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Waste Management Plan
Camp Operations & Project Support
Slater River Project
Norman Wells, NT

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1. INTRODUCTION

a. BACKGROUND

Husky Oil Operations Limited (Husky) is continuing activities on the Slater River Project located southeast of Norman Wells, NT to facilitate additional construction as well as exploration drilling and completions operations. Pursuant to Exploration License EL-463 Husky will facilitate the next phase of drilling for the project from September – October 2013. The completions phase of this activity will commence in October 2013 and continue until January 2014 with ongoing drilling and completions operations throughout 2014 and beyond. This activity will require a camp population of approximately 240 – 310 onsite personnel staying in the provided camp accommodations. Husky will mobilize personnel and equipment during the 2013 summer season to set up these continued drilling and completions operations.

The current camp accommodations are located on the camp/storage site and is a 103 person skid-mounted camp operating under existing Water License S11L3-002 and Land Use Permit S11T-002 which were granted by the Sahtu Land and Water Board (SLWB). These permits regulate the use of land and water resources, as well as the deposit of domestic waste streams as they pertain to this project. The current Land Use Permit allows for a 150 person camp with a 40 person contingency camp for a total occupancy of 190 persons.

Husky proposes to install a second camp which will bring the site occupancy level up to 310 people. To accommodate future project needs, Husky is requesting a maximum occupancy of 400 persons. This will provide flexibility to add additional camp accommodation if required. The new camp will be situated on the camp/storage expansion and adjacent to the current camp.

The purpose of this application is to incorporate the common activities covered by four current land use permit and water licenses that will encompass previously approved operations to support the ongoing exploration efforts. Camp Operations Waste Management Plan will dictate the safe and compliant management of waste as it relates to the base camp complex. The same operating principles and requirements of the previous land and water licenses will be adopted and adhered to regarding the new permits for camp operations.

Table 1. Current Husky Land Use Permits and Water Licences.

Permit or License	Permitted or Licensed Activity
Land Use Permit S11T-002	Permits camp operations, winter access, construction and use of staging area
Water License S11L3-002	Permits water for camp operations
Water License S11L1-003	Permits water for drilling operations
Land Use Permit S12-007	Permits construction and maintenance of an all-weather road, camp/storage site, airstrip and quarrying
S12X-006	Permits groundwater exploration program

b. CONTACT INFORMATION

The Slater River Project is owned and operated by:

PROJECT OPERATOR: Husky Oil Operations Limited
707 - 8th Avenue SW
Calgary, Alberta
T2P 1H5

SLATER RIVER PROJECT WASTE MANAGEMENT CONTACTS:

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c. PROJECT LOCATION

Husky's Slater River Project is located approximately 40 km southeast of the Town of Norman Wells in the Sahtu Region of the Northwest Territories.



Figure 1. Location of Slater River Project

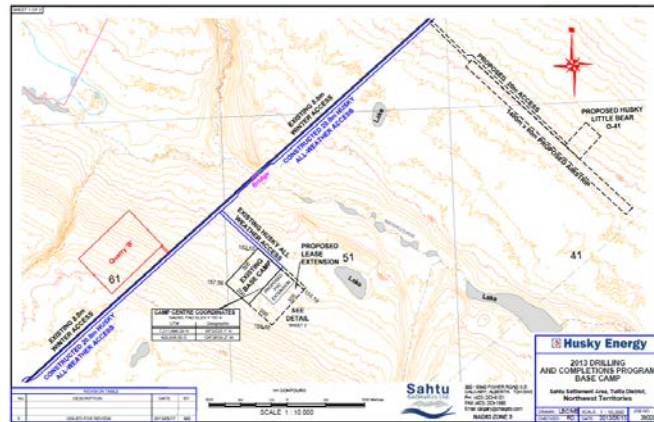


Figure 2. Location of Base camp at Slater River Project.

Access to the Slater River Project will be limited to barge vessels as well as fixed and rotary-winged aircraft in the spring, summer and fall. Ground access to site is only available during the winter months when the GNWT Winter Road is accessible. There is a limited amount of time to utilize the ice roads as the road is only operable early January to late March. Once spring break up occurs, there are no all-weather roads to enable access to the site, and barges or aircraft become the only means of transportation. A staging area was constructed on the west side of the Mackenzie River and will be used to offload barge supplies and store equipment.

Table 2. Base Campsite Location

Coordinates (NAD83 Zone 9)			
Latitude	Longitude	Northing (m)	Easting (m)
65.007681°N	126.435543°W	7211569	620875

d. EFFECTIVE DATE

Based on the receipt of required approval(s) this plan will be effective once the selected camp is mobilized to site via barge transportation and setup to support operations for the Slater River exploration drilling and completions projects. Mobilization of the camp will commence in summer of 2013.

e. PROPONENTS PRINCIPLES

This waste management plan incorporates the basic principles of waste management, source reduction, reuse, recycle/recover, treatment and disposal. Husky Energy is committed to conducting operations within the accepted environmental standards of the oil and gas industry. These methods are important to the oil and gas industry in reducing the environmental footprint of operations.

- Source reduction is the elimination or decrease of the volume or toxicity of waste by adopting practical methods such as using alternative materials or processes. This can be achieved by material elimination, inventory control and management, material substitution, process modification and improved housekeeping, maintenance and training.
- Reuse is achieved by using a product more than once for the same application or for different purposes. Reusing material such as drilling fluids is an industry expectation and can reduce the amount of waste generated.
- Recycling of products that typically have one use is an excellent method of reducing the volume of waste generated at a worksite. Sorting the products so that they can be managed in bulk eliminates the need for additional handling and allows for different products to be managed by efficient recycling processes.
- Waste treatment is used to reduce the volume, mass and/or toxicity of the material prior to disposal due to contaminants contained within the waste. There are a number of treatment options including thermal, chemical, biological and physical processing which may be used separately or combined to be the most effective and efficient.
- Disposal of waste is the final option for waste management. When disposing of waste, the type of waste, volume, location and final containment must be considered. The waste disposal options available to the oil and gas industry include deep well injection, landfills, and on-site burial or land farming. The physical and chemical characteristics as well as the regulatory requirements and liability associated with disposal may limit which options are available for waste disposal.

f. PURPOSE OF THE PLAN

This Camp Operations Waste Management Plan (WMP) will detail how waste generated will be safely managed. The management of camp wastes, particularly hazardous materials, are stringently regulated and require planning and implementation of those plans to handle waste in a compliant manner. The ultimate goal of waste management is to safely manage waste streams in temporary storage onsite, until waste can be treated onsite or shipped offsite and received at an approved waste management facility for end

disposal.

This Waste Management Plan will cover:

- Waste types including characterization of waste and waste management methods;
- Incineration management and ash disposal;
- Sewage and domestic waste water;
- Hazardous waste;
- Non-hazardous and other waste streams;
- Contractor services in regards to onsite waste management; and
- Project Emissions information

A relevant and up to date Waste Management Plan is necessary for projects requiring land and water use permits. This plan has been prepared for the Sahtu Land and Water Board and is being submitted by Husky to address the requirements and conditions set out in the Land Use Permit and Water license. Husky shall maintain a copy of this plan on site in a readily available location to the satisfaction of the inspector.

g. REGULATORY REQUIREMENTS

The following regulations are brief summaries of the legislation that affects the handling, transport and disposal of waste. Further details can be found in the CAPP Draft Guide “*Oil and Natural Gas Waste Management – Northwest Territories*” April 2008.

i. Federal

Canadian Environmental Protection Act 1999 (CEPA 1999) CEPA 1999 distinguishes between hazardous waste and hazardous recyclables in order to provide flexibility for dealing with materials that can be recycled. It is also based on a number of principles which includes the polluter-pay principle where producers and users of harmful substances, pollutants and wastes have a responsibility for bearing the costs associated with the safe use and disposal of these substances and wastes.

Particular regulations have been developed under the authority of CEPA 1999 that impact waste management. These include the Inter-provincial Movement of Hazardous Waste Regulations.

This regulation came into effect in August 2002 and replaced the provisions for movement of waste that were formerly regulated by the federal Transportation of Dangerous Goods Act (TDGA). Under this regulation duties for the waste generator of hazardous waste include:

- During transport, the Movement Document shall be kept in the location required for shipping documents under the Transportation of Dangerous Goods Regulations.
- The waste generator or the waste consignor shall send the required copies of the Movement Document with the waste transporter, and send the required copy to the appropriate authority of the territory.
- The consignee shall complete Part C of the Movement Document and shall ensure that the appropriate copies of the completed document are distributed to the appropriate authority of the territory.
- The consignor, each authorized carrier and the consignee shall retain a copy of the Movement Document for a period of two years after the hazardous waste is received by the consignee at their principal place of business in Canada.

Due to the remote location of the Slater River Project, all waste that cannot be handled on-site will require transport off-site to an approved receiving facility. Transport of waste will be limited to ice road during the winter season and barge vessels during summer/fall seasons. A fixed wing aircraft may be utilized at any time during the project as a last resource. When shipping waste using barge or aircraft, additional regulations will apply.

Transportation of Dangerous Goods Regulations:

The latest version of the federal Transportation of Dangerous Goods Act (TDGA) and regulations came into force in August 2002 and is informally called the Plain Language version. TDGA regulates the transportation of dangerous goods in Canada. The hazard classifications were the basis of current hazard definitions for wastes. The 2002 Plain Language Version of TDGA removed references to waste manifesting, used to track waste movements. The revision also removed several distinct waste classes from the TDGA. Wastes must still be classified under TDGA for shipment.

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International Maritime Dangerous Goods Code:

The International Maritime Dangerous Goods (IMDG) Code will apply to all shipments of waste being transported on a barge. The IMDG code is an international guideline to the safe transportation or shipment of dangerous goods or hazardous waste by water on a barge or other vessel. This code is intended to protect the crew onboard the vessel as well as to prevent marine pollution. It includes advice and information on terminology, packaging, labelling, placarding, markings, stowage, segregation, handling and

emergency response. The code is updated every two years by the DSC Sub-Committee of the International Maritime Organization (IMO). It is imperative to use the information from the most recent edition of the published code. The 2012 Edition; Incorporating Amendment 36-12, will be voluntary starting 1 January 2013 and become mandatory on 1 January 2014. All individuals preparing waste for shipment via barge must be trained and certified to handle and offer for transport various waste streams.

International Air Transport Authority:

In Canada, legislation for the transportation of dangerous goods by air is contained in the Clear Language Transportation of Dangerous Act and Regulations, Part 12 – Air. Transport Canada's Regional Aviation Dangerous Goods Offices are responsible for the administration and enforcement of the requirements that pertain to the transport of dangerous goods by air. The International Air Transport Authority (IATA) regulates all dangerous goods or hazardous waste shipped on aircraft.

Due to the sensitivities of shipping hazardous waste on aircraft, the regulations governing IATA are very strict and require waste to be packaged according to specific packaging instructions. The successful application of regulations concerning the transport of dangerous goods and the achievement of their objectives are greatly dependant on the appreciation of all individuals concerned of the risks involved and on a detailed understanding of the regulations. Husky does not anticipate hauling of any oilfield wastes via aircraft at this time, but is aware that these regulations exist.

ii. Northwest Territories

The Environmental Protection Act, in force since 1988, prohibits discharges of contaminants into the environment. It also enables officials to create regulations, guidelines and permits and to enforce the regulations. There are several regulations promulgated under the Environmental Protection Act. Otherwise, many guidelines have been issued to cover various components of waste management. Most of the guidelines have not been updated since 1998. They are administrated by the Environmental Protection Service (EPS) of the Department of Environment and Natural Resources (GNWT – ENR).

Guideline for Industrial Waste Discharges in the Northwest Territories: This was developed for the disposal of residual waste, both solid and liquid, from industrial operations in the NWT. It was authored by the Environmental Protection Service (EPS). This guideline sets the standards for industrial wastes that are suitable for landfills in the NWT.

Guideline for the General Management of Hazardous Waste: This was created to provide information for the proper management of hazardous waste in the Northwest Territories, increase awareness of hazardous waste, and establish a "cradle to grave" monitoring

system for hazardous waste from generation to final disposal.

Municipal Solid Wastes Suitable for Open Burning: The NWT has prohibited the open burning of wastes including Municipal Solid Waste (MSW) and used oil in the development of waste management guidelines. However, the NWT allows burning of paper products, paperboard packaging and untreated wood waste where alternative methods of disposal or recycling are not feasible.

Northwest Territories Water Act: The Act became effective in 1992 and regulates the water in the Northwest Territories in designated areas. It does not cover waters in designated federal parks. The act enables regulations and the Northwest Territories Water Board to support the Act. The Act defines waste (section 2) as:

- Any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of the water to an extent that is detrimental to its use by people or by any animal, fish or plant, or
- Water that contains a substance in such a quantity or concentration, or that has been so treated, processed or changed, by heat or other means, that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water to the extent described in paragraph (a).
- Any substance or water that, for the purposes of the Canada Water Act, is deemed to be a waste.
- Any substance or class of substances prescribed by regulations.
- Water that contains any substance in a quantity or concentration that is equal to or greater than a quantity or concentration prescribed by regulations.
- Water that has been subjected to a treatment, process or change prescribed by regulations.

