NORTHWEST TERRITORIES
POWER
CORPORATION

Incinerator General Operational Plan

BLUEFISH HYDROELECTRIC FACILITY

PLANT #122

BLUEFISH LAKE, NORTHWEST TERRITORIES

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Table of Contents

1 Scope

The Bluefish Hydroelectric Facility will use a series CY-2050-FA "D" double chamber cyclonator incinerator manufactured by Westland Environmental (Appendix A) to incinerate non-hazardous construction camp solid waste, paper and cardboard. This Incinerator General Operational Plan is intended to provide general guidance on the best environmental practice for the use of the construction camp batch solid waste incinerator. This document provides supplemental information to the procedures outlined in NTPC's Hazardous Waste Management Plan and the Bluefish New Dam Waste Management Plan. The incinerator operator is to refer to the manufacturer's operational documents for specific instructions and optimal operating conditions for the CY-2050-FA "D" incinerator.

The incinerator will be used as an alternative to shipping solid waste to the Yellowknife landfill.

1.1 Reference Documents:

Westland Environmental Services Inc. CY-2050-FA Incinerator Manual (Appendix A)

Bluefish New Dam Waste Management Plan

NTPC Hazardous Waste Management Plan

Technical Document for Batch Waste Incineration (Environment Canada), available at http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=F53EDE13-1

1.2 Applicable Regulations/Guidelines

Technical Document for Batch Waste Incineration

CCME Canada Wide Standards for Dioxins and Furans

CCME Canada Wide Standards for Mercury

NWT Environmental Protection Act

Transportation of Dangerous Goods (TDG)

2 Background

Incineration is recognized as an effective and environmentally sound disposal method for a wide range of wastes, provided the incinerator is properly operated and maintained. Reduction and diversion of waste should be the primary objective. Examine the waste to determine the opportunities that exist for:

- reducing the quantity of waste generated,
- reusing materials; and

- recycling as much as possible before disposal.

Incineration of wastes can lead to the emission of pollutants. Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDF), commonly known as dioxins/furans can be generated from incomplete combustion resulting from the use of inadequate incineration technology and/or operation. Dioxins and furans are toxic, persistent, bioaccumulative, and result predominantly from human activity.

Mercury is another high priority potential contaminant released from incinerators. Mercury is toxic and bioaccumulates in the environment. Mercury is not emitted unless the waste items incinerated contain mercury. The best method to control mercury is therefore to limit the amount of mercury in the waste fed into the incinerator.

3 Role and Responsibilities

Plant Operator

- Ensure the safety of all personnel and the site.
- Ensure that only properly trained individuals (Incinerator Operator) operate the incinerator.
- Ensure that the Incinerator Operator follows the requirements of the Incinerator General Operational Plan.
- Ensure that the required records are collected and maintained.

Incinerator Operator

- Ensure they are adequately trained to operate the incinerator.
- Wear proper Personal Protective Equipment.
- Ensure the safe operation of the incinerator equipment and the associated work and storage area.
- Ensure the proper operation and maintenance of the incinerator in accordance with the manufacturer's specifications.
- Ensure that only appropriate wastes are incinerated, and that inappropriate wastes are removed and handled accordingly.
- Document and maintain the required logs and records.
- Notify the Plant Operator of any incinerator upsets, malfunctions or required repairs.

4 Incinerator Feed

Only solid waste from camp operations, paper and cardboard are to be incinerated. These materials are segregated at source and are to be placed in specifically identified waste containers with transparent bags and in bins located throughout the Facility.

Prior to loading the incinerator, the feed material will be 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 (refer to the NTPC Hazardous Waste Management Plan).
- Mercury containing materials / waste (e.g. fluorescent lamps, thermometers, thermostats, dental amalgam, batteries). Limiting the quantity of mercury placed in the incinerator is the most effective way to limit mercury emissions.
- Metal and glass. These materials absorb energy from the furnace and increase the wear and tear on various incinerator components.
- Materials / wastes containing heavy metals (e.g. mercury-containing wastes, pressure or chemically treated wood (i.e. Chromated Copper Arsenate [CCA] or creosote), lead painted materials.
- Asbestos waste.
- Liquid wastes including petroleum hydrocarbons and sewage.
- Uncontaminated plastics, including chlorinated plastics.
- Inert materials such as concrete, bricks, ceramics, ash.
- Bulky materials such as machinery parts or large metal goods such as appliances.
- Radioactive materials such as smoke detectors.
- Potentially explosive materials such as propane tanks, other pressurized vessels, unused or ineffective explosives.
- Other hazardous materials such as organic chemicals (PCBs, pesticides), other toxics (arsenic, cyanide).
- Electronics.
- Batteries.
- Drywall.
- Fluorescent light bulbs.
- Whole tires.

When encountered, inappropriate waste material will be removed from the incinerator feed, where possible. If the inappropriate waste is too intermixed with the desired incinerator feed, then the batch will be rejected and not incinerated. Removed inappropriate wastes and rejected batches will be stored and handled in accordance with the NTPC Hazardous Waste Management Plan or Bluefish Dam Waste Management Plan, as appropriate. The waste feed inspections will be recorded on the incineration log sheet (Appendix B).

