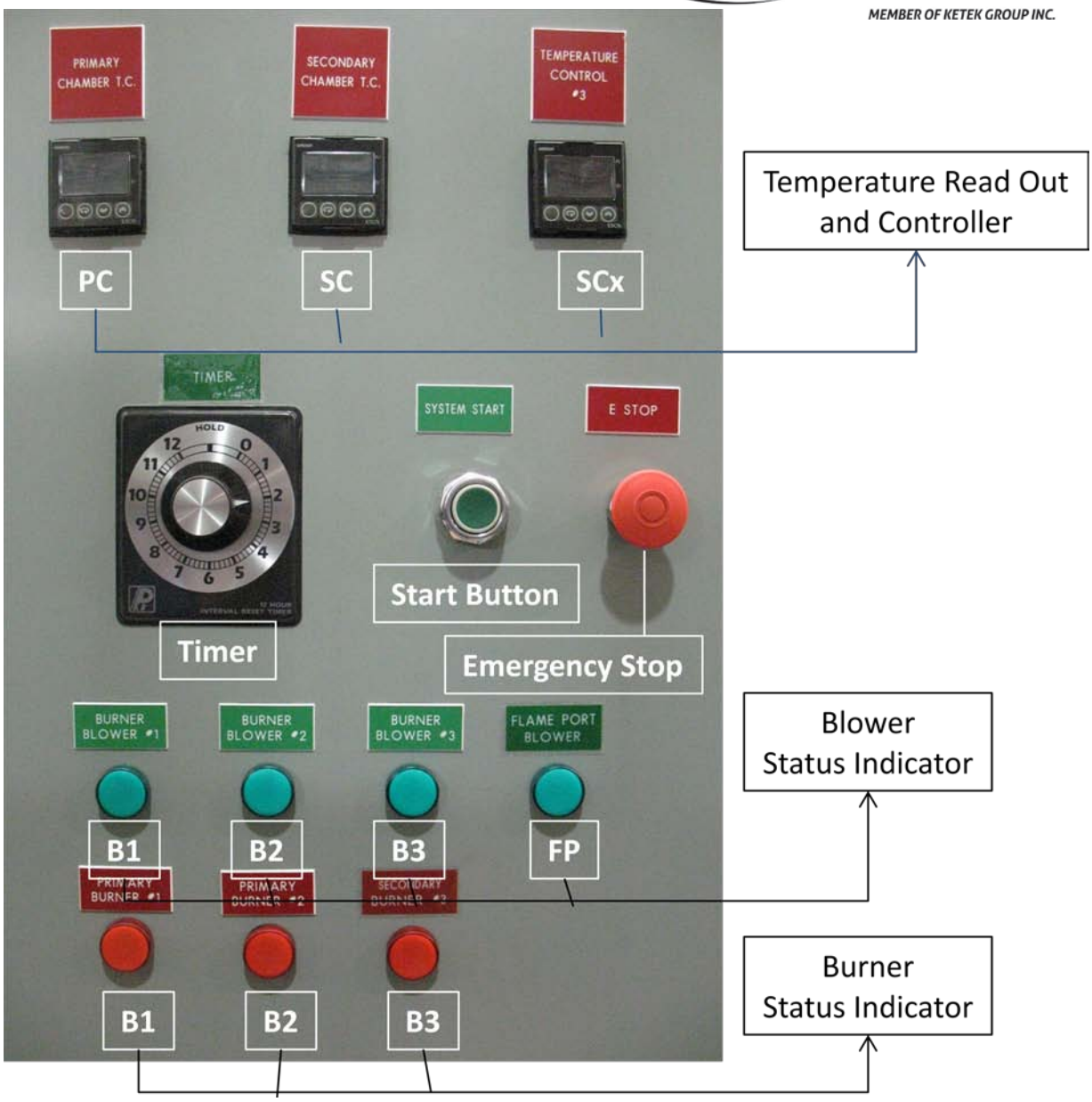


Figure 9 Control Panel

Legend: PC: Primary Chamber; **SC**: Secondary Chamber; **SCx**: Pre-heat controller (secondary chamber temperature); **B1**: Burner 1 (PC); **B2**: Burner 2 (PC); **B3**: Burner 3 (SC); **FP**: Flame-port)

6 DETAILS OF OPERATION AND MAINTENANCE

6.1 Operating Procedure

1. Maintain proper housekeeping around incinerator to avoid slips, trips and falls.
2. Complete the pre-operational checklist. Make sure all ash is taken out from the previous burn.

3. Have the operational checklist ready and keep filling it out with required information throughout the day
4. Load the incinerator.
5. Turn the timer to 12 hours and press the Green "Start" button.
6. Go around the incinerator and make sure all burner blowers (2 burners in primary chamber and 1 in secondary chamber) are running.
7. After 10 minutes both bottom burner motors will shut off and the secondary burner (Flame) should be running and you will see the temp going up in the temperature display "Secondary Chamber T.C".
8. The secondary burner heats up to the specified temperature in "Temperature controller 3".
9. At this point primary burners (Flame and blowers) and flame port blower would come on and you will see the temperature going up in the temperature display "Primary Chamber T.C" as well.
10. The temperature will keep rising until it goes up to the set point and after that burners will go on and off depending on the control system's call for heat.
11. After about approximately 4 hours into the burning process lower the set point on "Primary Chamber T.C" to 0 by pressing the "⮟" down arrow. Check and rake if it is necessary. Give about 1-2 hours for the primary chamber to cool down.
12. When you come back, load the next batch in the primary chamber and turn the timer to 12 hours and increase the set point on "Primary Chamber T.C" to 600 by pressing the "⮝" up arrow.
13. Repeat steps 10 and 11 for other batches of the day.
14. For the last batch of the day turn the timer to about 5-6 hours.
15. After the timer runs out, the primary burners will no longer produce flames, but the blowers will still keep running. At this time the secondary chamber burner will still keep running for another hour.
16. After secondary burners shuts down all the blowers will keep running for another 3 hours to give enough time for the incinerator to cool down and prevent any damage to the burners.
17. Hand over the pre-operational checklist and Operational checklist to your supervisor.

Note :

a) Steps 11-13 required for intermittent loading
b) Do not operate the incinerator if something is not working right, immediately tell your supervisors.

c) Wear all required PPE.
d) If flame detection control locks out try resetting it by pressing red button on the burner control, if it keeps resetting again and again, let your supervisor know immediately.
e) Always ask if unsure about something.