Except in accordance with the conditions of a license or as authorized by regulations no one shall deposit or permit the deposit of waste (Section 9):

- In any waters in a water management area.
- In any other place under conditions in which the waste, or any other waste that results from the deposit of that waste, may enter any waters in a water management area.

The Northwest Territories Waters Regulations is enabled by the Northwest Territories Water Act and provides the details for management of wastes. Any industrial activity other than mining and milling, including hydrostatic testing, the exploration for, and production and transportation of oil and gas and cooling systems, are covered by this regulation.

2. WASTE TYPES

a. WASTE CHARACTERIZATION

Waste characterization is used in assessing the appropriate handling, treatment, transportation and disposal of the waste. Characterization is the assessment of the physical, chemical and toxicological properties of the waste product. These properties are used to determine the dangers relating to handling, storage, and transportation of the waste on public roads, as well as to determine the environmental consequences of the waste so that an appropriate disposal option can be determined. This also allows the determination of a hazardous or non-hazardous waste as well as dangerous oilfield waste classification as required in Alberta. Waste transportation and disposal is regulated by the NWT or Environment Canada and the receiving jurisdiction, in this case Alberta.

Regulated wastes include any waste material which is specifically regulated as hazardous (in CEPA or through the various guidelines issued by EPS of GNWT-ENR), and dangerous for transport (in CEPA and TDGA). The NEB through COGOA and CODGR controls all wastes associated with a drilling activity except for the drilling wastes (drilling fluids and drill cuttings) which are managed by Aboriginal Affairs and Northern Development Canada (AANDC) and the Sahtu Land and Water Board.

The following are properties that wastes may have that require additional personal protective equipment, and safe work procedures when handling, storing and disposing:

i. Ignitability

This will apply to liquids, solids or gases; however, the most common are liquids or solutions which have a flash point of 23°C or below. Other materials included in this class are oxidizers which readily yield oxygen to support the combustion of organic materials, waste which can spontaneously combust, and flammable compressed gases. Examples of ignitable wastes include acetone, hexane, methanol, and isopropanol.

ii. Corrosives

This classification applies to liquids only. A waste is corrosive if its pH is equal to or less than 2, or equal to or greater than 10. Liquids which corrode steel at rates greater than 6.35 mm/yr are also considered corrosive. Examples of corrosive waste include mineral acids, sodium, and potassium hydroxide.

iii. Reactivity

This classification encompasses two types of hazards; physical and health. Wastes with reactive physical characteristics are those with the potential of reacting violently, presenting fire hazards, and/or capable of explosion at normal temperatures and pressures. Wastes with reactive health hazards are those which will release toxic or irritating vapours or fumes when mixed with water or acids. Examples are reactive laboratory wastes, such as sulphide solutions and water-reactive metals.

iv. Toxicity

This classification includes those substances which are capable of causing acute, chronic or adverse effects in humans and/or the environment. Examples of toxic wastes include biocides, carcinogens and heavy metals such as lead, chromium and arsenic.

Generally, a waste is considered non-hazardous if it does not possess any of the above mentioned characteristics; however extreme caution must be used when following these guidelines. Although some materials do not fall into these hazard classes, they still may pose a threat to the environment or humans and should be handled accordingly. The following compounds could be considered in this class:

- Sulphur dioxide and other sulphur compounds
- Oxides of nitrogen and other nitrogen compounds
- Carbon monoxide
- Organic compounds, in particular hydrocarbons (except methane)
- Heavy metals and their compounds
- Dust, asbestos, glass and mineral fibres
- Chlorine and its compounds
- Fluoride and its compounds

If doubt exists whether a material is a “hazardous waste” or a “dangerous good” consult with your supervisor or the onsite environmental representative.

b. WASTE MANAGEMENT METHODS

i. On-site Methods

Physical Methods:

Physical methods such as gravity separation and filtration are means of reducing solids and ease of handling of both liquid and solid. Residual surface water fluids meeting applicable criteria can then be pumped to natural areas to recharge the natural water cycle. Detailed information and requirements related to this strategy are included hereinafter.

Wastewater Dehydration:

Dehydration is used to reduce quantities of contaminated water that can be readily evaporated at low temperatures [100°C or less] such as water. Boiler blow-down water, snow contaminated with hydraulic oil or motor oil from various equipment or vehicle spills are evaporated using a diesel fired evaporator to reduce the volume. The resultant liquid is placed in drums or tanks and transported out of the Northwest Territories for recovery or disposal at an approved facility.

Incineration:

Incineration is another means of reducing the mass and volume of waste, including paper products, domestic rubbish, and kitchen wastes. It is also a method used to prevent wildlife scavenging. It is important to segregate the plastics and heavy metals from normal waste to meet the dioxin, furan and mercury standards. A two stage forced air, diesel fired incinerator with properly trained personnel will be utilized. Resulting ash is packaged, and transported to at an approved waste received waste facility.

ii. Off-site Disposal

Landfill Disposal

Landfills are generally specially constructed and monitored facilities designed to accommodate burial of waste. A key consideration in the operation of a landfill site is the need to ensure long-term containment. Husky will be using approved Landfill Facilities designed to receive construction and domestic waste.

Waste Transfer Facility

Waste transfer facilities are utilized by industry to accommodate smaller volumes and typically containerized waste. Hazardous or non-hazardous waste is received then consolidated with like wastes; this bulked material is then transported to end or final receiving facilities. The final receiving facilities are typically engineered to facilitate specific waste streams based on characterization and classification. These facilities are only utilized for waste transfer; as such they are engineered and regulated in a fashion that prevents environmental impact. Transfer facilities are licensed to receive all classes of waste with the exception of Class 1 Explosives and Class 7 Radioactive.

c. WASTE RECEIVING FACILITIES

Husky will only transport and dispose of waste utilizing approved carriers and receivers. This guarantees the companies are registered with the provincial authorities and hold all applicable licenses and permits to handle the waste they will transport or receive. It will also ensure cradle to grave management of liabilities associated with generating and

transporting hazardous or industrial wastes. Once the waste stream is received at the applicable, approved facility, the responsibility and liability is then transferred to the receiver.

Husky will be selecting approved disposal facilities based on liability as well as, general logistics and economics. This means Husky will select the closest approved facility that is located in the general area the trucks are dispatched from. This will not only reduce the cost of transporting the waste but will reduce the liabilities associated with the trucks being on the road for great distances.

d. **WASTE GENERATION TABLE**

Attached as Appendix A, a detailed table includes a summary of wastes to be generated during the completion program. This table also includes the description of generation, estimated volumes and addresses potential adverse environmental effects.

3. WASTE MANAGEMENT AT SLATER RIVER

Various wastes are generated during the day to day activities associated with operating camp facilities. It is essential that wastes are handled, stored and managed in a safe and environmentally responsible manner. Remote sites often face logistical challenges that must be rectified prior to project commencement. This section of the plan will go into specific detail on the type of waste management options Husky will utilize for the operation of their camp facilities which will house the crews required to facilitate the Slater River Project.

Should a spill occur at any time, please refer to the '*Spill Prevention and Response*' section of the Husky Oil Operations Emergency Response Plan. The disposal of wastes associated with spills and remedial plans will be determined by consultation among the Incident Commander, Husky Environmental Staff, environmental protection agency personnel, and any external environmental consultants that are contracted by the company.

Husky will report all spills immediately in accordance with instructions contained in the "Spill Report" from NWT. The 24 hour spill report line is (867)-920-8130. Additionally if an unauthorized discharge of waste(s) occur, or if such a discharge is foreseeable, Husky will:

- a) Employ the appropriate Spill Contingency Plan
- b) Report the incident immediately via the 24 hour NT-NU Spill Report Line. Currently the number is (867) 920-8130 and/or e-mail spills@gov.nt.ca
- c) Report the unauthorized discharge of waste to an inspector within 24 hours,
- d) Submit to the SLWB and an Inspector, a detailed report on each occurrence not later than 30 days after the initial reporting of the event, if required.

a. INCINERATION

i. Background

Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration is an efficient means of reducing the mass and volume of waste, including paper products, domestic rubbish, and kitchen wastes. Burning these waste streams is important to reduce the impact to local wildlife and will eliminate scavenging around the camp.

Non-hazardous waste generated by the camps and project activity will be incinerated by a method approved by the Water License Inspector. The Slater River Project utilizes forced-air fuel fired incinerators to incinerate all combustible garbage and debris generated by the project.

Husky will utilize three CY-2050-FA-D incinerators located at the main camp complex to manage burnable waste streams generated by the camp and drilling and completions projects. The unit is forced air and runs on diesel as per the conditions above. Consistent with Husky's intent to be a responsible operator, the main objective of this section is to ensure the incinerators are operated in a safe, efficient and environmentally compliant manner.

ii. 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). Husky's selected model is a batch feed incinerator.

The Technical 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 document 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. A copy of the Technical Document for Batch Waste Incineration can be found on Environment Canada's website or by using the following link:

<http://www.ec.gc.ca/gdd-mw/F53EDE13-1D01-4D05-B97D-1F3818D28657/Technical%20Doc%20for%20Batch%20Waste%20Incineration.2010.pdf>

iii. Waste Composition

Understanding waste stream composition is important as it drives advanced opportunities for waste management planning including control of incineration on-site and off-site movement. Based on operational experience in the region we can estimate waste types

and volumes that will be generated to predict required on-site incineration and off-site management. Once operational, incinerator logs and operational checklists will be used to monitor types and quantities of waste generated. Using information from former operations, Environment Canada and industry knowledge we can predict and plan waste management requirements. Tables and information illustrate anticipated program waste composition and annual volumes generated.

Table 3. Estimated composition of Slater River Incinerator waste streams.

Waste Type	Estimated Percentage of Waste by Weight	Management Method
Food Waste	40%	On-site Incineration
Paper/ Cardboard	20%	On-site Incineration
Plastic	10%	Off-site disposal
Inorganic	5%	Off-site recycle
Wood/Debris	25%	On-site Incineration

It is estimated that each individual generates 2.2 kilograms of domestic waste per day. This information can be used to determine the total monthly volume based on number of individuals' on-site. Operations will continue for approximately 10 months of the year allowing an annual volume estimate to be calculated. Of this total volume of waste generated approximately 85% of waste will be incinerated and 15% transported offsite for disposal or recycle. Incineration of waste will reduce the volume by approximately 85% resulting in 15% of residual ash. Waste ash will be temporarily stored for transportation and disposal off-site.

Table 4. Estimated annual domestic waste generation and incinerator ash.

Number of Personnel	Domestic Waste	On-site Incineration	Off-site Management	Estimated Ash
240	158,400 kgs	134,640 kgs	23,760 kgs	20,196 kgs
310	204,600 kgs	173,910 kgs	30,690 kgs	26,087 kgs
400	264,000 kgs	224,400 kgs	39,600 kgs	33,660 kgs

iv. Waste Collection and Segregation

Proper waste segregation is important in any incinerator application and only appropriate camp waste is permitted for burning. It is important to segregate hard plastics (ex, PCV piping) and heavy metals from normal waste to reduce the amount of dioxins, furans or mercury present in the stack emissions.

Dioxin and furan emissions from incinerators may be reduced by:

- Reducing or removing certain waste types from the incinerator waste stream;

- Burning waste in batches according to moisture content and caloric value;
- Placement of waste in the incinerator chamber according to manufacturer specifications to ensure optimal burning efficiency of waste; and
- Use of Pre-Operational, Operational and Maintenance Checklists and Log Books to ensure that the unit is operated in a safe and efficient manner.

There are certain waste streams that if incinerated can pose a threat to either the operators or the environment. Incinerator waste is segregated at the source to ensure non-burnable waste streams do not enter the feed stock for the incinerator. In the camp complex, all “burnable” waste is placed in specifically identified waste receptacles with transparent bags. Throughout the camp footprint there will also be sealable bins that will collect waste from field activities and crews.

Incinerator waste streams will be collected and stored onsite in sealable bins located at the base camp complex. The bins are sealable so as to reduce attractants to wildlife. Crews collecting garbage for incineration will load only the amount of waste that can safely and efficiently be incinerated in one cycle for each operational incinerator (about 80-90 kg each). The cycle will take around one hour depending on the caloric value and moisture content of the waste. The remaining will be stored in the sealable bins until it is ready for loading to eliminate any potential for attracting wildlife.