Prior to loading the incinerator, the following steps will need to be followed:

- Determine the source of the waste i.e. camp solid waste, paper or cardboard.
- Weigh the waste to determine how much will be incinerated.
- Record the source and amount of waste placed in the incinerator.

The CY-2050-FA "D" incinerator is designed with a maximum batch capacity of 1.3 m^3 and 112 kg/hour. Do not overload the incinerator.

The incinerator should be operated according to the Operation and Maintenance Manual (Appendix A, Section 4). When the incinerator is loaded with the appropriate mix and quantity of waste, close and lock the door, and start the burn cycle. The incinerator operator should observe the burn for at least 15 minutes after ignition of the primary chamber burner to ensure the volatility of the waste charged is not creating too much gas for the secondary chamber to handle. The primary chamber should be operated in the temperature range specified by the manufacturer (700,000 British thermal units per hour or 0.73 gigajoules per hour for the CY-2050-FA incinerator). When satisfied that the burn is proceeding in a controlled manner, the incinerator operator may leave the incinerator area while the equipment completes the burn cycle.

The burn cycle should not be interrupted by opening the charging door until after the burn is complete and the unit has cooled down. No additional waste is to be added to the primary chamber while in operation.

5 Incinerator Ash

When the burn is complete and the unit has cooled, the incinerator operator will open the door only when wearing protective equipment (see Section 4.1 in the Maintenance and Operating and Maintenance Manual, Appendix A).

The incinerator operator must remove the ash from the previous burn cycle before reloading the incinerator. Any unburned combustible materials found in the ash will be recharged to the primary chamber after the incinerator operator has cleaned the air ports, and before putting a fresh charge into the incinerator. Non-combustible materials such as residuals metal pieces will be disposed of with the ash.

Ash from the primary chamber of the incinerator can contain materials deleterious to the incinerator operator's health and the environment. Incinerator operators must use personal protective equipment when handling this material (see Section 4.1, Appendix A). The ash material will be removed from the hearth and placed in watertight, covered metal containers/drums and clearly marked "Incinerator Ash". The waste ash containers will be subsequently moved and stored in a dry area pending eventual transport by ice road to the Yellowknife Landfill for final disposal.

The incinerator operator will weigh, and maintain records of, the quantity of ash produced.

Representative samples of the bottom ash will be collected each time the incinerator ash is emptied (as per protocols presented for solid wastes in the NTPC Hazardous Waste Management Plan) for possible leachate toxicity testing. Ash will be cooled for at least one week before transporting to the Yellowknife landfill.

6 Standard Operating Procedures

To ensure good operation of the incinerator, the following standard operating procedures should be followed. See also Section 4 of the Operating and Maintenance Manual (Appendix A).

6.1 Cleaning and Loading

- The primary chamber should be cleaned of all ash before any new charge is introduced. Incinerator operators should check to ensure that the previous cycle is complete and that the primary chamber has cooled to room temperature before commencing clean out.
- Turn OFF all power to the incinerator before opening the primary chamber door.
- Inspect ash for complete combustion. If combustion is not complete, initiate a second incineration.
- Wear personal protective equipment (see Section 4.1 of the incinerator Operating and Maintenance Manual) and use appropriate equipment to remove the ash. Rake and shovel the ash from the hearth and place it in a metal container for transport to an approved disposal site.
- Inspect the incinerator as per Section 4.2 of the Operating and Maintenance Manual.
- Measure and record the weight of the materials to be combusted on the next burn cycle.
- Ensure waste loaded to the primary chamber does not block the burner. Follow the manufacturer's instructions concerning the mass or volume of waste that can be loaded (see Tables 3 and 4 in the Operating and Maintenance Manual).

6.2 Starting the Burn

- Follow the Pre-operational checks in Section 4.4 of the Operating and Maintenance Manual.
- If the secondary burner does not raise the temperature to the manufacturer's recommended set point, the incinerator operator should not override the controls and continue the burn. Any failures during the start-up should result in the incinerator shutting down. At this time the incinerator operator will need to commence fault identification procedures to overcome the deficiencies.
- The incinerator control system should maintain proper operating conditions throughout the timed burn cycle. Following the burn cycle, the system will go into a cool down mode. During this period air is introduced into the primary chamber to speed the cool down.

- Under no circumstances should the incinerator operator attempt to open the primary chamber doors when the system is operating. This practice can cause flashbacks that can injure personnel. The extra air entering the primary chamber will disrupt the combustion process, possibly leading to increased emissions.

7 Training

Only specifically trained individuals will be allowed to operate the incinerator. Incinerator operators are to be properly trained by the incinerator manufacturer. The training course will include, as a minimum, the following elements:

- System safety including identification of hazards that the incinerator operator should recognize.
- Waste characterisation and how waste composition can affect operation.
- Loading limitations, including materials that should NOT be charged to the incinerator, and the allowable quantities of different types of wastes that can be charged.
- Start-up procedures for the incinerator and the normal operation cycle.
- Operation and adjustment of the incinerator to maximise performance.
- Clean out procedures at the end of the cycle.
- Troubleshooting procedures.
- Maintenance schedule.
- Record keeping and reporting.