6.2 Safety equipment and protocol

The following personal protective equipment should be used while operating the incinerator system:

- Long sleeved shirt and long pants;
- Long cuffed, puncture resistant gloves;
- CSA approved, Grade 1 safety footwear;
- CSA/ANSI approved safety glasses.

The personal protective equipment related to specific tasks is listed below:

- Ash removal and handling: NIOSH N85 respirator
- Waste charging: (i) heat protective clothing and gloves, and (2) CSA/ANSI approved full face shield.

The hazards that could be encountered arise from the following (not in any order of importance):

- Contact with waste (infectious or toxic components, or sharps);
- Exposure to heat, from contact with hot surface or radiation from the primary combustion chamber when the waste charging door or ash removal door is opened.

Therefore, the general precautionary actions include:

- Not opening waste batches
- Not touching hot surfaces, and minimum exposure to heat radiation through open doors (charging and ash doors while combustion is taking place).
- Wearing appropriate personal protective equipment for charging waste and raking the primary chamber, AND minimize the time for those tasks.

6.3 Routine inspection and maintenance

- Check fuel lines for leak and check connections
- Check spark arrestor to ensure no plugging
- During ash removal (see later section):
  - Inspect refractory for large cracks (not expansion cracks)
  - Check combustion air hole for plugging
  - Inspect door gaskets for damages
- Refer to inspection and maintenance checklists and log sheets (part of SOP)

6.4 Waste batch preparation

The following cautionary notes should be followed:

- **NO** explosives, aerosol cans, tyres, PVC pipes or sealed containers containing combustible liquids
- Make sure that every batch can go through the waste charging door easily, regardless of its weight. If others prepare the batches, the operator should tell them about the maximum batch size.
- Do not open batches and "rearrange" the contents.

Additional Notes on waste charging:

** : The main danger is from exposure to heat radiation, and the waste batch catching fire before it is inside the primary chamber. Precautionary steps include: (a) Wear proper PPE, (b) Make sure waste batch can go through the charge door easily, (c) open door, charge waste and close door as quickly as possible.*

**: The time for complete combustion varies, depending on batch size, weight and composition. More than 30 minutes would be unusual. Check burning conditions from ash door or charge door. Rake if necessary*

6.5 Ash removal

Typically the ash from previous operation was left to cool, and ash removal is done first prior to current operation.

- Make sure combustion chamber is sufficiently cool. [7]
- (Do **NOT** spray water into the combustion chamber)
- While removing ash, avoid plugging the combustion air holes and damaging the burner tip
- Use non-combustible container
- Minimize dust generation
- Light water spraying on ash in the container is recommended to minimize dust generation
- Dispose of ash as specified in the guidelines or regulations

6.6 Pre-operational checks

- When diesel or propane is used: check fuel tank to make sure enough fuel (see Figure 17 for estimates of fuel consumption, depending on burner size and length of operation)
- Open fuel valve
- Re-check that the combustion chamber is empty and combustion air holes are clear

[7] The use of a "remote" thermometer is recommended to check the temperatures in the various places in the primary chamber.

- Check power connection
- When diesel is used, bleed the diesel lines to the burners if necessary
- Refer to pre-operational checklist (part of SOP)

6.7 Cool-down

There is nothing to be done here, except ensuring that the incinerator is sufficiently cooled (approximately 6 – 8 hours) for the scheduled ash removal for the next operation.

6.8 Maintenance and Inspection

In addition to the routine inspection and maintenance previously mentioned, only the burner(s) and the blower(s) require maintenance, which is quite minimal; see manuals in the binder. The following inspection steps are recommended:

Table 7 Recommended Inspections

How Often	Component	Inspection and checking
Daily	Refer daily inspection and maintenance checklist (provided with SOP)	
	Refractory and under-fire air holes in primary chamber PC1	No large (not expansion) cracks; repair if necessary No plugging of air holes; clean if necessary
Weekly	Air blowers	Inspect clean in-takes, clean if necessary
	Refer weekly inspection and maintenance checklist (provided with SOP)	
Monthly	External surfaces of PC1 and secondary chamber SC1	"Spotty" discoloration may indicates damage to refractory and/or insulation
	Refractory in SC1	No large (not expansion) cracks; repair if necessary
	Refer Monthly inspection and maintenance checklist (provided with SOP)	
Annual	Refer annual inspection and maintenance checklist (provided with SOP)	

6.9 Trouble Shooting

Table 9 shows a list of operational problems that may be encountered, the possible causes and corrective measures. No list can cover all potential problems. Please report problems or unusual observations, even if you have solve them yourself. Thanks.

Table 8 Trouble Shooting Guidelines

Observation	Possible Causes	Corrective Measures
Auxiliary burner PC5a, PC5b or SC8 not lit	No fuel	▪ Fuel tank is empty: fill ▪ Pump not primed: prime
As above, and also blowers PC6 and SC3	No power	E-stop disconnects main power: twist right
Waste not igniting (temperature in primary chamber plummets	Auxiliary burners PC5a and PC5b not functioning	▪ See above ▪ Check set point: too low? Increase it.
Flame pattern in burner not correct: "lazy", sooting or detached flame	Burner setting	▪ Consult manual and correct ▪ Check flame detectors

6.10 Auxiliary Fuel Consumption Rate

Figure 17 shows the volumetric flow rates of propane and diesel as a function of burner rating. If the TOTAL burner rating is X million Btu/h, and the operating time from start-up to the end of burn-down is t hours, the maximum fuel needed is:

$$V = Y * t \quad USG$$

where Y is the fuel consumption rate for X million Btu/h rating, as shown in the graph.