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 (fluorescent bulbs/lamps, thermometers, thermostats)
- Asbestos waste
- Liquid wastes including petroleum hydrocarbons and liquid sewage
- Materials containing heavy metals (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 aerosols, pressurized vessels, unused or ineffective explosives
- Other hazardous materials such as organic chemicals (e.g. PCBs, pesticides)
- Batteries (Lead Acid, Alkaline, Lithium, NiCad)
- Electronics, tires, rubber boots, etc.
- Kitchen grease can be incinerated in quantities of less than 4L per burn

When encountered, all 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 will be handled on a case by case basis depending what the characteristics are of the inappropriate waste. Operators are to consult their superiors in the event they are not sure how to handle the rejected waste. Depending if the waste exhibits hazardous or non-hazardous properties it will be packaged and labeled accordingly.

v. Description of Incinerator

The Westland Model CY-2050-FA-D incinerator has a manufacturer's stated capacity to burn 90 kg of waste an hour using diesel as the auxiliary fuel. The incinerator comes with a 1350 L diesel storage tank that is mounted on a skid type frame. There are also spill kits available nearby in the event of a spill or leaking fuel line. The unit weighs 5000kg and is 6.2 meter high with the stack vertical. The air supply is a forced air design, complete with a duct to the primary air jets and to secondary over-fire air jets.

Husky has mobilized three of the CY-2050-FA-D to site in September 2012 utilizing barges. The CY-2050-FA-D's are well within the capabilities of the units to handle the waste generated by a 350 man camp. Three incinerators will allow the garbage to be incinerated in a timely manner allowing less waste to accumulate between burns. Additionally, in the event one unit is down for maintenance or repair there are two more units available to service the camp. These incinerators are designed to burn Type 1, 2, and 3 wastes. See below for a description of these wastes.



Table 5. Incinerator waste stream types and description.

Type	Description	Components
0	Trash	Paper, cardboard, cartons, wood boxes and combustible floor sweepings from commercial and industrial activities. Less than 10% by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags and plastic or rubber scraps.
1	Rubbish	Trash and Type 3 (No more than 20%)
2	Refuse	Rubbish and Garbage
3	Garbage	Animal and vegetable wastes, kitchen garbage, general mixed garbage with plastics
4	Animal Pathological	Carcasses, organs, hospital and laboratory samples

vi. Possible Hazards

The hazards that could be encountered while operating an incinerator are listed below: (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 may have multiple job responsibilities and could involve working with flammable liquids such as jet fuel, gasoline and solvents. Supervisors are 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 contaminated Tyvek coveralls and gloves are to be removed

and properly disposed of, prior to approaching the incinerator unit.

- Check PPE for any possible flammable liquid spills again, prior to approaching the incinerator. If the operator can smell any trace of fuel, they are not to approach the incinerator. They are to contact their supervisor immediately and inform them of the situation.

vii. Safety Equipment

The following personal protective equipment will be used while operating or loading the incinerator unit:

- Flame retardant coveralls or leather welder's jacket
- Long cuffed, puncture resistant gloves
- CSA approved, Grade 1 safety footwear
- CSA/ANSI approved safety glasses
- Canadian Standards Association (CSA)/American National Standards Institute (ANSI) approved full face shield

During ash raking or removal additional PPE is required and includes the use of respiratory protection to protect the operator from any particulate matter and hot ash that may be disturbed. This will include National Institute for Health and Safety (NIOSH) full face or half face respirator and N95 or P95 cartridge and CSA/ANSI face shield.

viii. Training

Personnel with the responsibility of operating the Westland Model CY-2050-FA-D incinerator will be required to read and comprehend this section of the Waste Management Plan and the Westland Operating and Maintenance Manual. It would be beneficial for operators to also read the attached Technical Document for Batch Waste Incineration to further understand the theory of combustion and the issues associated with Dioxins and Furan emissions.

Incinerator operators are familiar with this type of system and will have completed incinerator training from Westland. Husky has contracted this service out to Marquis Alliance who will be providing Environmental Service Technicians to perform the various functions of waste management including incinerator operation. Occasionally, these technicians may have to supervise and train some of the local workers that are hired as general labourers on the project. Only competent and knowledgeable staff will operate or perform maintenance on the incinerator.

ix. Batch Preparation

There is no perfect formula when preparing a batch of waste for incineration as multiple factors can manipulate or affect a burn cycle. Factors that could affect each burn cycle differently include;

- Moisture content and volume of waste.
- Fresh or 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.
- 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 if 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 determines the proper batch composition for efficient burn cycles. Operators will have to estimate the weight of the bags as a scale will be unavailable. The units can each only burn 90 kg of waste per load. If the incinerator is overloaded you will not get a complete burn and will have to run the cycle longer until only ash remains.

Depending on burn time required for complete combustion and the above mentioned variables the CY-2050-FA-D typically incinerates 8-11 90 kg batches during a 12 hour shift. Batches are prepared using the following process:

1. Waste is sorted into the following four categories before opening the incinerator door and feeding the waste:
 - Paper/Cardboard
 - Kitchen/Food
 - Burnable Debris
 - Wood (not chemically treated or painted wood)
2. The amount of food waste available for each burn will determine the required composition for the other waste streams. If the volume of waste to burn is larger than the capacity of the machine, the batch will be broken down into smaller batches and the extra waste will be burned during the next batch. The extra waste will be placed back into a sealable bin immediately to wait for the burn cycle to complete on the prior batch. This will keep the incinerator area clean and will eliminate wildlife activity in the area.

3. Food waste bags are counted and the bags weights are estimated. The number of bags and approximate weight of food waste are recorded in the daily operations checklist.
4. This process is repeated for both the paper and cardboard waste, plastics and wood waste. The number of bags is not crucial; it is the weights that will determine a proper burn.

The incinerator should be operated according to the Operation and Maintenance Manual. The operator shall ensure that every batch can go through the waste charging door easily, regardless of its weight. If there are large pieces of wood or other waste it will have to be cut down so it can be placed inside and the door securely latched.

x. 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 when loading a batch of waste:

- **Paper (or small pieces of clean wood):** load first and place at the back of the incinerator
- **Wood and Debris:** load second and cover the paper waste
- **Food:** load last and cover the wood waste
- **Rags and absorbent pads:** small amounts should be distributed evenly throughout the batch

The operator will then initiate the burn cycle as per the manufacturer's instructions. The operator will return half way through the cycle to stir the burning waste. All PPE including the respiratory protection mentioned in section 3.1.7 above must be used. If the incinerator was properly loaded the volume of waste should be reduced by up to 85-90% of the original mass.

xi. Record Keeping and Inspections

Routine inspections of the incinerator and fuel tank will be conducted by a trained individual prior to daily start-up 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.

The manufacturer will supply specific pre-operation, operational, maintenance and monthly checklists for the CY-2050-FA-D unit. Records will be kept on file for each burn and will be available for audit by Husky management or regulatory agency representatives. Any out-of-specification situations need to be brought to the supervisor's attention 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 smoke.

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 ash, including the weight transported and the location of the disposal facility.
- Analytical results of ash sampling.

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.

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. 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. This form also directs the operator to properly weigh and document the amount of ash produced from the last burn.

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 can be between 8-11 burn cycles during a 12 hour period. For each cycle the estimated weight of all streams of waste are documented separately. These waste streams are divided up into the following categories: food waste, paper/cardboard waste, untreated wood and acceptable debris. 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”.

Maintenance Checklists

Onsite maintenance of the units falls under the Construction/Environmental Supervisors at the Slater River Project. This team consists of electricians and personnel trained and certified to work on boilers and burners. They should perform a monthly and yearly inspection on the various components of the incinerator, including the burners and blowers. Preventative maintenance and repairs will be documented accordingly. Maintenance requirements are described in the Westland Operating and Maintenance Manual Incinerator manual.

Supervisor Inspection Checklist

This checklist is for use by the Supervisor. 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.

xii. Ash Management

Husky will file an annual report with the board not later than September 30th, 2013 and each year thereafter for the life of the water license. The report will contain information including the monthly and annual quantities in cubic meters of all wastes discharged including domestic and ash.

All ashes associated with incineration will be deposited in a solid waste disposal facility approved by the water license inspector. Any other non-hazardous solid waste not incinerated will be deposited in an approved solid waste disposal facility.

In the morning, when the combustion chamber of the incinerator is cool, the incinerator operator will remove the ash from the previous burn cycles before loading 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 3m³ ash bin. The bin is sealable to prevent attraction of wildlife. When full, this bin is sealed, weighed and stored until a few bins can be transported at the same time to reduce transport costs.

To properly classify the waste for shipment and to ensure the ash is not hazardous periodic samples will be taken and sent to an accredited lab for the following analysis:

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

These are part of the LANDFILL-CLASSIFIED: Class II Basic Landfill w/Paint Filter package required for disposal at most landfills. This will allow Husky to determine if the ash needs to be shipped offsite as hazardous or non-hazardous waste.

Ash from the incinerators will be shipped off-site for disposal as either hazardous or non-hazardous waste. The off-site waste handling facility will be provided with the analytical results. Hazardous waste shipments will follow the Transportation of Dangerous Goods regulations as well as the Interprovincial Movements of Hazardous Waste. Husky will be using approved waste receiving Facilities based on classification.

b. SEWAGE AND DOMESTIC WASTE WATER

All liquid wastes and sewage generated by the camp will be processed on-site by a portable Waste Water Treatment Plant (WWTP) prior to being spread on the surface of the land. The camp will house the WWTP's required to manage all sewage waste generated by the Slater River Camp. The current WWTP's have a capacity of 200 persons. Additional units will be added to accommodate the total camp capacity. These units utilize a membrane system, and will treat sewage to meet or exceed the waste water criteria for effluent discharge.

Four main waste streams are expected as a result of the waste water and potable water operations. These streams are listed below.

- Raw sewage generated from camp operations
- Treated Waste water effluent after treatment in the WWTP

- Residual Sludge generated during treatment in the WWTP
- Backwash waste water generated at the potable water plant.

Raw Sewage

Raw Sewage generated at the camp operations will be collected in a series of sewage lift stations equipped with automated, redundant level switches and pumps. When the sewage is generated it will be immediately pumped to the WWTP in flexible hoses equipped with both insulation and heat trace to ensure that the transfer lines do not freeze in the cold climate conditions.

Membrane System

Based on the size of camp being serviced, Husky will utilize membrane systems to treat sewage onsite. These plants are used in Alberta, British Columbia, Saskatchewan and the Northwest Territories. Systems are capable of producing treated effluent where the BOD and TSS can be expected to be lower than the values observed in the receiving environment.

The treatment process consists of several bioreactor tanks in front of the membrane bioreactor. These tanks serve to provide equalization storage, pre-treatment for suspended solids, oil and grease removal and recycle and growth of the activated sludge bio-solids, which help optimize system performance. The next part of the process involves the submerged plate and frame membrane system which is equipped with intense submerged fine bubble diffusers.

These plants will be operated daily by qualified personnel. There will be daily checks for all major equipment components, sampling effluent quality and temperature measurements, as these pertain to process performance.

Treated Effluent

After waste water effluent is treated in the plant, samples are taken and various parameters are verified to ensure that the effluent meets the criteria to discharge the waste to the environment.

All required analysis will be conducted in accordance to methods described in the current edition of "Standard Methods for the Examination of Water and Waste Water," or by such other methods approved by the analyst. During personnel change, approximately every two weeks, chain of custody samples will be transported to an accredited laboratory for testing for residual CBOD, TSS, Oil and Grease and Fecal Coliforms. An operator will be on site 24 hours a day, 7 days a week and will be responsible for the operation of WWTP systems as they will have special training for the operation of these plants. Discharge to the surrounding environment will commence once effluent meets the regulatory requirements.

Table 6. Criteria for WWTP effluent discharge

Parameter	Maximum Concentration
Suspended Solids	100mg/L
Oil and Grease	5mg/L and no visible sheen
BOD ₅	100mg/L
Fecal Coliforms (counts/100 ml)	< 1 x 10 ⁶ CFU/100 ml
pH	6-9

A series of discharge hoses will have small holes drilled throughout to slowly disperse the effluent across the chosen environment away from the camp.

Residual Sludge

Residual sludge generated on site will occur within the Membrane Bioreactor system as it is the natural by product of these processes. The eventual accumulation of sludge is impossible to avoid as these materials represent the inorganic fractions of the raw sewage and/or the organic fractions of the biomass highly resistant to aerobic decomposition. These residuals require final treatment and management at longer term facilities and as such will be vacuumed out and transferred to an approved facility for longer term treatment / management. These volumes are relatively small and represent only a minor fraction of the total volume of raw sewage generated and/or treated effluent disposed. Both the raw sewage and treated effluent flows are measured and recorded on site. Any trucked residuals or bypasses are also recorded with the logs to ensure an accurate record of the sewage, effluent and residuals is maintained. Solid wastes removed from the camp sewage effluent will be collected and deposited at an approved waste receiving facility.