8 Maintenance

Routine preventative maintenance will be carried out in accordance with the manufacturer's specifications (Section 4.8, Operating and Maintenance Manual). An annual inspection and maintenance program will be established with the incinerator manufacturer.

9 Records

To demonstrate appropriate operation and maintenance of the incinerator, the facility will maintain records containing at least 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 any refresher courses.
- All preventative maintenance activities undertaken on the equipment.
- Records of operation of the incinerator.

- 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 ash sampling information.

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 2 years.

10 Reporting

It is estimated that approximately 20 tonnes of solid waste will be produced per year by construction activities at the Bluefish hydro plant. Incineration will be used as an alternative to shipping waste to the Yellowknife landfill. In the event that NTPC incinerates in excess of 26 tonnes of non-hazardous solid waste in a single year, NTPC will report PCDDF, hexachlorobenzene, and mercury emissions to the National Pollutant Release Inventory (NPRI), with the following supporting information:

- quantity of waste incinerated;
- date, description, and weight of each load;
- relevant operating data (dates, temperatures, and burner operating times);
- volume or weight of ash produced;
- names of the incinerator operator for any particular load along with notes on observations or problems experienced with the load;
- training received by the staff(who conducted the training and when);
- any changes in operation, and the reason for the changes made; and
- results of any testing on the ash or emissions.

APPENDIX A

Westland Environmental Services Inc. CY-2050-FA Incinerator Manual

Forced Air Incineration Systems

Operating and Maintenance Manual

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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 knowledgeable, and hence a better operator. Table 1 outlines the contents of this manual.

Table 1 Organization of Manual

Chapter 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 the incinerator capacity.
3	**System Description** The components of both the single-chamber and dual chamber 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 gas.

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.

[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..

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.

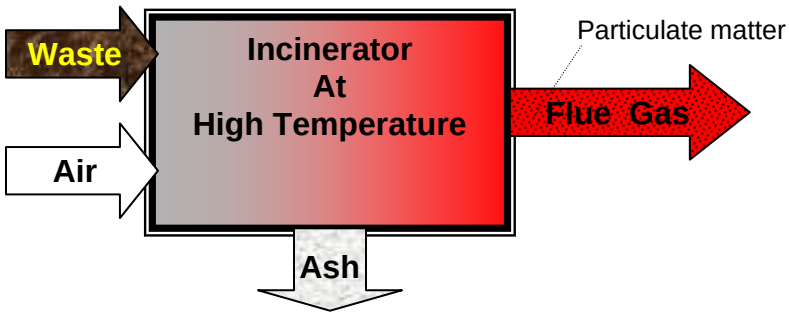

Figure 1 Schematic Diagram of Incineration Process

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. And in remote areas where wildlife is present, scavenging can be prevented by incineration.

In some cases, incineration is used to recover the energy contained in the waste in the form of electricity, steam, hot fluids or hot air. And 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, which requires a lot of energy, [3] which in turn, has the effect of lowering the temperature of the flue gas.

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:

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[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.

[4] The term "organic" is also used, which is strictly incorrect in that some "inorganic" elements or compounds are combustible, such as carbon, sulphur and carbon monoxide.

(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 particulate matter.

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.

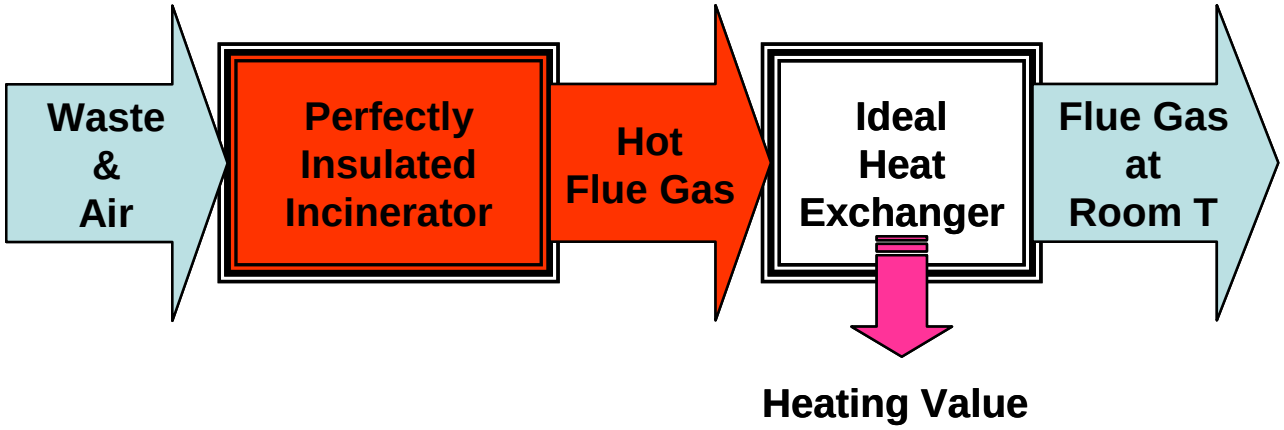

Figure 2 The Concept of Heating Value

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).