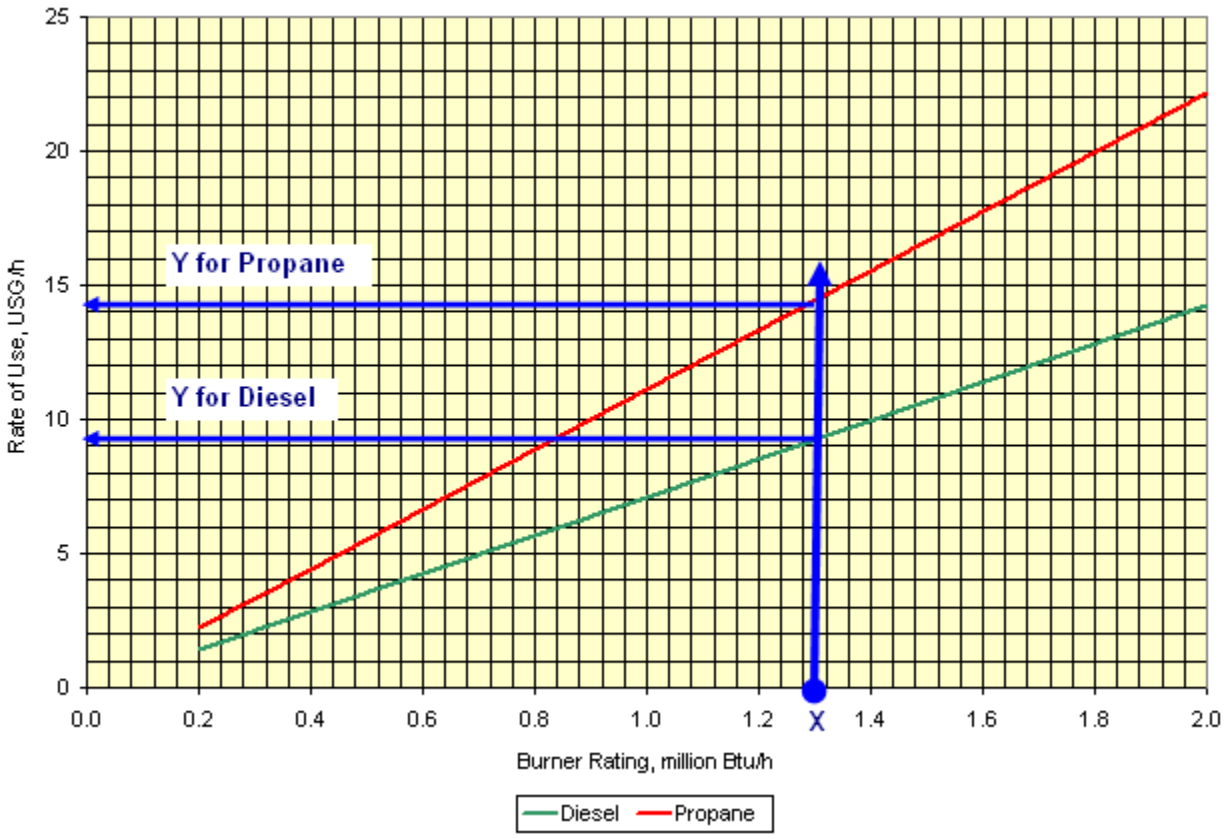


Figure 8 Consumption Rates of Propane and Diesel

7 WARRANTY

WESTLAND ENVIRONMENTAL SERVICES INC.

1. Westland Environmental Services Inc. hereby warrants to the Purchaser, for a one (1) year period of time from the date of acceptance and upon the conditions hereinafter set forth, each new product sold by it, to be free from defects in material and workmanship (specifically excluding there from component parts and accessories manufactured, furnished, and supplied by others) under normal use, maintenance and service. Except for the above Warranty, it is agreed and understood that no other WARRANTY or CONDITION whether express, implied, or statutory is made by Westland Environmental Services Inc.
2. The obligation of Westland Environmental Services Inc. under this Warranty shall be limited to the repair or replacement (**not in excess of its factory labour rate**) of its units; which, upon examination by Westland Environmental Services Inc., shall disclose to their satisfaction to have been defective in material and/or workmanship under normal use, maintenance, and service.
3. The foregoing shall be the Purchaser's sole and exclusive remedy whether in contract, tort, or otherwise; and Westland Environmental Services Inc. shall not be liable for injuries to persons, for damage to property or for loss of any kind which results (whether directly or indirectly) from such defects in material or workmanship, or for any other reason; and, it is agreed and understood that the Purchaser shall keep Westland Environmental Services Inc. indemnified against any such claim. In no event shall Westland Environmental Services Inc. be liable for incidental or consequential damages, or commercial losses, or for any loss or damage except as set forth in paragraph 2 herein.
4. This Warranty does not apply to, and no warranty or condition is made by Westland Environmental Services Inc. regarding any purchased components, parts, and accessories; manufactured, supplied and/or furnished by others, or any non-standard features or items specified by the Purchaser; nor does this Warranty expand, enlarge upon, or alter in any way, the warranties provided by the makers and suppliers of such component parts and accessories.
5. The liability of Westland Environmental Services Inc. under this Warranty shall cease and determine if:
   (a) The Purchaser shall not have paid in full all invoices as submitted by Westland Environmental Services Inc., or affiliated companies on or before their due dates:
   (b) Representatives of Westland Environmental Services Inc., are denied full and free right of access to the units:
   (c) The Purchaser permits persons other than the agents of Westland Environmental Services Inc. or those approved or authorized by Westland Environmental Services Inc. to effect any replacement of parts, maintenance, adjustments, or repairs to the units:
   (d) The Purchaser has not properly maintained the units in accordance with instructions, pamphlets or directions given or issued by Westland Environmental Services Inc. at the time of the sale and/or from time to time thereafter:
   (e) The Purchaser uses any spare parts or replacements not manufactured by or on behalf of Westland Environmental Services Inc. and supplied by it, or by someone authorized by it, or fails to follow the instructions for the use of the same:
   (f) The Purchaser misuses, or uses this unit for any purpose other than that for which it was intended or manufactured:
   (g) The defective parts are not returned to Westland Environmental Services Inc. within 15 days of repair.
6. No condition is made or is to be implied, nor is any Warranty given or to be implied as to the life or wear of the units supplied; or that they will be suitable for use under any specific conditions; notwithstanding that such conditions may be known or made known to the seller.
7. Defects in material and/or workmanship must be brought to the attention of Westland Environmental Services Inc. by written notification within ten (10) days of discovery, and repairs must be commenced within forty-five (45) days thereafter.
8. It is agreed and understood that the Purchaser is responsible for and must pay for the transporting of the defective goods or of the replacement parts to the place of repair. Premium freight charges (such as air express or air fare charges for transportation of personnel, tools and for replacement parts) and other expenses, apart from servicemen's regular straight time travel, mileage, and regular straight time labour required to repair or replace defective parts and the cost of the parts, will be paid for by the customer at Westland Environmental Services Inc. regular billing rates on usual credit terms.