Backwash Water

The final waste stream represents the backwash water from the potable water plant. Given the nature of the potable water plant and its pre-treatment cartridge filters, the backwash water is expected to be free of contaminants (essentially surface water). Current potable water standards do not permit the recycle of these backwash waters within the potable water plant. These waste streams will be pumped to the WWTP for final treatment with the raw sewage and subsequent effluent discharge.

Should the WWTP fail, heated, temporary storage tanks will be used to store the sewage and waste water onsite. If the system is repaired in a timely manner, the sewage and waste water stored in the tanks will be slowly fed through the waste water treatment system, and the effluent will again be discharged to the surrounding environment. If the failure is more substantial in time, transport and disposal of the sewage / wastewater will need to take place at an approved facility for treatment. Husky is currently seeking approval from various approved facilities for an emergency waste water treatment facility.

c. HAZARDOUS WASTE

Waste which may contain hazardous properties may be generated during the day to day operations of any facility or construction project. These hazardous wastes require special handling and disposal to ensure they do not negatively affect human health or the environment. The NT Guideline for the General Management of Hazardous Wastes define “hazardous wastes” as: *“A contaminant which is a dangerous good that is no longer used for its original purpose and is intended for recycling, treatment, disposal or storage. A hazardous waste does not include a contaminant that is:”*

- *Household in origin*
- *Included in class 1, Explosives or class 7, Radioactive materials of Transportation of Dangerous Goods Regulations (Canada)*
- *Exempted as a small quantity*
- *An empty container*
- *Intended for disposal in a sewage system or by land filling that meets the applicable standards set out in schedules I, III or IV of the Nunavut Environment Guideline for Industrial Waste Discharges in the NWT.”*

A copy of the Guideline for the General Management of Hazardous Waste in the Northwest Territories can be found on the GNWT Environment and Natural Resources website or by using the following link:

http://www.enr.gov.nt.ca/live/documents/content/General_management.pdf

An example of Hazardous waste that may be generated onsite includes equipment batteries, aerosols, solvents, some petroleum hydrocarbons, glycol contaminated fuel, etc. Please find applicable flowcharts in Appendix B.

Husky will dispose of all toxic or persistent substances in a manner approved, in writing, by the SLWB. All contaminated material will be removed from the permitted area in a timely manner. There is anticipated to be very small volumes of hazardous waste during the construction process. All hazardous waste generated during the constructions phase of the Slater River Project will be stored, transported and disposed of in a safe manner which minimizes, to the extent of possible risk to the site workforce, the general public and the environment. All hazardous waste generated at the project must be classified, collected in appropriate labeled containers, segregated into compatible groups, securely stored, transported and disposed of in an appropriate and approved manner. Documentation related to the management of hazardous wastes will be accurately completed, and submitted to required regulatory bodies with copy(s) retained onsite for a period no less than 2 years.

Husky has received a hazardous waste generator registration number **NTG000277** from the Northwest Territories Environmental Protection Division of Environment and Natural Resources.

i. Training

The Transportation of Dangerous Goods (TDG) Regulations state that;

“A person who handles, offers for transport or transports dangerous goods must;

- a) be adequately trained and hold a training certificate in accordance with this Part; or*
- b) perform those activities in the presence and under the direct supervision of a person who is adequately trained and who holds a training certificate in accordance with this Part.*

An employer must not direct or allow an employee to handle, offer for transport or transport dangerous goods unless the employee;

- a) is adequately trained and holds a training certificate in accordance with this Part;*
or
- b) performs those activities in the presence and under the direct supervision of a person who is adequately trained and who holds a training certificate in accordance with this Part“*

Personnel working in the waste management facility will be required to be certified or under the direct supervision of a certified individual in the following;

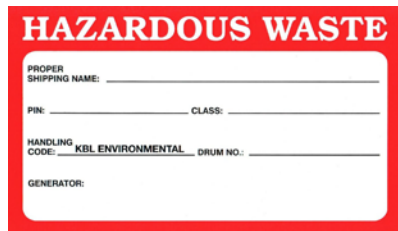
- Workplace Hazardous Material Information System (WHMIS)
- Transportation of Dangerous Goods (TDG)

ii. Handling and Storage

Safe handling precautions and product specific information is found in Material Safety Data Sheets (MSDS) which must be located on site and accessible to all workers. The following points will be considered for handling and storage of waste streams:

- Transportation means will be selected according to HSE requirements;
- Carriers of waste will be provided with instructions on how to handle emergency situations;
- All persons interacting with hazardous wastes will be required to wear the appropriate PPE;
- Regular inspections will be performed and recorded;
- Containers are placed so that each container can be inspected for signs of leaks or deterioration;

- All hazardous wastes are stored in a location that provides the maximum amount of safety for site personnel and protection of the environment;
- Incompatible chemical wastes are not packaged or stored together based on the WHMIS and/or the MSDS for each chemical;
- All hazardous wastes are stored on-site for the shortest practical length of time and in a manner that prevents release to the environment;
- Appropriately sized containers are used for collecting and storing the waste;
- In the case of 4 or 10 L plastic containers, 20 L pails, and 205 L drums, the container is also the “package” and shall have the appropriate waste label affixed to it;
- Efforts are made not to contaminate the outside of the container during filling. Containers and packages with visible signs of external contamination will not be used in the storage or transport of hazardous wastes;
- Personnel ensure that all container and package lids are secured tightly;
- Personnel ensure that all approved containers and packages are structurally capable of withstanding the aggregate weight of all containers within the package;
- Leaking or deteriorated containers are removed as soon as practical and their contents transferred to a sound container;
- The storage facility is equipped with emergency response equipment appropriate for the type and volume of materials stored within (i.e. spill kit, appropriate type of fire extinguisher, etc.); and
- All waste containers and packages are properly labeled according to the appropriate WHMIS, MSDS and/or federal Transportation of Dangerous Goods Regulations. The following general requirements will apply for waste labeling:
 - Each package must be labeled, an example is as follows:



HAZARDOUS WASTE

PROPER SHIPPING NAME: _____

PIN: _____ CLASS: _____

HANDLING CODE: KBL ENVIRONMENTAL DRUM NO.: _____

GENERATOR: _____

- Each container must be labeled with the contents prior to being packed and sealed;
- Only proper chemical names are used on all labels. Acronyms, trade names, or chemical formulas are not acceptable;
- UN numbers should be used in labeling where applicable to ensure clear identification of materials;
- Personnel ensure that all labels are securely attached to the container so that it will not come off during transport;
- All other labels must be removed from the container or otherwise made illegible (i.e. painted over, scratched out, or otherwise defaced);

- No waste may protrude from the packaging container and must be sealed for transport; and
- When transporting waste on site to the waste management collection area and berm, ensure it is secure and will not leak during transport as well as once in storage.

d. OTHER WASTES

Non-hazardous solid waste not incinerated will be disposed in a solid waste disposal facility approved by the water license inspector.

Lube Oils: As there are no plans to install an oil burner, all combustible petroleum products will be shipped off-site to a waste oil receiver. This oil will be tracked on movement documents.

Recyclables: will be packaged appropriately in multi-sectional bins and shipped to the appropriate recycling facilities, dependant on facility availability.

Wooden debris: will be recovered for reuse, burned in a suitable incinerator (described above) or transported for disposal at an approved landfill.

Food Waste: All food waste will be stored in sealed containers to prevent the attraction of wildlife.

Containers with Residues: The containers are to have the residuals consolidated by like wastes so that the drums can be considered empty with residuals. These drums must be empty and labelled as Residue Last Contained and tracked on a movement document prior to removal from site to a recycler. If waste cannot be safely consolidated, then Husky will classify the residuals according to class and volume and will dispose of the waste at an approved facility. Pails are to have the contents drained so that the lids can be removed, and the pails can be stacked inside each other and placed in lined mega bags. The lids can be thrown into the mega bag as well.

Scrap Metal: Metal will be consolidated in a marked bin on-site labelled "Scrap Metal". Only various types of metal shall be place in the bin. The bin is fitted with a winch style lid to prevent precipitation from entering the bin. Once full, the bin will be removed from site and the metal will be transported to a scrap metal recycler.

Discarded Machinery and Parts: These items will be collected in a designated laydown area and will be hauled out utilizing barges in the summer months or will be stored until the winter road opens in 2014 for ground transport via truck. Discarded machinery will have the fluids drained (oil, glycol, fuel) prior to transport.

Building and Building Material: Small volumes can be placed in the designated rig bins on-site. Sections for general debris have been labelled as such. Larger volumes or articles will be placed in a designated laydown yard and will be hauled out utilizing barges in the summer or winter road ground transport once the road is open in 2014.

Hydrocarbon Impacted Waters: This waste may be generated from the collection of surface run-on/run-off waters from rain or snow melt. Water will be managed as per Energy Resources and Conservation Board (ERCB) Directive 55, Section 11 titled Criteria for the surface discharge of collected surface run-on/ run-off water. Collected waters (in berms or dykes) must be tested and will meet the following criteria prior to being released in a controlled fashion to adjacent lands;

- Chloride content 500 mg/L maximum
- pH 6.0 to 9.0
- No visible hydrocarbon sheen
- No other chemical contamination
- Land owner or occupant consent
- Water not allowed to flow directly into any water course, and
- Each release shall be recorded, including the pre-release test data and estimated volume of water released.

If the water has been contaminated or does not meet the above criteria, the water will not be released to the environment. Impacted waters will be processed in an on-site dehydration unit and/or sent to an approved treatment or disposal facility depending on the characteristics of the contamination. This directive can be referenced at the following link: <http://www.ercb.ca/directives/Directive055.pdf>

e. Transportation

Storage containers will be utilized on-site for waste packaging prior to shipment off-site by marine and road transport or the 2014 winter road season. Due to the remote location, Husky faces logistical challenges when shipping waste off-site for disposal at an approved facility. Husky has the option of shipping waste during the short barge season utilizing the Mackenzie River or preparing waste for shipment via truck on the GNWT Winter Road.

All hazardous waste transported off-site for recycling or disposal must be packaged and transported according to the specifications provided in the Northwest Territories Guideline for General Management of Hazardous Waste in the NWT, the federal Transportation of Dangerous Goods Regulations (TDG), the International Air Transportation Association (IATA), the International Maritime Dangerous Goods (IMDG), and the Interprovincial Movement of Hazardous Wastes Regulations to meet specific requirements for packaging and labeling (placards, limitations, etc.) dependent on the mode of transportation.

Only personnel trained, certified and competent in the above regulations for shipment of hazardous waste on an aircraft or barge (IATA/IMDG) can prepare the waste for transport and can complete designated shipping documents.

Waste transported via barge to Fort Simpson or Hay River will require the waste to be transferred from the barge onto trucks with a registered carrier number to haul hazardous waste. For multi-modal transportation (barge to truck) a trained and certified individual (IMDG) will need to complete either;

- a) A "Successive Carriers" form recognized by Environment Canada and attach it to the original Marine waste manifest; or
- b) A second waste manifest for the second carrier cross referenced with the first waste manifest (from the first carrier) attached to the original waste manifest.

This ensures the waste is correctly manifested and tracked during its journey to an approved receiving facility. The type of waste in the container will dictate the disposal facility required. Hazardous wastes in small quantities (drums, mega bags, pails) will be transported to an approved facility. Bulk wastes such as solidified drill waste and cuttings will require receipt at an approved landfill. Liquids will be shipped via tank, drums or other bulk liquid container to an approved Oilfield Waste Facility.

f. Tracking and Recording

Tracking and recording waste types and volumes is a necessary and important function in an efficiently running waste management system. Adequate records on waste details such as dates, quantities, waste in storage, being transported, treated and disposed of, shall be kept for a period of at least two years. Husky maintains an accurate record of all hazardous waste materials generated on-site and all materials transported off-site. That record, at a minimum, includes:

- A list of the materials being stored/transported;
- The volume of each material being stored/transported;
- The type of container used to store the material;
- The location of the stored material; and
- MSDS sheets for all waste handled by personnel to ensure safe handling.

An excel template is used to track all waste currently waiting for transport off-site for disposal, treatment or recycling. A summary is prepared each year to monitor waste trends and allow for tracking waste volumes and types.

All waste records must be tracked from cradle to grave by the generator and kept on record for a period of two (2) years. The waste generator of the waste (supervisor or his delegate associated with the activity – construction) will be responsible for completing part A of the Federal Movement Document (FMD) This individual will be required to hold a

valid certificate in TDG.

Hazardous Waste: The Guideline for the General Management of Hazardous Waste in the NWT requires that a completed waste manifest form accompany shipments of hazardous waste. In addition, hazardous waste regulations in other provinces and by Environment Canada's Interprovincial Movement of Hazardous Waste Regulations must be followed. A Movement Document supplied by the Department of Environment and Natural Resources qualifies as a hazardous waste manifest form and is recognized by other provincial agencies. All parties involved in the disposal of hazardous wastes, the generator, the carrier and the receiver must be registered and provided with the appropriate registration number. In the NWT, these numbers are provided by the ENR according to the Guideline above.