[5] The terms "ash" and "inorganic" are also used. Note that the latter is inaccurate as explained previously.

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 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".

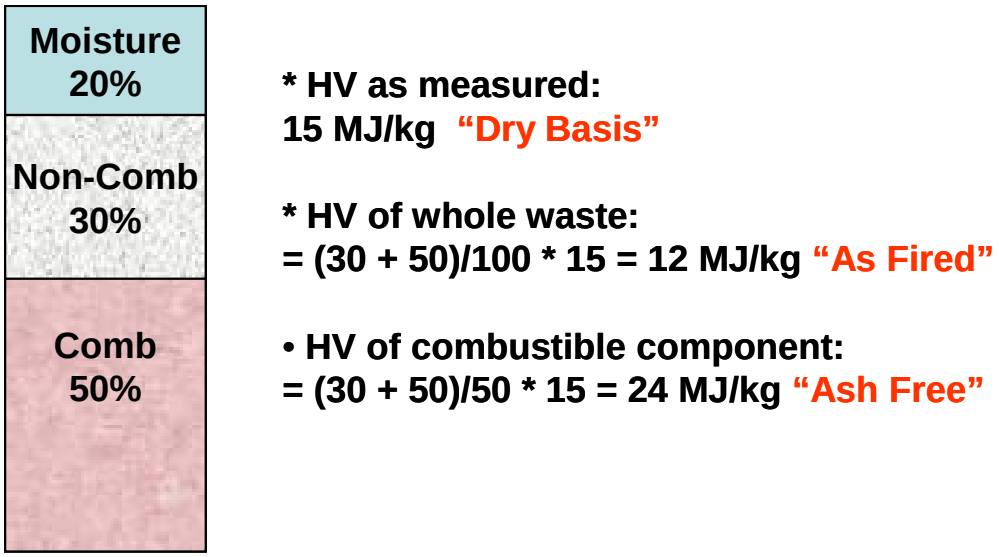

Figure 3 Different Bases for Expressing Heating Value (HV)

2.6 Examples of waste characteristics

Approximate 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 abbatoir, 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. In general, the higher the heating value, the lower is the capacity in terms of kg/h that can be incinerated. This can be explained by noting that a waste that has a higher heating value requires more air per unit mass than that required to incinerate a waste with a lower heating value. To put it another way, for the same amount of air, more mass of a waste with a lower heating value can be incinerated.

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, insufficient amount of air would generate black smoke.

Unfortunately, waste composition is not always known. Nevertheless there may be indications 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

3 SYSTEM DESCRIPTION

3.1 Different Models

Westland's forced air incinerators are of two types:

- Single-chamber, referred to as the Primary Chamber; and
- Dual-chamber, which has an additional Secondary Chamber.

The term forced air denotes the use of one blower or two blowers to "force" combustion air into the combustion chamber(s).

Different sizes are produced, and the auxiliary fuel can be diesel, propane or natural gas, as specified by the user. Key design parameters of the different models are summarized in Table 5.

The combustion air blower characteristics are shown in Table 6. [6] Beckett's Oil Burner model SF is used when diesel is the auxiliary fuel. [7] When propane or natural gas is used, a Midco Incinomite burner is used. [8] The information sheets and manuals can be found in Appendix A: Information sheets and Manuals for Burners and Blowers.

3.2 System components

Regardless of the model of your incinerator, the components are similar. Figure 4 shows a schematic diagram of the dual-chamber design. If your incinerator is single-chamber,

[6] http://www.eccohtg.com/links/Product%20Listing/Ventilation%20Products/Miscellaneous%20Fans.pdf

[7] http://www.beckettcorp.com/res2.htm

[8] http://www.midcointernational.com/products/incinomite/

then ignore the Secondary Chamber and the associated burner and blower. Figure 5 and Figure 6 show photographs of the Single-Chamber (CY-1050-FA) and Dual-Chamber (CY-2050-FA) designs, respectively. Table 7 summarizes the components and their functions.

Table 5 Key Design Parameters of Westland's Forced Air Incinerators

Model	Air Blower Series No.	Burner Rating		PC Volume		Approximate Maximum Capacity* (Type 3 Waste)	
		1000 Btu/h	GJ/h	ft^3	m^3	lb/h	kg/h
CY-1013-FA	AMU 400	350	0.37	13	0.37	90	40
CY-1020-FA	AMU 400	490	0.51	20	0.5	110	50
CY-1050-FA	AMU 625	700	0.73	50	1.3	245	112
CY-2020-FA	PC: AMU 400 SC: AMU 245	PC: 490 SC: 280	PC: 0.51 SC: 0.29	20	0.5	110	50
CY-2050-FA	PC: AMU 625 SC: AMU 225	PC: 700 SC: 280	PC: 0.73 SC: 0.29	50	1.3	245	112

Notes: PC: Primary Chamber; SC: Secondary Chamber. * Actual capacity depends on properties of the waste being incinerated; see Table 2 for waste properties.