9. The liability of Westland Environmental Services Inc. under this Warranty is limited to the purchase price of the unit and in no case shall a claim be advanced for more than such amount.
10. All repairs and replacements are made and furnished subject to the same terms, conditions, warranties, disclaimer or warranty and limitations of liability and remedy as applied to each new unit sold.
11. This warranty and the Purchaser's rights under it, is not transferable, or is it assignable.

DATE IN SERVICE: _____

MODEL NUMBER: CY 100- CA- D

SERIAL NUMBER: _____

PURCHASED BY: _____

SELLING BRANCH: _____

APPENDIX A:

INFORMATION SHEETS AND MANUALS FOR BURNERS AND BLOWERS

Standard Operating Procedure for OPERATING CY-100-CA-D INCINERATOR

1. PURPOSE

To standardize the safe operating procedure for operating the waste management facility's CY-100-CA-D Incinerator. Proper waste segregation, operating procedures, and regular maintenance will be required for safe, efficient, long term operation of the unit.

2. SCOPE

This procedure applies to all personnel involved or assisting in any component of the CY-100-CA-D Incinerator. There are potential hazards associated with the operation of this or any other incinerator. In addition to codes and regulations that will be listed and detailed in this SOP, general safety rules and precautions must be followed at all times to prevent accidents.

3. DEFINITIONS

Control Panel - This is the main panel which displays the temperatures of the primary and secondary chambers. It also has indicator lights that display if the blowers and burners are on.
Primary Chamber - The lower chamber where the waste is loaded and where the combustion occurs.
Front Door - This is the larger of the two doors on the primary chamber. It is used to load the incinerator and for ash removal.
Rear Door - This is the smaller of the two doors and is located on the rear of the primary chamber. It is used for raking purposes and some ash removal.
Contact Switch - There are two contact switches which are located on the front and rear door of the primary chamber. When the doors are closed it signals the burners to ignite. When the doors are open it signals the burners to turn off.
Primary Burners/Blowers - These are located on each side of the unit. The primary chamber has two burner/blowers while the secondary only has one. These units produce the flame and air required to burn the waste.
Thermocouple - There are two thermocouples on the CY 100 Incinerator. One on the top of the primary chamber situated in the middle. One more is located on the secondary chamber in the same location.
Secondary Chamber - This is the higher chamber above the primary chamber. Its job is to combust the gases and soot that generates from the primary chamber.
Flame Port - The large port where the soot and ash is generated from the primary and is passed into the secondary chamber. It mixes fresh air with the gases and soot to provide proper combustion.
Flame Port Blower - This blower is located near the back of the unit and is bolted to the incinerator deck. It provides the Flame Port with fresh air.
Secondary Burner/Blower - This burner/blower is located on the back of the secondary chamber. Its purpose is to provide the ignition and air to combust the soot and ash from the primary chamber.
Stack - This is the large unit attached to the secondary chamber which exhausts the gases out of the top of the incinerator.
Spark Arrestor - The mesh that surrounds the top of the stack which helps to break down any ash or sparks that may pass through the secondary chamber.

4. RESPONSIBILITY

Title or Position	Key Responsibilities
Supervisor	• Ensure all equipment is installed properly and safely, according to the CY-100-CA-D Incinerator Manual. • Ensure that everyone has read and signed off on this procedure. • Monitoring and reviewing this operating procedure. • Recording data from pre operational and operational checklists. • Be sure all workers are wearing proper PPE at all times.
Worker	• Inspect the inside and outside of unit for defects. • Removal of ash every morning. • Follow the pre operational and operational checklists. • Reading and complying with this procedure. • Ensure proper waste segregation and waste classes are loaded into the incinerator in the proper order. • Be sure all workers are wearing proper PPE at all times.

5. PERSONAL PROTECTIVE EQUIPMENT

Proper PPE is to be worn at all times. Supervisors are to ensure that prior to assigning work activities that appropriate PPE is available to protect the worker. Please refer to the list below for required PPE.

- Fire retardant clothing
- Thick leather gloves
- Hard hat
- Safety glasses
- Face shield
- Respirator with P100 cartridge.

6. PROCEDURE

PRE-OPERATIONAL:

1. Area around the incinerator building is free of hazards.
2. Check for damage to the stack and spark arrestor.
3. Check the fuel tank for adequate fuel.
4. Check for any damage to the outside of the incinerator.
5. Check all fuel valves are set to the open position.
6. Check for any damage to the primary thermocouple.
7. Check that the Flame Port Blower inlet is clean.
8. Check that the Control Panel has power.
9. Check that the Front and Rear door seal on the Primary Chamber are intact.
10. Check front and rear contact switch for freedom of movement.

Standard Operating Procedure for OPERATING CY-100-CA-D INCINERATOR

11. Remove ash from Primary Chamber. Weigh and record on pre-operational checklist (HB-WS-OPS-FM-001; Appendix A)
12. Visually check the inside of the primary chamber for any new cracks or pieces of refractory that may have come out.

OPERATION:

FIRST BATCH

1. Separate food waste from paper waste and weigh accordingly. Record on First Batch Operational Checklist (HB-WS-OPS-FM-002; Appendix B).
2. Next throw your paper waste to the back of the incinerator, then your food waste and STP on top of the paper and in front of the burners.
3. Set the burner time to 12 hours and primary temperature to 600 C on the control panel and record what time the unit was started.
4. Ensure all 3 blowers are on and working.
5. Record what time the Secondary Chamber fires up. You will hear this and also the indicator light on the control panel will come on. Also you must check the indicator light on the burner to ensure it is on. If it is blinking or not on notify your supervisor.
6. Record what time the Primary Chamber fires up. You will hear this and also the indicator light on the control panel will come on. Also you must check the indicator light on both burners to ensure it is on. If it is blinking or not on notify your supervisor.
7. Check the stack for any black smoke and record appropriately.
8. Rake every hour and take temperature readings every half an hour. Record.
9. Generally a load will take anywhere between 3-5 hours to burn. Once you feel the waste is burnt adequately turn the primary chamber temperature to 0 degrees and let the unit cool for 30-60 minutes.