The form contains the following information.

- detailed information on the types and amounts of hazardous waste shipped;
- a record of the firms or individuals involved in the shipment; and
- information on the storage, treatment or disposal of the waste and confirmation that they reached their intended final destination

The Generator (Consignor), Carrier and Receiver (Consignee) must each complete their portion of the FMD. The information provided on the FMD as well as other TDGR requirements (i.e.: labeling and placarding) are also intended to assist first responders (police, ambulance, fire fighters) with hazard information should a transportation accident occur. The FMD completion instructions are provided on the reverse side of each movement document.

Non Hazardous Waste: Movement documents will be used to track all non-hazardous waste. Hazardous Waste transported via aircraft will require an air waybill to be included with the federal waste manifest. Hazardous Waste transported via barge will require a maritime dangerous goods declaration as well as a federal manifest.

g. CONTRACTOR AND ENVIRONMENTAL SERVICES

Husky will have dedicated environmental consultants and waste contractor personnel both in the field and in the Calgary office during the project operations. Waste contractor selection will be conducted through the company's internal selection process to ensure that the contractor is qualified according to company requirements. The prime contractor at the worksite will provide oversight and manage all wastes with a dedicated waste management provider as deemed necessary. The contractor will comply with the following:

- Contracts with waste contractors contain appropriate provisions on health, safety and environmental protection

- Equipment provided for the storage and transport of wastes such as waste bins or containers and trucks are in good working order prior to being accepted by Husky
- Waste materials transferred to contractors are packaged and labeled appropriately, and shipping notification and documentation completed in accordance with approved procedures and that documentation rests with Husky at the end of the winter program
- Waste consignments reach the specified final disposal site and are disposed of at an approved facility
- Transportation costs are closely monitored. These costs are a major cost component of the waste management program and require close control.

Environmental services will include a senior environmental advisor who will provide direction and guidance to the program through the field environmental advisor. The field environmental advisor will be knowledgeable in the handling of wastes as well as requiring the following.

- Knows intimately the waste regulations for the NT, B.C. and Alberta
- Can characterize the wastes prior to generation or when it is generated
- Have influence in managing water volumes in the drilling operation
- Ensure that cross contamination of waste does not occur on the drilling lease or any other Husky operated property
- Coordinate the handling and disposition of wastes
- Track the waste material and volumes being generated, transported and manifested
- Monitor the performance of waste containing equipment being supplied by outside contractors and the authority to reject faulty equipment
- Work with the selected contractor and Husky's logistics personnel.

h. SLATER RIVER PROJECT EMISSIONS

Husky recently completed a comprehensive Emissions Inventory based on all the equipment located at the Slater River Project that could create emissions. These items include;

- Domestic Waste Incinerators
- Generators, Engines and Boilers
- Vehicles
- Propane Heaters and Dehydration Units

Each emission category above has a table indicating the emission factors used and associated reference. These tables can be referenced in Appendix E. The emissions inventory previously calculated for the equipment used for construction of the all weather road, staging area, airstrip and camp pad is located in the Construction Waste Management Plan under Water Licence S12L8-007, and Land Use Permit S12F-007. It has been added in Appendix E for quick reference as well.

Camp emissions noted in Appendix E have also been included in the inventory for both a propane burning camp and diesel electric generator camps. It may be that one or the other, or a combination of both will be used.

4. SUMMARY OF WASTE PLANNING

Each class of waste generated in Husky's operation is identified in the attached Waste Management Table which contains the following:

- Waste Stream
- Description
- Handling Method
- Disposal Method (Handling Code)
- AB Code
- Shipping Name
- PIN
- Class
- PG
- Comments

The Waste Management table will be posted at the operations site to help field staff determine how wastes are to be managed. The On-site Environmental Technician is responsible, in conjunction with the Husky Supervisor, to ensure that all wastes are managed accordingly.

Appendices

Appendix A **Husky Waste Management Table**

Appendix B **Guideline for the General Management of Waste in the NWT
Reference Diagrams**

Appendix C **Dangerous Goods Hazards Classes and Placards**

Appendix D **Energy Resources Conservation Board
Directive 55, Section 11 – Surface Water Discharge**

Appendix E **Emissions Inventory Summary**

Appendix A

Husky Waste Management Table

Appendix B

Guideline for the General Management of Waste in the NWT: Reference Diagrams

Appendix C

Dangerous Goods Hazard Classes and Placards

Appendix D

Energy Resources and Conservation Board

Directive 55, Section 11 – Surface Water Discharge

Appendix E

Emissions Inventory Summary



Husky Oil Operation Ltd.
Waste Management Summary Table

Waste Generator Number: NTG 000277										
Waste Stream	Description	Handling Method	Management Method	AB Code	Shipping Name	PIN	CLASS	PG	Est. Volume	Comments
Absorbents	Absorbent materials used for spill clean up	Store in drum with rags	Handled by construction, drilling or seismic contractor / send to an approved landfill	OILABS	Environmentally hazardous substance, solid, N.O.S. (pads cont/w BTEX)	UN3077	9	III	Unknown	CHECK FLASHPOINT, BTEX & SPONTANEOUS COMBUSTION
Aerosols	Not Empty	Bulk in an approved drum or pail	Transport to an approved waste receiving facility	WSTCGS	Aerosols, flammable (waste)	UN1950	2.1	N/A	Unknown	
Antifreeze / Glycol	From engines possibly contaminated with heavy metals	Store in drum	Transport to an approved waste receiving facility	GLYCHM	Environmentally hazardous substance, Liquid, N.O.S. (used antifreeze)	UN3082	9	III	Unknown	CHECK LEAD
Batteries (acid)	Lead / acid batteries	Wear glove,handle carefully, store upright in battery bins or palletize	Transport to an approved waste receiving facility	BATT	Batteries, wet, filled with acid, electric storage (waste)	UN2794	8	III	Unknown	
Batteries (alkali)	Alkali batteries	Wear gloves, handle carefully, store upright in battery bins or palletize	Transport to an approved waste receiving facility	BATT	Batteries, wet, filled with alkali, electric storage	UN2795	8	III	Unknown	
Batteries (gel cell)	No free liquid and unable to leak if battery were damaged	Store separately from other wastes	Transport to an approved waste receiving facility	BATT	Not regulated by the TDG Act and Regulation	N/A	N/A	N/A	Unknown	
Batteries (NiCd)	Rechargeable consumer batteries	Store separately from other wastes	Transport to an approved waste receiving facility	BATT	Not regulated by the TDG Act and Regulation	N/A	N/A	N/A	Unknown	
Beverages Cans and Plastics	Pop and juice containers	Place in Enviro-bin or Seacan	Recycle	No Provincial Code	Not regulated by the TDG Act and Regulation	N/A	N/A	N/A	Unknown	
Containers with Residue	Empty chemical drums, less than 2% full	Store in secure area on sides, lids and bungs on	Transport to an approved waste receiving facility	EMTCON	Sample to confirm management method	Unknown	Unknown	Unknown	Unknown	TDG INFORMATION WILL DEPEND ON THE CLASS OF RESIDUE
Contaminated Snow	Snow contaminated with either diesel, oil, drilling fluid or other spill material	Consolidate contaminated snow and place in a dehydrator unit	Consolidate liquid concentrate containers or tanks for shipment to an approved receiving facility	No Provincial Code	Sample to confirm management method	Unknown	Unknown	Unknown	Unknown	CHECK FLASHPOINT AND BTEX
Diesel or Diesel Max	Used as a fuel. Not considered a waste unless contaminated by a substance that makes it unusable for the purposes as a fuel	Store in large volume containers and enclosed by secondary containment	Transport to an approved waste receiving facility	WSTFLQ	Waste Flammable Liquid, NOS (Fuel)	UN1993	3	III	Unknown	
Domestic Garbage	Camp waste, kitchen waste, burnable debris/wood	Food waste must be stored in secure, airtight (odour proof) containers	Dispose of all burnable waste in onsite incinerators, pull out plastic from the incinerator waste stream	DOMWST	Food waste will not be shipped offsite. Plastics should be removed from the incinerator waste stream, packaged and shipped offsite to a receiving facility	N/A	N/A	N/A	See Table 4	EACH CY-5050-FA-D INCINERATOR UNIT CAN BURN 90KB PER HOUR OF DOMESTIC GARBAGE
Empty Pails with residues	Pails with hydrocarbon residues	Wear PPE. Remove lids and transfer any unused hydrocarbon resuals into a drum labelled used oil. Stack the pails and place in lined mega bags	Try to use all residuals of the product. Unused or contaminated product can be shipped to an approved receiving facility in drums depending on volume		Not regulated by the TDG Act and Regulation	N/A	N/A	N/A	Unknown	Mega bags must have the lines placed inside to collect and remaining residuals.
Filters	Process (glycol, dips, water)	Store in on site filter container	Transport to an approved waste receiving facility	FILOTH	Environmentally hazardous substance, solid N.O.S. (waste filters BTEX)	UN3077	9	III	Unknown	
Fluorescent Light Tubes	Fluorescent Light Tubes	DO NOT BREAK TUBES. Use caution when handling, tubes contain trace levels of mercury and phosphorus. PPE, including respirators should be worn if there is a chance of the bulb breaking.	Place whole tubes inside a sturdy crate and try to prevent tubes from breaking. Transport to an approved waste receiving facility.	WSTMIS	Not regulated by the TDG Act and Regulation but will require tracking on a federal manifest.	N/R	N/R	N/R	N/R	
Grease	Lubrication Grease	Store in approved container	Transport to an approved waste receiving facility	No Provincial Code	Not regulated by the TDG Act and Regulation	N/A	N/A	N/A	Unknown	CHECK FLAMMABILITY, FLASHPOINT
Hydraulic and Transmission Fluids	Source is a vehicle maintenance program	Store in drums	Transport to an approved waste receiving facility	HYDOIL	Not regulated by the TDG Act and Regulations	N/A	N/A	N/A	Unknown	IF CONTAMINATION IS SUSPECTED OR LIKELY SAMPLE TO ENSURE WASTE MEETS NON REGULATED CRITERIA. MAY CONTAIN METALS.
Incinerator Ash	Feed source is generally burnable domestic waste and paper products	Package in non-haz bag when cool	Transport to an approved waste receiving facility	INCASH	Incinerator ash (waste)	N/A	N/A	N/A	See Table 4	CHECK LEACHATE FROM METALS
Kitchen Grease	Kitchen Grease	Burn in an incinerator	Transport to an approved waste receiving facility	No Provincial Code					Unknown	
Lube Oils	From oil changes including hydraulic fluid	Bulk in double walled tank/drum	Transport to an approved waste receiving facility	LUBOIL	Non DOW, NON TDG regulated	N/A	N/A	N/A	Unknown	
Lube Oil Filters	Spin on filters	Package in on site filter contanier	Transport to an approved waste receiving facility	FILLUB	Environmentally hazardous substance, solid, N.O.S. (lube oil filters)	N/A	N/A	N/A	Unknown	
Paint	In cans or pails	Package in un approved open top drum	Transport to an approved waste receiving facility	WPAINT	Paint or paint related material (waste)	UN1263	3	II	Unknown	
Propane	Heating, torches, welding etc	Transport and store upright in a ventilated location away from ignition sources. Cylinders not in use must have valves in place. Do not store with oxydizing agents or oxygen.	Empty cylinders may contain residuals. Return to manufacturer for refilling or transport to an approved receiving facility if unable to send for refill	No provincial code	Liquified Petroleum Gas (Propane)	UN1075	2.1	N/A	Unknown	
Rags	Contaminated with chemicals / oil	Package onsite in sealed containers and transport to an approved landfill	Transport to an approved waste receiving facility	OILRAGS	Environmentally hazardous substance, solid, N.O.S. (rags cont/w BTEX)	UN 3077	9	III	Unknown	
Sanitary Sewage	Treated and untreated sewage effluent from the camps	Store and treat in heated treatment units at the camp and store at drilling lease. Release treated effluent to surrounding area at camp.	Transport to an approved waste receiving facility	No provincial code	Not regulated by the TDG Act and Regulations	N/A	N/A	N/A	Unknown	
Scrap Metal	Not contaminated with chemicals	Stockpile onsite	Local scrap metal dealer or approved landfill outside of the NWT	SMETAL	Scrap metal	N/A	N/A	N/A	Unknown	
Solvents	Thinners, varsol, xylene	Store in approved drums	Transport to an approved waste receiving facility	SOILALP	Flammable liquid, N.O.S. (waste solvents, thinners)	UN3077	9	III	Unknown	CHECK MSDS
Waste Flammable Liquids	Diesel, gasoline, varsol, inhibitor, jet fuel	Store in approved drums	Transport to an approved waste receiving facility	WSTFLQ	Flammable liquid, N.O.S. (waste)	UN1993	3	II	Unknown	
Wood Materials	Lathes, wood boards, boxes	Incinerate what can be incinerated and stockpile the remainder	Recycle, reuse or place in a sanitary landfill	No Provincial Code	Not regulated by the TDG Act and Regulations	N/A	N/A	N/A	Unknown	