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Table 6 Combustion Air Blowers Characteristics

MODEL	HP	RPM	AIR DELIVERY (CFM AT R.P.M. SPECIFIED)							
			Free Air	1/8" SP	1/4" SP	3/8" SP	1/2" SP	3/4" SP	1" SP	1-1/4" SP
AMU-75	1/60	3000	75	61	54	43	–	–	–	–
AMU-130	1/70	1550	130	107	87	30	–	–	–	–
AMU-245	1/20	1550	245	225	210	190	162	–	–	–
AMU-400	1/12	1550	400	380	365	340	315	200	–	–
AMU-525	1/4	1725	525	500	480	460	420	240	120	–
AMU-625	1/4	1725	625	600	560	540	500	420	280	100
AMU-845	1/2	1725	845	825	790	760	730	650	570	425
AMU-1100	1/3	1140	1100	1050	1000	950	860	700	–	–
Tested by The Nozzle Chamber Method as directed in A.M.C.A. Bulletin #210 Figure #4										

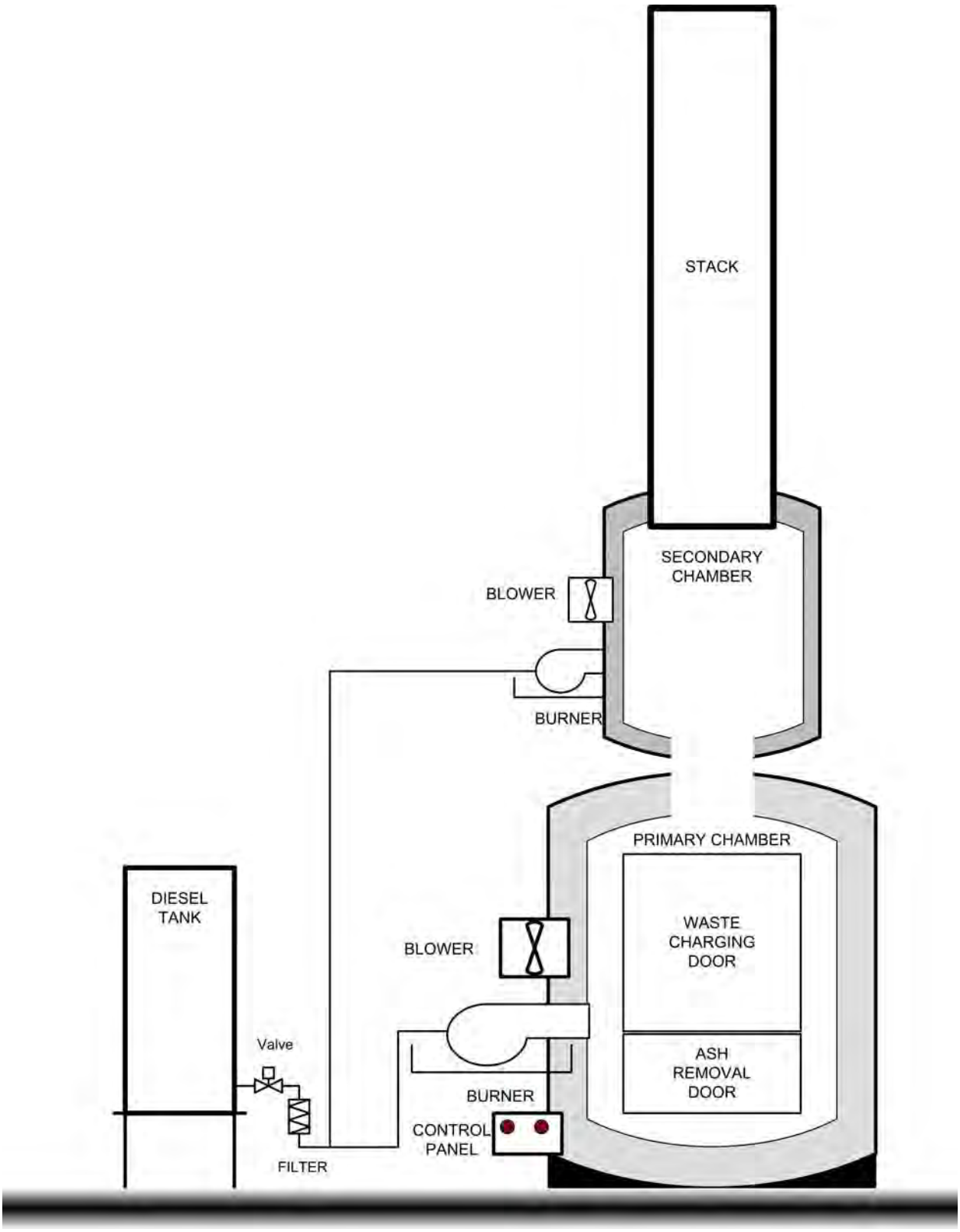

Figure 4 Schematic Diagram of Forced Air Dual-Chamber Design

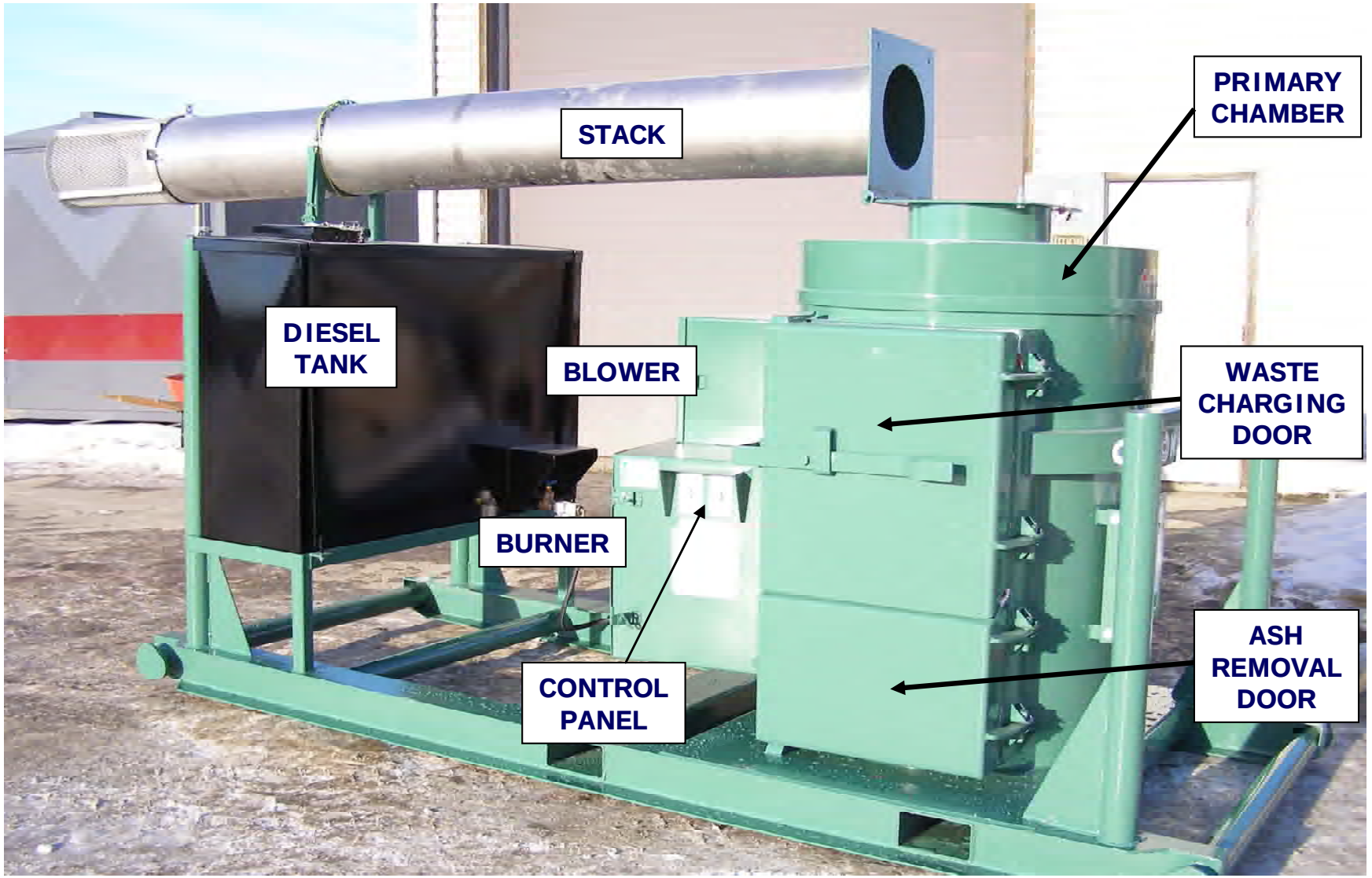

Figure 5 Photograph of the Single-Chamber Design

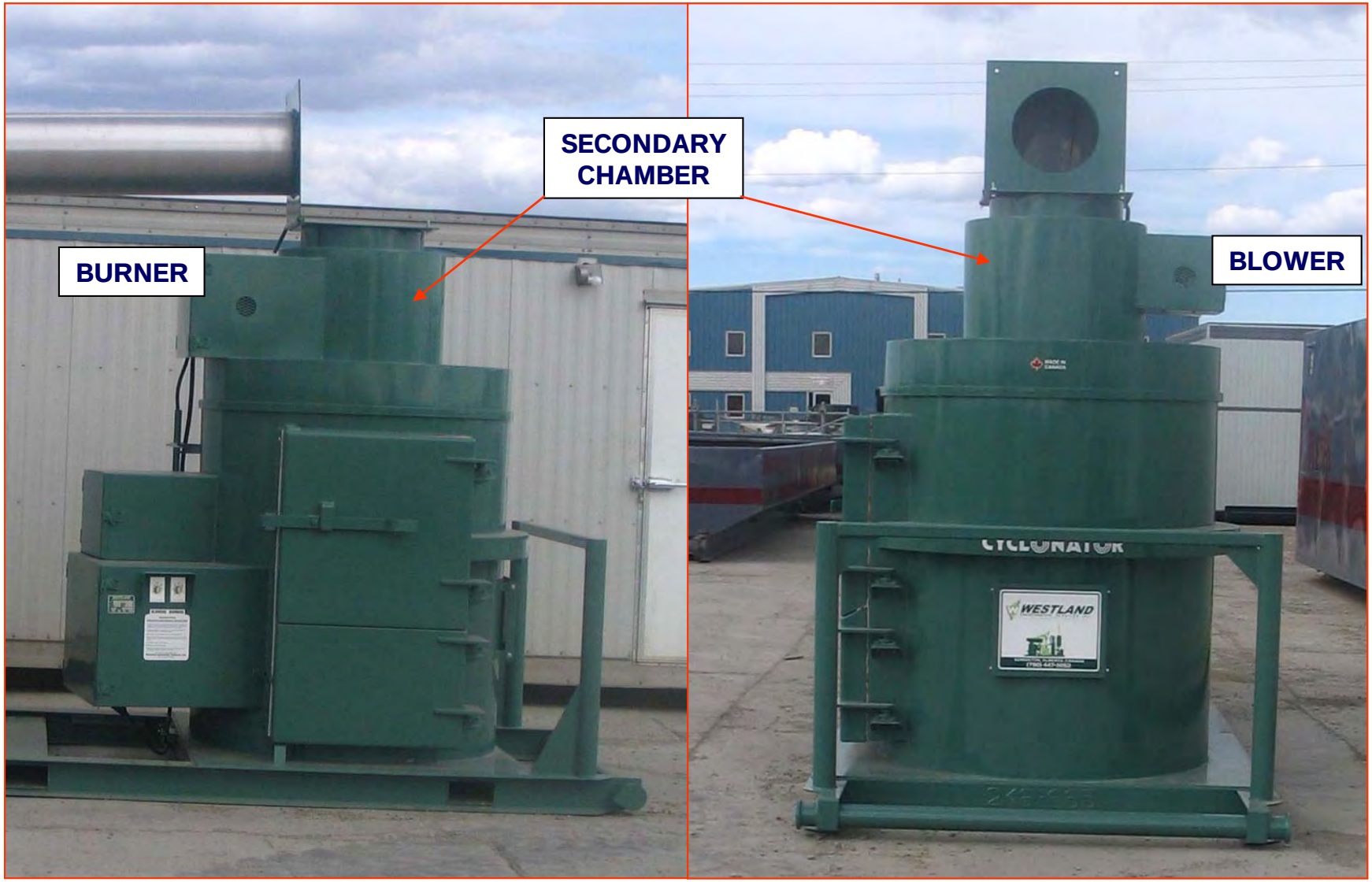

Figure 6 Photographs of the Dual-Chamber Design

Table 7 Components and Their Functions

COMPONENT	FUNCTION	DESCRIPTION
Primary Chamber	Waste combustion	WES *. Refractory lined (3 "), insulated (1")