SECOND BATCH

1. Separate food waste from paper waste and weigh accordingly. Record on Second Batch Operational Checklist (HB-WS-OPS-FM-002; Appendix B).
2. Next throw your paper waste to the back of the incinerator, then your food waste and STP on top of the paper and in front of the burners.
3. Set the burner time to 12 hours and primary temperature to 600 C on the control panel and record what time the unit was started. Also you must check the indicator light on the burner to ensure it is on. If it is blinking or not on notify your supervisor.
4. Check the stack for any black smoke and record appropriately.
5. Rake every hour and take temperature readings every half an hour. Record.
6. Once you feel the waste is burnt adequately turn the primary chamber temperature to 0 degrees and let the unit cool for 30-60 minutes.

THIRD BATCH

1. Separate food waste from paper waste and weigh accordingly. Record on Third Batch Operational Checklist (HB-WS-OPS-FM-002; Appendix B).
2. Next throw your paper waste to the back of the incinerator, then your food waste and STP on top of the paper and in front of the burners.
3. Set the burner time to 8 hours and primary temperature to 600 C on the control panel and record what time the unit was started. Also you must check the indicator light on the burner to ensure it is on. If it is blinking or not on notify your supervisor.

Here is an example of a typical **FULL** load (S. No 1). I would suggest keeping weights within 25 lbs of these numbers. For smaller loads simply divide these numbers to keep the ratio the same (S. No 2-4). The number of bags is not crucial; it is the weights that will determine a proper burn.

S. No	**Food Waste(lbs)**	# of BAGS	**Paper & Cardboard (lbs)**	# of BAGS	**ANY OTHER WASTE** (specify)
1	275	16	115	17	110 lbs STP (4)
2	250	14	90	13	85 lbs STP (3)
3	125	8	55	6	55 lbs STP (2)
4	75	4	30	3	25 lbs STP (1)

Note: Oily rags and absorbents can also be burned in the incinerator in small batches. The manufacturer recommends burning these materials in quantities no more than 3 to 4 % of the total batch weight. The material should be separated into 4 or 5 bundles of no more than 3 kg, distributed throughout the incinerator chamber.

7. SAFETY

1. Always wear PPE (Steel Toe Boots, Safety Glasses, and Fire Retardant Coveralls)
   When raking, and cleaning the ash out, a hard hat with a visor must be worn, fire proof gloves, and a respiration device.
2. When moving/lifting any bags of waste be sure to square off to the load and use your legs for lifting before throwing into the incinerator.
3. If at any time one of the burner/blowers stops working immediately notify your supervisor.
4. Be aware that you will be dealing with extremely hot surfaces and temperatures so all safety precautions must be enforced and abided by.

5. RELATED DOCUMENTS

Hope Bay Project Incinerator Management Plan
Dual Chamber Controlled Air Incinerator CY100-CA-D Operating and Maintenance Manual (Revised 2011)

6. REQUIRED RECORDS

Completed copies of all pre-operational inspection checklist (HB-WS-OPS-FM-001)
Completed copies of all batch operational checklists (HB-WS-OPS-FM-002)
Electronic spreadsheet of batch loading weights

8. RELEVENT REGULATIONS

Environmental Guidelines for the General Management of Hazardous Waste
Stockholm Convention on Persistent Organic Pollutants (POPs)
Canadian Environmental Protection Act, 1999 (CEPA 1999)
Canadian Council of Ministers of the Environment (CCME)
Environment Canada Technical Document for Batch Waste Incineration (2010)

9. APPENDICES

HB-WS-OPS-FM-001 Pre-operational inspection checklist
HB-WS-OPS-FM-002 Batch operational checklists

10. REVIEW

Annual review and revision as required.

REVISION RECORD

Version	*Date*	*Description*	*Author*	*Signature*
1.0	Dec 2011	Original	M. Dirks	

SOP ACTIVATION RECORD
THIS SOP WILL BE IN EFFECT ON THE ISSUE DATE APPROVED BY THE UNDERSIGNED.

POSITION	NAME	SIGNATURE	DATE OF ACCEPTANCE
FACILITIES MANAGER	**GLENN WINSOR**		

Standard Operating Procedure for OPERATING CY-100-CA-D INCINERATOR

SOP STANDARD

REVIEW AND ACKNOWLEDGEMENT

By signing off on this form, you acknowledge that you have reviewed, understand and accept the terms of this Standard.

First Name (Print)	Last Name (Print)	Company	Position	Date	Signature

CY-100-CA-D Incinerator Training

Training Outline

Stakeholders:		
Course Owner (sign-off)	***Subject Matter Experts - Role***	***Target Audience Depts***
Fred Penner Glenn Winsor		*CY-100-CA-D Operators*

Course Description:

This course in intended to train operators in the safe operation on the CY-100-CA-D Incinerator. The course will be conducted in two parts; a classroom portion and a hands-on portion. By participating in the classroom portion, potential operators will learn the theory behind the operation of the incinerator, safe operating strategies and proper preshift inspections and Operator documentation. Participants will be given a written test at the end of the classroom portion with a passing grade being 80%. The hands-on portion of the course will allow operator's the opportunity to observe as well as perform the daily operations of the CY-100-CA-D Incinerator. Once the operator and his/her supervisor becomes proficient at operating the incinerator the operator will be given a practical evaluation. The practical evaluation will be pass/fail.

Course Objectives:

The learner will be able to:

1. Describe the parts and pieces of the CY-100-CA-D.
2. Explain the general theory behind incineration.
3. Demonstrate the safe operation the incinerator.
4. Demonstrate proper use of task specific PPE.
5. Perform a proper Preshift Inspection.
6. Exhibit safe ash removal.
7. Demonstrate proper start-up procedures.
8. Show how to sort, batch, and load waste.
9. Demonstrate safe raking techniques.
10. Prepare for the additional batches.
11. Perform proper documentation on the Operator's Worksheet.