- Notes:
- 1. Use a Federal Movement Document for the transport all Hazardous waste tpyes.
 - 2. Use a Bill of Lading Movement Document for the transport of all Non-hazardous waste types.
 - 3. DOW = Dangerous Oilfield Waste

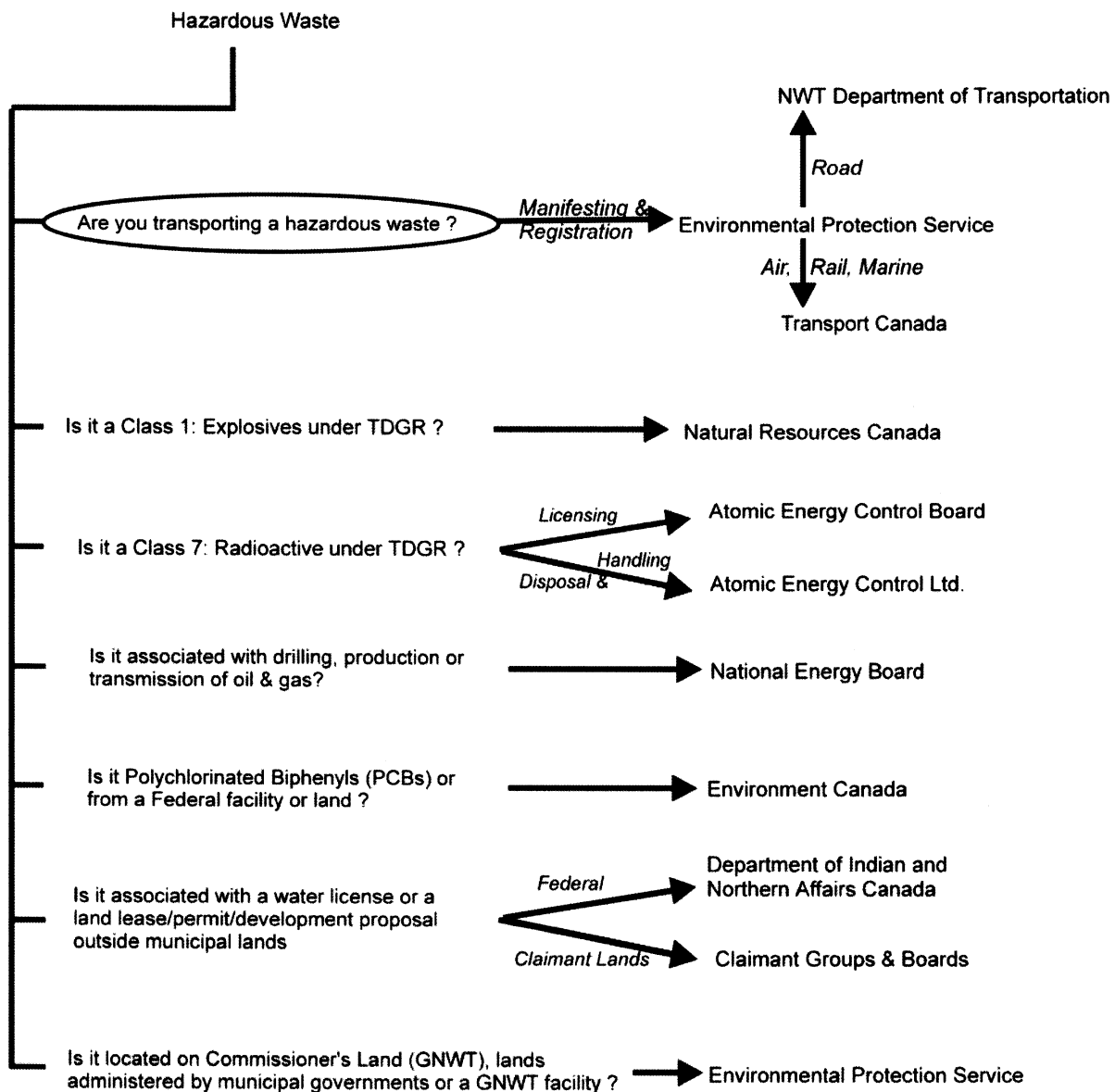


Figure 1: Primary Regulatory Contact for Hazardous Waste Management

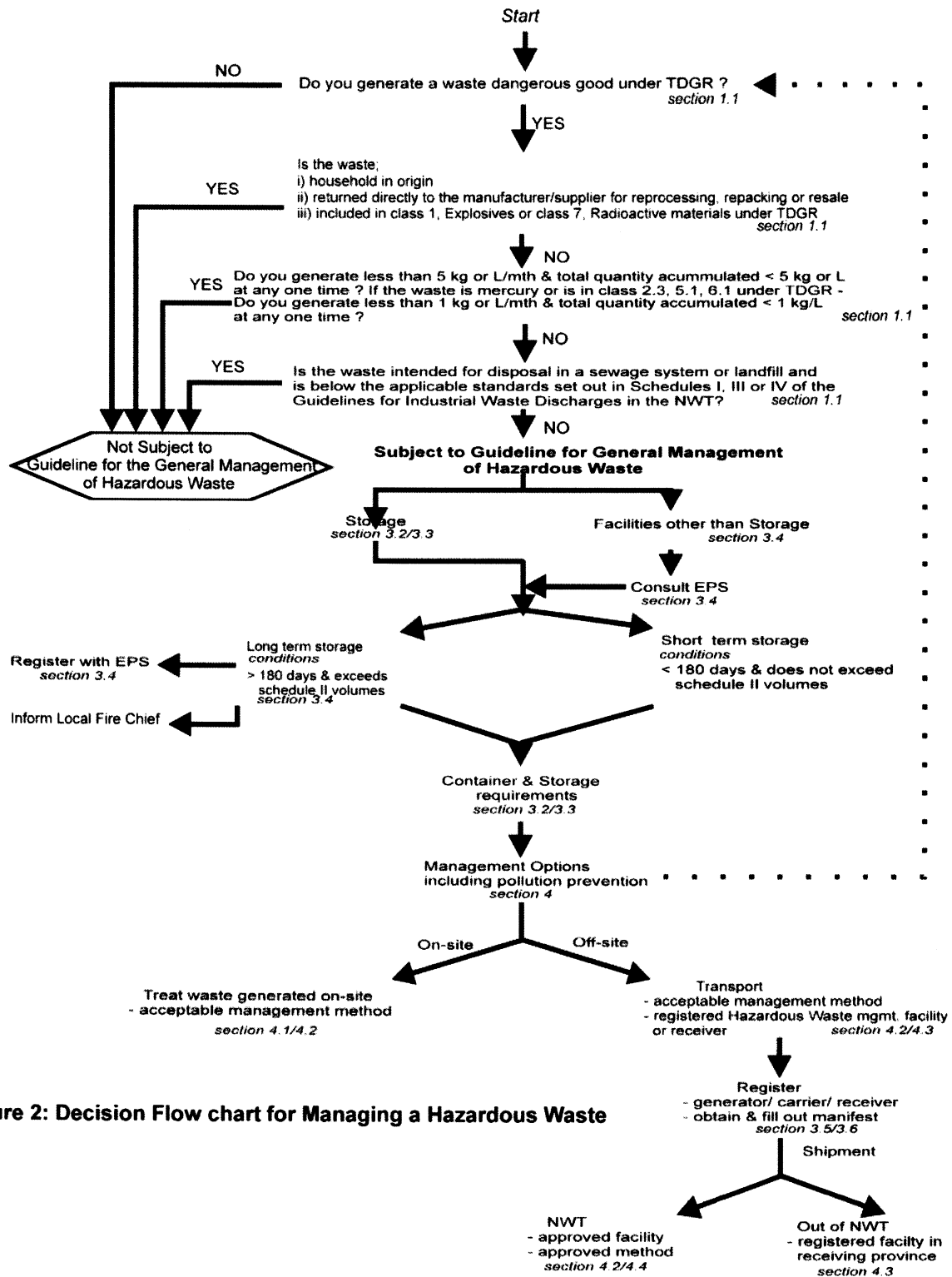


Figure 2: Decision Flow chart for Managing a Hazardous Waste

DANGEROUS GOODS HAZARD CLASSES AND PLACARDS

Class 1 – Explosives¹



Class 2 – Compressed Gases

Division 2.1 – Flammable Gases

Division 2.2 – Non-flammable and Non-toxic Gases

Division 2.3 – Poison Gases



Class 3 - Flammable Liquids



Class 4 – Flammable Solids

Division 4.1 – Flammable Solids

Division 4.2 – Spontaneously Combustible

Division 4.3 – Water Reactive



Class 5 - Oxidizing Substances and Organic Peroxides

Division 5.1 – Oxidizing Substances

Division 5.2 – Organic Peroxides



DANGEROUS GOODS HAZARD CLASSES AND PLACARDS

Class 6 - Toxic and Infectious Substances

Division 6.1 – Toxic Substances

Division 6.2 – Infectious Substances



Class 7 - Radioactive Materials²



Class 8 - Corrosives



Class 9 - Miscellaneous



1. Class 1 substances (Explosives) are regulated by Natural Resources Canada under the *Explosives Act*.
2. Class 7 substances (Radioactive Materials) are regulated by the Canadian Nuclear Safety Commission under the *Nuclear Safety and Control Act* and *Nuclear Liability Act*.

11 Criteria for the Surface Discharge of Collected Surface Run-on/Runoff Waters

This section applies to EUB-only regulated upstream petroleum sites and to those EUB/AENV jointly regulated sites that do not have conditions in the EPEA approval pertaining to the discharge of collected surface run-on/runoff waters.

Provided the water has not been contaminated, surface run-on/runoff waters collected on an upstream petroleum site (e.g., within a diked area of a tank farm, within the surface water collection system) should be released back into the environment (hydrology cycle). Collected waters must be tested and meet the following criteria prior to being released in a controlled fashion to adjacent lands:

- chloride content 500 mg/L maximum (e.g., test strips),
- pH 6.0 to 9.0 (e.g., test strips and/or meter readings),
- no visible hydrocarbon sheen (roughly equates to less than 10 mg/L),
- no other chemical contamination (e.g., clean operating conditions such that collected waters are not impacted by spills/releases),
- landowner or occupant consent,
- water not allowed to flow directly into any watercourse, and
- each release recorded, including the prerelease test data and the estimated volume of water released.

Contaminated water must not be released into the environment. It should be sent to an approved facility for treatment and/or disposal or, if possible, treated on site and then released. The minimal parameters listed above are intended as screening parameters for sites exhibiting good house-keeping practices. On sites where spills or releases have occurred, the collected surface water should be tested for parameters that would demonstrate that the water has not been affected.

The discharge of collected surface waters into a watercourse is not permitted unless otherwise specified in an EPEA approval. Approval holders or licensees wishing to use collected surface waters in a facility's process must consult with AENV regarding the need for a water diversion licence.

Emissions Inventory

The emissions inventory has been categorized by operation type which consists of:

- Camp Operations
- Camp Expansion
- Staging Area Operations

For each type of operation the estimated emissions were calculated based on emission source where the equipment type has been categorized into one of the following three sections:

- Vehicles
- Generators, Engines and Boilers
- Propane Fuelled Heaters

Each emission category has a table indicating the emission factors used and the associated reference.

Within each spreadsheet calculations are presented for the following:

- a. Emissions per piece of equipment “PER UNIT” are presented as kg/day except for CO which is reported as t/d.
- b. Emissions for the duration of the project “TOTAL (Duration of Project)” are presented as kg except for CO which is reported as t.
- c. Emissions for the domestic waste incinerator are presented as kg per unit of time for an individual unit operating at capacity for 1, 2, 4, 6, 12 and 24 hours.

Camp Operations

Generators, Engines, Boilers

USEPA EF, Table 3.3-1	NOx	CO	SOx	PM10	CO2	Aldehydes
Diesel, output (kg/kw-h)	0.0188	0.0041	0.0012	0.0013	0.6992	0.0003
Diesel, fuel input (lb/MMBtu)	4.41	0.95	0.29	0.31	164	0.07

Unit	Make	Model	Power Rating kW	Fuel type	# of Units	Operation	Days of Operation	PER UNIT						TOTAL (All Equipment)						TOTAL (Duration of Project)					
								NO _x Potential emissions (kg/d)	CO Potential emissions (kg/d)	SO _x Potential emissions (kg/d)	PM ₁₀ Potential emissions (kg/d)	CO ₂ Potential emissions (t/d)	Aldehydes Potential emissions (kg/d)	NO _x Potential emissions (kg/d)	CO Potential emissions (kg/d)	SO _x Potential emission s (kg/d)	PM ₁₀ Potential emission s (kg/d)	CO ₂ Potential emission s (t/d)	Aldehyd es Potential emission s (kg/d)	NO _x Potential emission s (kg)	CO Potential emission s (kg)	SO _x Potential emission s (kg)	PM ₁₀ Potential emission s (kg)	CO ₂ Potential emission s (t)	Aldehyd es Potential emission s (kg)
Rental Equipment																									
Light Towers	Kohler	KDW1003	7.5	Diesel	8	24 hrs/day	275	3.4	0.7	0.2	0.2	0.1	0.1	27.1	5.8	1.8	1.9	1.0	0.4	7463.8	1608.3	493.6	529.7	276.9	111.5
Light Towers	Kohler	KDW1003	7.5	Diesel	8	24 hrs/day	275	3.4	0.7	0.2	0.2	0.1	0.1	27.1	5.8	1.8	1.9	1.0	0.4	7463.8	1608.3	493.6	529.7	276.9	111.5
Generators	Isuzu	4HK1X5.4 L	100	Diesel	2	24 hrs/day	275	45.2	9.7	3.0	3.2	1.7	0.7	90.5	19.5	6.0	6.4	3.4	1.4	24879.4	5361.1	1645.2	1765.6	922.9	371.6
Generators	Isuzu	4HK1X5.4 L	100	Diesel	2	24 hrs/day	275	45.2	9.7	3.0	3.2	1.7	0.7	90.5	19.5	6.0	6.4	3.4	1.4	24879.4	5361.1	1645.2	1765.6	922.9	371.6
Camp																									
Main Camp Generators	Caterpillar	3241	500	Diesel	4	24hrs/d	365	226.2	48.7	15.0	16.1	8.4	3.4	904.7	194.9	59.8	64.2	33.6	13.5	330217.0	71156.4	21836.9	23434.8	12250.0	4932.0
Main Camp Gen Warm Up Engine	Isuzu	A4BG1	54	Diesel	2	1hr/d	275	1.0	0.2	0.1	0.1	0.04	0.0	2.0	0.4	0.1	0.1	0.1	0.0	559.8	120.6	37.0	39.7	20.8	8.4
Silver Generator Shack	Isuzu	A6BG1T	76	Diesel	2	Back up	275	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WestQuip WQ20 Main Camp Light 1	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	365	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	6604.3	1423.1	436.7	468.7	245.0	98.6
WestQuip WQ20 Main Camp Light 2	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	365	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	6604.3	1423.1	436.7	468.7	245.0	98.6
WestQuip WQ20 Main Camp Light 3	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	365	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	6604.3	1423.1	436.7	468.7	245.0	98.6
WestQuip WQ20 Main Camp Light 4	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	275	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	4975.9	1072.2	329.0	353.1	184.6	74.3
WestQuip WQ20 Main Camp Light 5	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	275	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	4975.9	1072.2	329.0	353.1	184.6	74.3
WestQuip WQ20 Main Camp Light 6	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	275	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	4975.9	1072.2	329.0	353.1	184.6	74.3
WestQuip WQ20 Security Gate Light 1	Isuzu	4LE2 2.2L	20	Diesel	2	24hrs/d	275	9.0	1.9	0.6	0.6	0.3	0.1	18.1	3.9	1.2	1.3	0.7	0.3	4975.9	1072.2	329.0	353.1	184.6	74.3
Generator, Engines, Boilers Subtotal								387.8	83.6	25.6	27.5	14.4	5.8	1268.6	273.4	83.9	90.0	47.1	18.9	435179.6	93774.2	28778.0	30883.7	16143.8	6499.6

Vehicles

USEPA Emission Std	NOx	CO
Heavy Duty Engines (kg/kw-h)	0.0040	0.0155

Unit	Make	Model	Power Rating kW	Fuel type	# of Units	Operation	Days of Operation	PER UNIT			TOTAL (All Equipment)			TOTAL (Duration of Project)	
								NO _x Potential emissions (kg/day)	CO Potential emissions (kg/day)		NO _x Potential emissions (kg/day)	CO Potential emissions (kg/day)		NO _x Potential emissions (kg)	CO Potential emissions (kg)
Miscellaneous Vehicles & Equipment															
Water Trucks	Cummins	NTC 400 14 L	298	Diesel	2	8 hrs / day	20	9.5	37.0		19.1	73.9		381.4	739.0
Rental Pickup Truck	Ford F-350	6.7 L V-8	298	Diesel	8	12 hrs/day	275	14.3	55.4		114.4	443.4		31468.8	15242.7
Vehicle Subtotal								23.8	92.4		133.5	517.3		31850.2	15981.7

Propane Heaters, Dehydrator

USEPA EF, Table 1.5-1	PM Filterable	NOx	CO2	CO	TOC
Propane (kg/10³L)	0.07	2.3	1500	0.04	0.06

USEPA EF, Table 1.3-1	PM Filterable	NOx	CO2	CO	TOC
No.2 Fuel Oil (Diesel, kg/10³L)	0.24	2.4	-	0.6	-

										PER UNIT						SUBTOTAL (All Equipment)						TOTAL (Duration of Project)				
Unit	Make	Model	Power Rating kW	Fuel type	Fuel Consumpti on (L/day)	# of Units	Operation	Days of Operation		PM filterable Potential emissions (kg/day)	NOx Potential emissions (kg/day)	CO2 Potential emissions (t/day)	CO Potential emissions (kg/day)	TOC Potential emissions (kg/day)		PM filterable Potential emissions (kg/day)	NOx Potential emissions (kg/day)	CO2 Potential emissions (t/day)	CO Potential emissions (kg/day)	TOC Potential emissions (kg/day)		PM filterable Potential emissions (kg)	NOx Potential emissions (kg)	CO2 Potential emissions (t)	CO Potential emissions (kg)	TOC Potential emissions (kg)
Rental Equipment																										
Wellsite Trailers				Propane	35	7	24 hrs/day	250		0.002	0.081	0.053	0.001	0.002		0.017	0.564	0.4	0.010	0.015		4.288	140.875	91.875	2.450	3.675
Wellsite Trailers				Propane	35	7	24 hrs/day	250		0.002	0.081	0.053	0.001	0.002		0.017	0.564	0.4	0.010	0.015		4.288	140.875	91.875	2.450	3.675
Dehydrator	CleanSteam			Diesel	575	4	24 hrs/day	250		0.1	1.4	-	0.3	-		0.6	5.5	-	1.4	-		138.0	1380.0	-	345.0	-
Propane Heaters, Dehydrator Subtotal										0.1	1.5	0.1	0.3	0.0		0.6	6.6	0.7	1.4	0.0		146.6	1661.8	183.8	349.9	7.4

Staging Area Construction Equipment & Rentals that will Generate Emissions - Drilling and Completions Support

Vehicles

USEPA Emission Std	NOx	CO
Heavy Duty Engines (kg/kw-h	0.0040	0.0155

								PER UNIT		TOTAL (All Equipment)		TOTAL (Duration of Project)	
Unit	Make	Model	Power Rating kW	Fuel type	# of Units	Operation (hrs/day)	Days of Operation	NOx Potential emissions (kg/day)	CO Potential emissions (kg/day)	NOx Potential emissions (kg/day)	CO Potential emissions (kg/day)	NOx Potential emissions (kg)	CO Potential emissions (kg)
Dozers	CAT	D5	67	Diesel	1	12	19	3.2	12.5	3.2	12.5	61.1	236.8
Dozers	CAT	D6N/D6M	112	Diesel	2	12	19	5.4	20.8	10.8	41.7	204.3	395.8
Dozers	CAT	D8R/D8T/D8 N	228	Diesel	3	12	19	10.9	42.4	32.8	127.2	623.8	805.8
Wheel Loader	CAT	950F	130	Diesel	1	12	19	6.2	24.2	6.2	24.2	118.6	459.4
Wheel Loader	Komatsu	644K	173	Diesel	1	12	19	8.3	32.2	8.3	32.2	157.8	611.4
Grader	CAT	140G	112	Diesel	1	12	19	5.4	20.8	5.4	20.8	102.1	395.8
Grader	CAT	14M	193	Diesel	1	12	19	9.3	35.9	9.3	35.9	176.0	682.1
Rock Trucks	CAT	730	228	Diesel	4	12	19	10.9	42.4	43.8	169.6	831.7	805.8
Rock Trucks	CAT	740	336	Diesel	3	12	19	16.1	62.5	48.4	187.5	919.3	1187.4
Rock Trucks	CAT	740B	354	Diesel	6	12	19	17.0	65.8	102.0	395.1	1937.1	1251.0
Hydraulic Excavator	CAT	330C	184	Diesel	1	12	19	8.8	34.2	8.8	34.2	167.8	650.3
Hydraulic Excavator	CAT	345/349	213	Diesel	2	12	19	10.2	39.6	20.4	79.2	388.5	752.7
Packers	CAT	CS563	115	Diesel	1	12	15	5.5	21.4	5.5	21.4	82.8	320.9
Packers	CAT	815F	189	Diesel	1	12	15	9.1	35.2	9.1	35.2	136.1	527.3
Tractor and Disc	Case IH	9170	250	Diesel	2	12	10	12.0	46.5	24.0	93.0	240.0	465.0
Sub Totals								138.4	536.4	338.0	1309.6	6147.0	9547.4

Camp Expansion Construction Equipment & Rentals that will Generate Emissions - Drilling and Completions Support

Vehicles

USEPA Emission Std	NOx	CO
Heavy Duty Engines (kg/kw-h	0.0040	0.0155

Unit	Make	Model	Power Rating kW	Fuel type	# of Units	Operation (hrs/day)	Days of Operation	PER UNIT		TOTAL (All Equipment)		TOTAL (Duration of Project)	
								NOx Potential emissions (kg/day)	CO Potential emissions (kg/day)	NOx Potential emissions (kg/day)	CO Potential emissions (kg/day)	NOx Potential emissions (kg)	CO Potential emissions (kg)
Dozers	CAT	D5	67	Diesel	1	12	28	3.2	12.5	3.2	12.5	90.0	348.9
Dozers	CAT	D6N/D6M	112	Diesel	2	12	28	5.4	20.8	10.8	41.7	301.1	583.3
Dozers	CAT	D8R/D8T/D8 N	228	Diesel	3	12	28	10.9	42.4	32.8	127.2	919.3	1187.4
Wheel Loader	CAT	950F	130	Diesel	1	12	28	6.2	24.2	6.2	24.2	174.7	677.0
Wheel Loader	Komatsu	644K	173	Diesel	1	12	28	8.3	32.2	8.3	32.2	232.5	901.0
Grader	CAT	140G	112	Diesel	1	12	28	5.4	20.8	5.4	20.8	150.5	583.3
Grader	CAT	14M	193	Diesel	1	12	28	9.3	35.9	9.3	35.9	259.4	1005.1
Rock Trucks	CAT	730	228	Diesel	4	12	28	10.9	42.4	43.8	169.6	1225.7	1187.4
Rock Trucks	CAT	740	336	Diesel	3	12	28	16.1	62.5	48.4	187.5	1354.8	1749.9
Rock Trucks	CAT	740B	354	Diesel	6	12	28	17.0	65.8	102.0	395.1	2854.7	1843.6
Hydraulic Excavator	CAT	330C	184	Diesel	1	12	28	8.8	34.2	8.8	34.2	247.3	958.3
Hydraulic Excavator	CAT	345/349	213	Diesel	2	12	28	10.2	39.6	20.4	79.2	572.5	1109.3
Packers	CAT	CS563	115	Diesel	1	12	20	5.5	21.4	5.5	21.4	110.4	427.8
Packers	CAT	815F	189	Diesel	1	12	20	9.1	35.2	9.1	35.2	181.4	703.1
Tractor and Disc	Case IH	9170	250	Diesel	2	12	12	12.0	46.5	24.0	93.0	288.0	558.0
HRN Contracting Crew Trucks	Ford	F-350	298	Diesel	5	12	28	14.3	55.4	71.5	277.1	2002.6	1552.0
Husky Crew Trucks	Ford	F-350	298	Diesel	5	12	28	14.3	55.4	71.5	277.1	2002.6	1552.0
Sub Totals								0.0	0.0	481.0	1863.9	12967.5	16927.5

Diesel Fuelled Generators, Engines, Boilers & Dehydrator

Table 3.1-1 was taken directly from the Fifth Edition of US EPA's AP-42 document "Compilation of Air Pollutant Emission Factors" and used as the basis to estimate the potential emissions from use of the diesel dehydrator.

Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES^a

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO _x	0.011	1.63	0.031	4.41	D
CO	6.96 E-03 ^d	0.99 ^d	6.68 E-03	0.95	D
SO _x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10 ^b	7.21 E-04	0.10	2.20 E-03	0.31	D
CO ₂ ^c	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

^a References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

^b PM-10 = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be ≤ 1 µm in size.

^c Assumes 99% conversion of carbon in fuel to CO₂ with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

^d Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

Propane Fuelled Heaters

Table 1.5-1 was taken directly from the Fifth Edition of US EPA's AP-42 document "Compilation of Air Pollutant Emission Factors" and used as the basis to estimate the potential emissions from use of the planned and anticipated equipment to be located at the well site.

Table 1.5-1. EMISSION FACTORS FOR LPG COMBUSTION^a

EMISSION FACTOR RATING: E

Pollutant	Butane Emission Factor (lb/10 ³ gal)		Propane Emission Factor (lb/10 ³ gal)	
	Industrial Boilers ^b (SCC 1-02-010-01)	Commercial Boilers ^c (SCC 1-03-010-01)	Industrial Boilers ^b (SCC 1-02-010-02)	Commercial Boilers ^c (SCC 1-03-010-02)
PM, Filterable ^d	0.2	0.2	0.2	0.2
PM, Condensable	0.6	0.6	0.5	0.5
PM, Total	0.8	0.8	0.7	0.7
SO ₂ ^e	0.09S	0.09S	0.10S	0.10S
NO _x ^f	15	15	13	13
N ₂ O ^g	0.9	0.9	0.9	0.9
CO ₂ ^{h,j}	14,300	14,300	12,500	12,500
CO	8.4	8.4	7.5	7.5
TOC	1.1	1.1	1.0	1.0
CH ₄ ^k	0.2	0.2	0.2	0.2

^a Assumes PM, CO, and TOC emissions are the same, on a heat input basis, as for natural gas combustion. Use heat contents of 91.5 x 10⁶ Btu/10³ gallon for propane, 102 x 10⁶ Btu/10³ gallon for butane, 1020 x 10⁶ Btu/10⁶ scf for methane when calculating an equivalent heat input basis. For example, the equation for converting from methane's emissions factors to propane's emissions factors is as follows: lb pollutant/10³ gallons of propane = (lb pollutant /10⁶ ft³ methane) * (91.5 x 10⁶ Btu/10³ gallons of propane) / (1020 x 10⁶ Btu/10⁶ scf of methane). The NO_x emission factors have been multiplied by a correction factor of 1.5, which is the approximate ratio of propane/butane NO_x emissions to natural gas NO_x emissions. To convert from lb/10³ gal to kg/10³ L, multiply by 0.12. SCC = Source Classification Code.

^b Heat input capacities generally between 10 and 100 million Btu/hour.

^c Heat input capacities generally between 0.3 and 10 million Btu/hour.

^d Filterable particulate matter (PM) is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. For natural gas, a fuel with similar combustion characteristics, all PM is less than 10 µm in aerodynamic equivalent diameter (PM-10).

^e S equals the sulfur content expressed in gr/100 ft³ gas vapor. For example, if the butane sulfur content is 0.18 gr/100 ft³, the emission factor would be (0.09 x 0.18) = 0.016 lb of SO₂/10³ gal butane burned.

^f Expressed as NO₂.

^g Reference 12.

^h Assuming 99.5% conversion of fuel carbon to CO₂.

^j EMISSION FACTOR RATING = C.

^k Reference 13.

The AP-42 emission factor rating is an overall assessment of how good a factor is, based on both the quality of the test(s) or information that is the source of the factor and on how well the factor represents the emission source. Higher ratings are for factors based on many unbiased observations, or on widely accepted test procedures. For example, ten or more source tests on different randomly selected plants would likely be assigned an "A" rating if all tests are conducted using a single valid reference measurement method. Likewise, a single observation based on questionable methods of testing would be assigned an "E", and a factor extrapolated from higher-rated factors for similar processes would be assigned a "D" or an "E". AP-42 emission factor quality ratings are thus assigned:

A — Excellent. Factor is developed from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.

B — Above average. Factor is developed from A- or B-rated test data from a "reasonable number" of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with an A rating, the source category population is sufficiently specific to minimize variability.

C — Average. Factor is developed from A-, B-, and/or C-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.

D — Below average. Factor is developed from A-, B- and/or C-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.

E — Poor. Factor is developed from C- and D-rated test data, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

Domestic Waste Incinerators: Westland CY-2050-FA Double Chamber Forced Air Incinerator

Based on the manufacturers specification sheet the following waste stream types presented below can be accepted by each incinerator at a maximum feed rate of 90kg/hr. Although not accounted for in the emission calculation it was also understood that Husky personnel would remove all form of plastic from the incinerator. It was also understood that typical operation of each incinerator would average 4 – 6 hours per day at the camp. There are three incinerators in total that will be in operation.

Type 1 Waste – Rubbish consisting of combustible waste paper, cartons, rags, wood scraps, combustible floor sweepings from domestic, commercial and industrial sources. Type 1 Waste is a mixture of 80% (by weight) rubbish and 20% (by weight) garbage. It has a heating value of 6,500 Btu per pound, a moisture content of 25% (by weight) and an ash content of 10% (by weight).

Type 2 Waste – Refuse (Municipal Solid Waste) consisting of rubbish and garbage from residential sources (50% rubbish and 50% garbage). Type 2 Waste has a heating value of 4,300 Btu per pound, a moisture content of 50% (by weight) and an ash content of 7% (by weight).

Type 3 Waste – Garbage consisting of animal and vegetable food wastes from restaurants, hotels, markets, institutional, commercial and club sources. Type 3 Waste is a mixture of 65% garbage and 35% rubbish. It has a heating value of 2,500 Btu per pound, a moisture content of 70% (by weight) and an ash content of 5% (by weight).

Tables 2.1-1 and 2.1-3 were taken directly from the Fifth Edition of US EPA's AP-42 document "Compilation of Air Pollutant Emission Factors" and used as the basis to estimate the potential emissions from use of the Westland CY-2050-FA double chamber forced air incinerator.

Table 2.1-1 (Metric Units). PARTICULATE MATTER, METALS, AND ACID GAS EMISSION FACTORS FOR MASS BURN AND MODULAR EXCESS AIR COMBUSTORS^{a,b}

Pollutant	Uncontrolled		ESP ^c		DSI/ESP ^d		SD/ESP ^e		DSI/FF ^f		SD/FF ^g	
	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING
PM ^h	1.26 E+01	A	1.05 E-01	A	2.95 E-02	E	3.52 E-02	A	8.95 E-02	A	3.11 E-02	A
As ^j	2.14 E-03	A	1.09 E-05	A	ND ^k	E	6.85 E-06	A	5.15 E-06	C	2.12 E-05	A
Cd ^j	5.45 E-03	A	3.23 E-04	B	4.44 E-05	E	3.76 E-06	A	1.17 E-05	C	1.36 E-05	A
Cr ^j	4.49 E-03	A	5.65 E-05	B	1.55 E-05	E	1.30 E-04	A	1.00 E-04	C	1.50 E-05	A
Hg ^j	2.8 E-03	A	2.8 E-03	A	1.98 E-03	E	1.63 E-03	A	1.10 E-03	C	1.10 E-03	A
Ni ^j	3.93 E-03	A	5.60 E-05	B	1.61 E-03	E	1.35 E-04	A	7.15 E-05	C	2.58 E-05	A
Pb ^j	1.07 E-01	A	1.50 E-03	A	1.45 E-03	E	4.58 E-04	A	1.49 E-04	C	1.31 E-04	A
SO ₂	1.73 E+00	A	ND	NA	4.76 E-01	C	3.27 E-01 ^m	A	7.15 E-01	C	2.77 E-01 ^m	A
HCl ^j	3.20 E+00	A	ND	NA	1.39 E-01	C	7.90 E-02 ^m	A	3.19 E-01	C	1.06 E-01 ^m	A

^a All factors in kg/Mg refuse combusted. Emission factors were calculated from concentrations using an F-factor of 0.26 dscm/joule (J) and a heating value of 10,466 J/g. Other heating values can be substituted by multiplying the emission factor by the new heating value and dividing by 10,466 J/g. Source Classification Codes 5-01-001-04, 5-01-001-05, 5-01-001-06, 5-01-001-07, 5-03-001-11, 5-03-001-12, 5-03-001-13, 5-03-001-15. ND = no data. NA = not applicable.

^b Emission factors should be used for estimating long-term, not short-term, emission levels. This particularly applies to pollutants measured with a continuous emission monitoring system (e. g., SO₂).

^c ESP = Electrostatic Precipitator

^d DSI/ESP = Duct Sorbent Injection/Electrostatic Precipitator

^e SD/ESP = Spray Dryer/Electrostatic Precipitator

^f DSI/FF = Duct Sorbent Injection/Fabric Filter

^g SD/FF = Spray Dryer/Fabric Filter

^h PM = Filterable particulate matter, as measured with EPA Reference Method 5.

^j Hazardous air pollutants listed in the *Clean Air Act*.

^k No data available at levels greater than detection limits.

^m Acid gas emissions from SD/ESP- and SD/FF-equipped MWCs are essentially the same. Any differences are due to scatter in the data.

Table 2.1-3 (Metric Units). ORGANIC, NITROGEN OXIDES, CARBON MONOXIDE, AND CARBON DIOXIDE EMISSION FACTORS FOR MASS BURN WATERWALL COMBUSTORS^{a,b}

Pollutant	Uncontrolled		ESP ^c		SD/ESP ^d		DSI/FF ^e		SD/FF ^f	
	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING	kg/Mg	EMISSION FACTOR RATING
CDD/CDF ^g	8.35 E-07	A	5.85 E-07	A	3.11 E-07	A	8.0 E-08	C	3.31 E-08	A
NO _x ^h	1.83 E+00	A	*		*		*		*	
CO ^h	2.32 E-01	A	*		*		*		*	
CO ₂ ^j	9.85 E+02	D	*		*		*		*	

^a All factors in kg/Mg refuse combusted. Emission factors were calculated from concentrations using an F-factor of 0.26 dscm/J and a heating value of 10,466 J/g. Other heating values can be substituted by multiplying the emission factor by the new heating value and dividing by 10,466 J/g. Source Classification Codes 5-01-001-05, 5-03-001-12. * = Same as "uncontrolled" for these pollutants.

^b Emission factors should be used for estimating long-term, not short-term, emission levels. This particularly applies to pollutants measured with continuous emission monitoring system (e. g., CO, NO).

^c ESP = Electrostatic Precipitator

^d SD/ESP = Spray Dryer/Electrostatic Precipitator

^e DSI/FF = Duct Sorbent Injection/Fabric Filter

^f SD/FF = Spray Dryer/Fabric Filter

^g CDD/CDF = total tetra- through octa- chlorinated dibenzo-p-dioxin/chlorinated dibenzofurans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and dibenzofurans are hazardous air pollutants listed in 1990 *Clean Air Act*.

^h Control of NO_x and CO is not tied to traditional acid gas/PM control devices.

^j Calculated assuming a dry carbon content of 26.8% for feed refuse.^{126,135} CO₂ emitted from this source may not increase total atmospheric CO₂ because emissions may be offset by the uptake of CO₂ by regrowing biomass.

Summary of Potential Emissions due to Operation of one Westland CY-2050-FA Double Chamber Forced Air Incinerator. There are three incinerators in total that will be in operation.

Pollutant	Emission factor Kg/metric ton	Maximum Waste Feed rate kg/hr	Potential emissions from 1 Hour of operation (kg)	Potential emissions from 2 Hours of operation (kg)	Potential emissions from 4 Hours of operation (kg)	Potential emissions from 6 Hours of operation (kg)	Potential emissions from 12 Hours of operation (kg)	Potential emissions from 24 Hours of operation (kg)
PM	12.6000	90	1.134	2.268	4.536	6.804	13.608	27.216
As	0.00214	90	0.0001926	0.0003852	0.0007704	0.0011556	0.0023112	0.0046224
C	0.00545	90	0.0004905	0.000981	0.001962	0.002943	0.005886	0.011772
Cr	0.00449	90	0.0004041	0.0008082	0.0016164	0.0024246	0.0048492	0.0096984
Hg	0.00280	90	0.000252	0.000504	0.001008	0.001512	0.003024	0.006048
Ni	0.00393	90	0.0003537	0.0007074	0.0014148	0.0021222	0.0042444	0.0084888
Pb	0.10700	90	0.00963	0.01926	0.03852	0.05778	0.11556	0.23112
SO ₂	1.73000	90	0.1557	0.3114	0.6228	0.9342	1.8684	3.7368
HCl	3.20000	90	0.288	0.576	1.152	1.728	3.456	6.912
CDD/CDF	8.35E-07	90	7.515E-08	1.503E-07	3.006E-07	4.509E-07	9.018E-07	1.8036E-06
NO _x	1.83000	90	0.1647	0.3294	0.6588	0.9882	1.9764	3.9528
CO	0.23200	90	0.02088	0.04176	0.08352	0.12528	0.25056	0.50112