▪ Burner	Supply heat to ignite and sustain combustion	Beckett SF or Midco Incinomite
▪ Blower	Supply air (oxygen) for combustion	AMU series
Secondary Chamber	Complete combustion	WES *. Refractory lined (3"), insulated (1")
▪ Burner	Supply heat to ignite and sustain combustion	Beckett SF or Midco Incinomite
▪ Blower	Supply air (oxygen) for combustion	AMU Series
Control Panel	Timers for burner and blower operations	Intermatic
Diesel Tank	Supply of auxiliary fuel	WES *
Valve	Cut off fuel to burner(s)	(General)
Filter	Prevent clogging of burner nozzle	LFF 22
Stack	Disperse hot flue gas	WES *. SS Stack
Electrical System	Burner and blower operations	WES *. 115 V, 60 Hz, Single Phase

Note: WES * : Manufactured in-house. Manuals for blowers and burners are in Appendix A: Information sheets and Manuals for Burners and Blowers

4 OPERATION AND MAINTENANCE

4.1 Safety equipment

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 are 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.

4.2 Routine inspection and maintenance

- Check fuel lines for leak and check connections
- Check spark arrestor to ensure no plugging
- During ash removal (see next section):
  - Inspect refractory for large cracks (not expansion cracks)

- Check combustion air hole for plugging
- Inspect door gaskets for damages

4.3 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
- (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 OK to minimize dust generation
- Dispose of ash as specified in the guidelines or regulations

4.4 Pre-operational checks

- Install stack if necessary
- Check fuel tank to make sure enough fuel (Use 5 USG/h for single-chamber, and 7.5 USG/h for dual-chamber. Actual values depend on the size of the incinerator.)
- Open fuel valve
- Re-check that combustion chamber is empty and combustion air hoes are clear
- Connect electrical plug
- Prime pump if necessary

4.5 Waste batch preparation

As previously mentioned incinerator capacity in kg/h is dependent on the heating value of the waste, which is normally not known. The nominal capacity of your incinerator is as shown in Table 5 for Type 1 to Type 3 waste, and somewhat less for Type 0.

The following cautionary notes should be followed:

- NO explosives, aerosol cans or 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 for health reasons.