Course Materials:

Name of Document	File Location
Attendance Sheet	..\..\Attendance Form\attendance Form May 11, 2011.pdf
CY-100-CA-D IncineratorPresentation	
CY-100-CA-D Incinerator Written Test	
CY-100-CA-D Incinerator Practical Evaluation	/
CY-100-CA-D Daily Training Report	

Course Format:

Time	Topic/Section	Description of Activity
3 hrs	Presentation	**Instructor Led** – Introduce the course, reviewing the objectives of the session. Proceed through the presentation.
1 hr	Test	Administer and review the test after completing the presentation.
6-12 hrs	Hands-On	**Instructor Led** - Show the class the proper use of the CY-100-CA-D Incinerator by demonstrating the Preshift Inspection, batching and use of the Operator's Worksheet.
3hrs	Practical Evaluation	**Employee Led** - Have each participant model the demonstration and ensure that each step is being performed and the overall use of the CY-100-CA-D Incinerator was performed safely. Instructor to complete the practical evaluation form.
13 hrs	**Total Time**	

Support Documentation

Name of Document	File Location
Canadian Incinerator Standards	

Sign-off:

Course Owner: _____ Date: _____

Please Clearly Print Name and Sign

Training Rep: _____ Date: _____

Please Clearly Print Name and Sign

NEWMONT
NORTH AMERICA

CY-100-CA-D

Pre – operational Checklist

Name of Operator (Print clearly): _____

Operator's Signature: _____

Date: _____

Check the following:

Exterior of Building

- ☐ Area around the Incinerator building is free of hazards (if no, fix hazard before start-up).
- ☐ Check for damage to stack and spark arrestor.
- ☐ Check Fuel (should be full at the start of shift).
    - o Ordered fuel? ____yes ____no

Interior of Building

- ☐ Area around Incinerator is free of hazards (if no, fix hazard before start-up).
- ☐ Check for any damage to the Incinerator.
- ☐ Check fuel lines for any leaks.
- ☐ Check all fuel valves for open position.
- ☐ Check for damage to the Thermocouple.
- ☐ Check that Flame Port Blower inlet is clean.
- ☐ Check that Control Panel has power (temperature controls are displaying numbers).
- ☐ Check rear door seal and contact switch.

Primary Chamber

- ☐ Check main door seal and contact switch.
- ☐ Clean out and weigh ash from previous burn.
- ☐ Primary chamber is clean.
- ☐ Visually check the refractory:
    - o Any new bigger cracks. ____Yes ____ No.
    - o Pieces fell out of the refractory into the chamber. ____Yes ____ No.

Amount of ash collected: _____ lbs.

Comments / Hazards Corrected:

_____

_____

_____

WESTLAND CONSULTING
MEMBER OF KETEK GROUP INC.

Operational Checklist

CY-100-CA-D

DATE: _____ **TIME_____**

OPERATORS:_____

FIRST BATCH OF THE DAY.

Batch Preparation / Weighing

S. No	**Food Waste(lbs)**	# of BAGS	**Paper & Cardboard (lbs)**	# of BAGS	**ANY OTHER WASTE** (specify)
1					
2					
3					
4					
5					

- ☐ Total Amount of Waste added .....☐ Kg ☐ lb Time _____.
- ☐ Burner timer set at 12 Hours. State time you started the incinerator _____. Press Start button.
- ☐ All **3** burner blowers are working. (check for vibration - climb up and check 2^{ndary} burner/blower too)
- ☐ **Secondary chamber burner** fired. Time: _____. (Climb up and Check for green light)
- ☐ **Primary chamber burners** and **flame port blower** fired. Time: _____. (check for green light)
- ☐ Black smoke noticed (Yes / No) _____. (**check every 3 minutes** for half an hour)
- ☐ Rake every hour for first burn of the day. Note below in comment section.

Take reading of Temperature of primary and secondary Chambers every **HALF HOUR** after primary was fired.

Time	**Primary chamber temperature**	**Secondary chamber temperature**	**Comments / RAKING?**

- ☐ Primary chamber temperature was set to 0 C at _____.

Any Other Observations:

_____

_____

Note: To be used as sample only. Sites to modify templates as per their requirement.

WESTLAND CONSULTING
MEMBER OF KETEK GROUP INC.

SECOND BATCH OF THE DAY.

OPERATOR: _____ TIME:_____

S. No	**Food Waste(lbs)**	# of BAGS	**Paper & Cardboard (lbs)**	# of BAGS	**ANY OTHER WASTE** (specify)
1					
2					
3					
4					
5					

- ☐ Total Amount of Waste added ……☐ Kg ☐ lb Time _____.
- ☐ Burner timer set at 12 Hours. State time _____.
- ☐ Temperature of primary chamber set to 600 C.
- ☐ Black smoke noticed (Yes / No) _____. (**check every 3 minutes** for half an hour)
- ☐ Rake every **Hour and a half** for second burn of the day. Note below in comment section.

Take reading of Temperature of primary and secondary Chambers every **HALF HOUR** after primary was fired.

Time	**Primary chamber temperature**	**Secondary chamber temperature**	**Comments / RAKING?**

- ☐ Primary chamber temperature was set to 0 C at _____.

Any Other Observations:

_____

_____

_____

Note: To be used as sample only. Sites to modify templates as per their requirement.

WESTLAND CONSULTING
MEMBER OF KETEK GROUP INC.

THIRD BATCH OF THE DAY.

OPERATOR: _____ TIME:_____

S. No	**Food Waste(lbs)**	# of BAGS	**Paper & Cardboard (lbs)**	# of BAGS	**ANY OTHER WASTE** (specify)
1					
2					
3					
4					
5					

- ☐ Total Amount of Waste added ……☐ Kg ☐ lb Time _____.
- ☐ Burner timer set at 6 Hours. Time _____.
- ☐ Temperature of primary chamber set to 600 C.
- ☐ Black smoke noticed (Yes / No) _____. (**check every 3 minutes** for half an hour)

Time	**Primary chamber temperature**	**Secondary chamber temperature**	**Comments / RAKING?**

Any Other Observations:

_____

_____

_____

_____

_____

Signatures of the Operators:

_____ _____

Note: To be used as sample only. Sites to modify templates as per their requirement.

Maintenance and Inspection Log

CY-100-CA-D

Component	Maintenance & Inspection	Check
Checks when incinerator is not operational.	**Date: _____**	
Electrical Panel	No physical Damage.	
Incinerator Body	No physical Damage.	
Thermocouples & Contact Switches	No physical damage, No obstructions and free movement.	
Primary Chamber Burners	No blockage at air inlet (e.g. Snow or Leaves), No Physical damage.	
Primary Chamber	No plugging of under fire air holes.	
Feed Door & Ash Door	Check movement. Inspect gasket (repair/replace as needed)	
Flame port Air Blower	No blockage at air inlet (e.g. Snow or Leaves), Physical damage.	
Secondary Chamber Burner	No blockage at air inlet (e.g. Snow or Leaves), Physical damage	
Fuel tank, Fuel lines & Valves.	No leaks, no cracks in hose.	
Stack and Spark Arrestor	No physical damage, no blockage (Spark Arrestor)	
Grease door bearnings	3 bearings on the front door	
Checks when incinerator is in operation.	**Date: _____**	
Primary Burners	Check if working. Bleed if necessary.	
Secondary Burner	Check if working. Bleed if necessary.	
Flame port Air Blower	Check if working.	
Electrical Panel	Check all lights, temperature controllers are functional.	

Additional Observations:

_____

_____

_____

_____

_____

_____

_____

Print Full Name: _____

Signatures: _____

Note: To be used as sample only. Sites to modify templates as per their requirement.

WESTLAND CONSULTING
MEMBER OF KETEK GROUP INC.

Inspection and Maintenance Checklist

CY-100-CA-D

Daily Maintenance

- ✓ Check for evidence of cracks on the refractory
- ✓ Keep the area clean
- ✓ Carefully sweep the area around the incinerator
- ✓ Clean tools and equipment
- ✓ Maintain fuel stock levels
- ✓ Inspect for any visible damage to the equipment

Weekly Maintenance

- ✓ Maintain good housekeeping of the waste disposal site (WDS)
- ✓ Ensure the fencing to the WDS is intact (to avoid its exposure to wildlife, if applicable)

Monthly Maintenance

- ✓ Check the vertical fixings of the stack
- ✓ Check the doors seals
- ✓ Check the external body for evidence of thermal damage
- ✓ Check the feed and ash door for corrosion
- ✓ Check the feed and ash door for damaged hinges
- ✓ Check the feed and ash door for latch blockage in the doorframe
- ✓ take an inventory of condition of tools and equipment

Yearly Maintenance

- ✓ Inspect and replace metal parts and consumable parts (e.g. thermocouples, burners, etc)
- ✓ Overhaul the incinerator (to be carried out by incinerator manufacturer)
- ✓ Check the status of the ash management system
- ✓ Perform annual audit
- ✓ Ensure environmental audits and licenses are obtained

Inspection Checklist for Supervisors

CY-100-CA-D

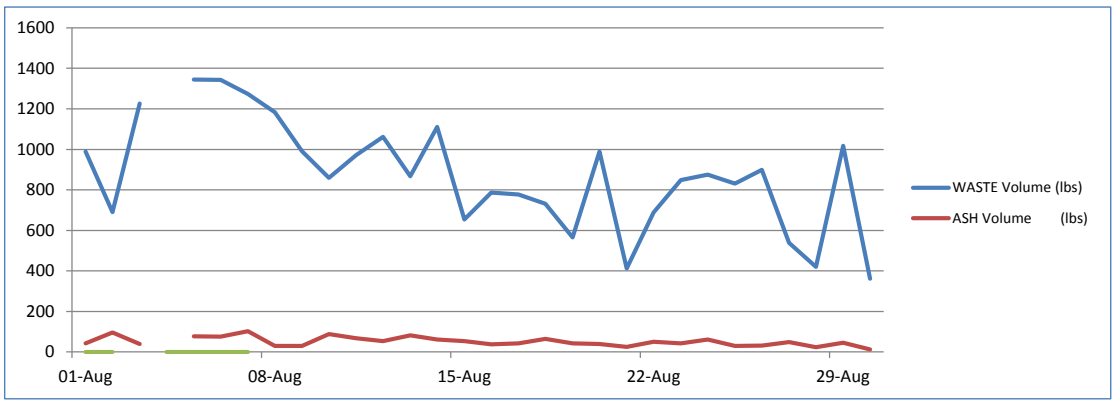
Facility:		Date:		
Name / model of incinerator:				
	Activity	**Yes**	**No**	**Remarks**
A	**Safety**			
1	Is there adequate personal protective equipment (PPE)?			
2	Is the PPE being used?			
3	Is the PPE in good condition?			
4	Is there restricted entry to the waste incineration site?			
5	Is there functional fire safety equipment?			
6	Do the operators know how to use the equipment?			
7	Is there adequate first aid kit?			
8	Are the operators conversant with use of the kit?			
9	Is flammable material stored away from the incinerator?			
10	Are the operators medically examined?			
11	Are warning signs distinctly displayed?			
Additional comments on safety:				
B	Operation			
	Activity	**Yes**	**No**	**Remarks**
1	Is there a sufficient supply of fuel?			
2	Is the procedure for preparation of waste for incineration being followed?			
3	Is the incinerator cleaned daily?			
4	Is the waste weighed upon reception?			
5	Is the waste temporarily stored neatly?			
6	Is the loading of incinerator done in the right way?			
7	Is the temperature regulated adequately during the burn?			
8	Is the incinerator allowed to burn down and cool before cleaned?			
9	Is the ash properly disposed as specified by compliance procedures?			
10	Are the following tools and equipment available?			
a.	Ash rakes			
b.	Shovel			
c.	Hand brush / dustpan			

d.	Hard broom			
e.	Non combustible ash disposal drums			
f.	Weighing scales			
g.	Fire extinguishers			
h.	Fire retardant gloves			
i.	Eye protection / face mask			
j.	Overalls or suitable clothing to cover the upper body, including the lower arms			
k.	Safety first aid kit			
Additional comments on operation:				
C	**Maintenance**			
	Activity	**Yes**	**No**	**Remarks**
1	Is there evidence of cracks?			
2	Is there general good housekeeping?			
3	Is the status of the ash handling and disposal system good?			
Additional comments on maintenance:				
D	**Records**			
	Activity	**Yes**	**No**	**Remarks**
1	Are the relevant forms available?			
2	Are the forms filled accurately and completely?			
3	Are incidents recorded?			
4	Are reports of the waste incinerated done on time?			
Additional comments on records:				
Name of supervisor:		Signature:	Designation:	

CY100 Monthly Trend

MONTH: **August-11**

DATE	**WASTE** Volume (lbs)	**ASH** Volume (lbs)	LOADS	COMMENTS:
01-Aug	989	42	3	Spark arrestor needs to be replaced. Reburn from previous day. Sheldon Olson now certified.
02-Aug	691	96	2	Re burn in the morning due to unburnt material. Spoke with Jeff Richards about getting rear fuel line re located and also replacing the Spark Arrestor on the stack.
03-Aug	1226	40	3	
04-Aug				Incinerator down this morning for repair to Spark Arrestor and also to relocate rear fuel line. Also needed to replace secondary thermocoupler.
05-Aug	1344	77	3	The rear door seal at the bottom is stuck to the door.
06-Aug	1343	76	3	The rear door seal at the bottom is stuck to the door.
07-Aug	1274	102	3	The rear door seal at the bottom is stuck to the door.
08-Aug	1184	30	3	Couple bolts missing on blower inlet pipe. Also a crack on the connection. The rear door seal at the bottom is stuck to the door. Some waste left unburnt so only removed half of the ash.
09-Aug	991	30	3	The rear door seal at the bottom is stuck to the door.
10-Aug	860	88	3	The rear door seal at the bottom is stuck to the door.
11-Aug	971	68	3	The rear door seal at the bottom is stuck to the door.
12-Aug	1061	53	3	The rear door seal at the bottom is stuck to the door.
13-Aug	867	82	3	The rear door seal at the bottom is stuck to the door.
14-Aug	1110	62	3	Had to reset Primary 1 twitch on the first batch.
15-Aug	654	54	2	The rear door seal at the bottom is stuck to the door.
16-Aug	787	38	3	The rear door seal at the bottom is stuck to the door.
17-Aug	777	42	3	The rear door seal at the bottom is stuck to the door.
18-Aug	731	64	2	The rear door seal at the bottom is stuck to the door.
19-Aug	566	42	2	The rear door seal at the bottom is stuck to the door.
20-Aug	989	39	3	The rear door seal at the bottom is stuck to the door.
21-Aug	413	25	2	The rear door seal at the bottom is stuck to the door.
22-Aug	689	51	3	The rear door seal at the bottom is stuck to the door.
23-Aug	848	42	3	The rear door seal at the bottom is stuck to the door.
24-Aug	875	62	3	one small piece of refractory came out (2x2x2)
25-Aug	831	30	2	The rear door seal at the bottom is stuck to the door.
26-Aug	899	31	3	The rear door seal at the bottom is stuck to the door.
27-Aug	538	49	2	The rear door seal at the bottom is stuck to the door.
28-Aug	420	24	1	Westland here doing the testing on the Incinerator that's why there was only one load burn't
29-Aug	1017	45	2	Westland here doing the testing on the Incinerator that's why there was only two loads burn't
30-Aug	361	12	1	Westland here doing the testing on the Incinerator that's why there was only one load burn't
31-Aug	**734**	**22**	**2**	Westland here doing the testing on the Incinerator that's why there was only two loads burn't
Total	**26040**	**1518**	**77**	



BILL OF LADING

KBL Environmental LTD.
PO Box 1108
Yellowknife, NT X1A 2N8

DATE SAMPLE NO 1764

CONSIGNOR/CUSTOMER SITE ADDRESS

Name: HOPE BAY MINING LTD

Address: DORIS CAMP, NUNAVUT
WASTE MANAGEMENT

Telephone: 604-998-5400 Contact: MIKE | SHELDON

Generator Pin #: N/A Manifest #:

CONSIGNEE/RECEIVER SITE ADDRESS

Name: KBL ENVIRONMENTAL

Address: #17 CAMERON ROAD
YELLOWKNIFE, NT X1A-2N8

Telephone: 867-873-5263 Contact: DOUG.

Receiver Pin #: NTG000412 Manifest #:

CUSTOMER BILLING ADDRESS

Name: HOPE BAY MINING LTD

Address: SUITE 300-899 HARBOURSIDE DR.
NORTH VANCOUVER, BC V7P-3S1

Telephone: 604-345-3122 Contact: A. HOLZAPFEL

Account #: PO #:

CARRIER/TRANSPORTER

Name: ARCTIC SUNWEST

Address: YELLOWKNIFE, NT

Driver: VARIOUS Unit #: BUFFALO 5

Carrier Pin #: N/A

DANGEROUS GOODS INFO. 24 HOUR EMERGENCY PHONE #
CANUTEC (613) 996-6666

PLACARDS REQUIRED BY CARRIER (PER T.D.G REGULATIONS)
Yes ☐ No ☒ Number Required Type

DG	SHIPPING NAME/ DESCRIPTION	T.D.G INFORMATION					UM	EXPECTED QUANTITY	ACTUAL QUANTITY
		CLASS	P.I.N.	PACKING GROUP	PACKAGING NO.	PACKAGING CODE			
	NON REGULATED SOLIDS (INCINERATOR ASH)	N/R	N/R	N/R	04	01	kg	9560	
	SAMPLE ONLY								

INVOICE TO FOLLOW

DG-Dangerous Goods (X-Yes)

**UM-Unit of Measure (L-Litre, K-Kilogram, E-Each)

TECHNICIAN TIME: TRANSPORT TIME:

General Terms and Conditions:
All wastes must meet the specifications as described on the Customer's Bill of Lading sheet. Wastes that do not meet the profile are subject to rejection at the Receiver site or conditional acceptance at a higher price. Customer acknowledges and accepts these conditions by signing below. Customer agrees to indemnify and save harmless KBL from any and all claims, penalties, forfeitures, and expenses incident thereto, which it may incur as a result of death, bodily injuries to any person, destruction or damage to any property, contamination or any adverse effects on the environment, violation of laws, regulations, or orders, caused in whole or in part by the Customer failure to provide waste which meets the specifications as described on this Bill of Lading.

CONSIGNOR SIGNATURE	DRIVER SIGNATURE	CONSIGNEE SIGNATURE
Krystal Malkin	N/A	RECEIVING FACILITY TO SIGN
ABOVE NAME PRINTED	ABOVE NAME PRINTED	ABOVE NAME PRINTED
KRYSTAL MALKIN	N/A	KBL ENVIRONMENTAL

White – Customer **Canary – File** **Pink – Receiver** **Green – Carrier**

KBL Environmental LTD.

Certificate of Disposal

Date: xxxx

KBL Job xxxx
Invoice xxxx

KBL Environmental Ltd hereby certifies that the waste shipped from Hope Bay Mine, received on KBL Bill of Lading xxxx which was shipped to KBL Environmental Ltd. on xxxx has been processed, recycled/disposed of in accordance with all applicable Federal and Territorial /Provincial Regulations.

Generator:
Hope Bay Mine
C/O BBE Yellowknife
NUG 100032

Issued By:

John Oldfield
General Manager
KBL Environmental Ltd.
NTR 0000123