4.6 Incineration

1. Re-check the burner and blower operations
2. Pre-heat the combustion chambers for 10 minutes: close doors and set the burner timer for 10 minutes
3. Load waste to Primary Chamber up to 60% of its volume
4. Start incineration: close waste charging door, set blower timer for 120 minutes and burner timer for 30 – 60 minutes depending on the amount waste loaded.
5. Check status: set timers off, open waste charging door, inspect and rake if necessary

6. If combustion is not complete, repeat Steps 4 and 5 until it is.
7. If there is more waste to be burnt, repeat Steps 3 to 6. Otherwise, go to shut-down protocol.

4.7 Shut-down

- Make sure all timers are off
- Unplug electrical connection
- Turn off fuel valve
- Un-install stack if incinerator is to be moved elsewhere.

4.8 Maintenance

In addition to the routine inspection and maintenance previously mentioned, only the burner(s) and the blower(s) require maintenance, which is quite minimum; see manuals in Appendix A: Information sheets and Manuals for Burners and Blowers. The fuel filter should be replaced every three months.

4.9 Auxiliary Fuel Consumption Rate

Figure 7 shows the volumetric flow rates of propane and diesel as a function of burner rating.

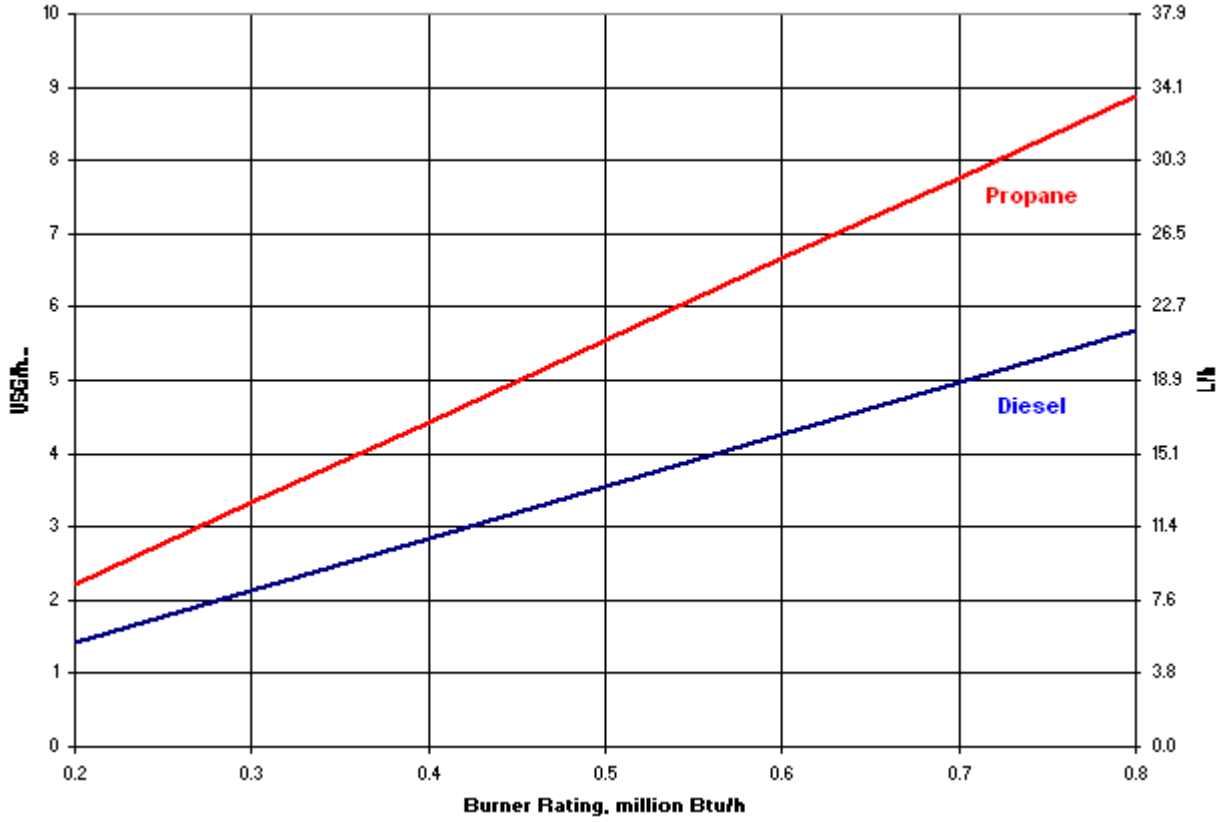

Figure 7 Consumption Rates of Propane and Diesel

5 WARRANTY

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 therefrom 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 operated and 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: _____

SERIAL NUMBER: _____

APPENDIX B

Incinerator Operation Log

NTPC Incinerator Operation Log

Year: Plant:

Date	Operator Name	Waste added (kg)	Waste Description	Temperature	Incineration Time	Ash Produced (kg)	Notes

Send completed log to: Andrew Ellis, NTPC Hay River

Other Notes

Record all other operational information here. All entries should include your name and the date.

Problems experienced:

Changes in operation:

Staff training:

Fuel consumption:

Ash or emissions testing:

Other: