Waste Management Plan
I-78 Abandonment
Northwest Territories
November 2023
Version 1

Suite 4700, 888 3rd Street SW
Calgary, AB T2P 5C5
Ph: (403) 290-3600
Fax: (403) 262-7994

Contents

Glossary iii

1. Introduction 1

2. Environmental Overview 1

3. Regulatory Framework 2

3.1 Regulatory Approvals 2

4. Waste Management Strategy 2

4.1 Waste Minimization 3

4.2 Waste Treatment and Disposal 5

4.3 Waste Characterization and Classification 5

4.4 Waste Segregation 6

4.5 Waste Storage 9

4.6 Determining Destinations for Waste 10

4.7 Waste Transporting and Tracking 10

4.7.1 Waste Contractors 10

4.7.2 Trucking 11

4.7.3 Tracking Hazardous and Non-Hazardous Waste 11

5. Waste Specific Management Options 12

6. References 17

Appendix 1: Project Maps and Surveys

Appendix 2: Paramount HSE Policy

Appendix 3: Beverage Container Preparation

Appendix 4: MGM Energy Contact Information

Appendix 5: Environment Canada Technical Document for Batch Waste Incineration

Glossary

Dangerous Goods

Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* (TDGR) in any of the classes listed in the schedule provided in the *Transportation of Dangerous Goods Act* (TDGA) [Transportation of Dangerous Goods Act (Canada)]

Class 1: Explosives, including explosives within the meaning of the *Explosives Act* (Canada).

Class 2: Gases; compressed, deeply refrigerated, liquefied or dissolved under pressure.

Class 3: Flammable and combustible liquids.

Class 4: Flammable solids; substances liable to spontaneous combustion and substances that on contact with water emit flammable gases.

Class 5: Oxidizing substances; organic peroxides.

Class 6: Poisonous (toxic) and infectious substances.

Class 7: Radioactive materials and prescribed substances within the meaning of the *Atomic Energy Control Act* (Canada).

Class 8: Corrosives.

Class 9: Miscellaneous products, substances or organisms that are considered by the Lieutenant Governor in Council to be dangerous to life, health, property or the environment when transported and are prescribed to be included in this class.

Well Waste (not including seismic shot hole drilling waste)

A mixture of water, cuttings, additives and various other wastes that are specifically related to the suspension and abandonment activities.

Grey Water

The liquid resulting from the treatment of sewage.

Hazardous Waste

A contaminant which is a dangerous good that is no longer used for its original purpose and is intended for storage, recycling, treatment or disposal. Materials that do not meet the criteria in schedules I, III or IV, or the standards for dioxins and furans, of the Guideline for Industrial Waste Discharges in the NWT.

A hazardous waste does not include a contaminant that is:

(a) household in origin,
(b) included in class 1, Explosives or class 7, Radioactive materials of TDGR,
(c) exempted as a small quantity,
(d) an empty container, or

(e) intended for disposal in a sewage system or by land filling that meet the applicable standards set out in schedules I, III or IV of the Guideline for Industrial Waste Discharges in the NWT.

Household Hazardous Waste	Common everyday products that people use in and around their homes including paint, paint thinner, herbicides, and pesticides that, due to their chemical nature, can be hazardous if not properly disposed.
Kitchen Waste	In this document, kitchen waste is composed of foodstuff, paper products, plastic film wrapping, *etc*.
Non-hazardous Waste	Wastes that do not fall into the "Hazardous Waste" category.
Produced Water	Any water that is produced to the surface along with oil or gas.
Run off	In this document, excessive rain or snowmelt can produce overland flow to retention ponds.
Sewage	Human excrement, water borne human excretion or the water-carried wastes from liquid or non-liquid culinary purposes, washing, cleansing, laundering, food processing or ice production.
Testing Required	Occasionally, laboratory analysis may be required to fully characterize and classify a waste product.

1. Introduction

The East Mackay I-78 Wellsite Area (Wellsite Area) and East Mackay I-78 Staging Area (Staging Area), collectively called the Site, are located in the Sahtu Settlement Area (SSA), Northwest Territories (NWT). The Wellsite Area is located approximately 110 km southeast of Norman Wells. The Staging Area is located approximately 22 km north of the Wellsite Area along the banks of the Mackenzie River (Appendix A: Project Map). The Wellsite Area is approximately 2.7 ha and includes a Wellhead, Recovered Wellhead Bare Area and groundwater monitoring wells. The decommissioned Staging Area is a 0.80 ha parcel. Maps and an as built survey can be found in Appendix A of this document.

The drilling and construction activities for the well occurred in the 2012-2013 winter season, the well has remained in a suspended state since. MGM has been regularly conducting environmental monitoring of the location and has been conducting Office of the Regulator Oil and Gas Operations ("OROGO") inspections of the wellhead. On February 1, 2017 OROGO implemented the Well Suspension and Abandonment Guidelines and Interpretation Notes ("the guidelines"). To comply with the guidelines MGM Energy ("MGM") is planning on abandoning wellbore, removing the wellhead and completing any reclamation activities that are needed.

2. Environmental Overview

The project falls within the Mackenzie River Plain Ecoregion. This ecoregion extends from north of Fort Good Hope on the west side of the Mackenzie River to Wrigley. It is a narrow northern extension of the boreal forest along the east side of the Mackenzie River. The ecoregion is marked by cool summers and very cold winters. The mean annual temperature is approximately -6.5°C. The mean summer temperature is 11.5°C and the mean winter temperature is -24.5°C. The mean annual precipitation ranges from 300 to 400 mm. The ecoregion is classified as having a subhumid high boreal ecoclimate.

The ecoregion is a broad, rolling, drift-covered plain lying between Mackenzie and Franklin mountains, into which the Mackenzie River is entrenched for part of its course. Native vegetation consists predominantly of medium to tall, closed stands of black spruce and jack pine with an understory of feathermoss, bog cranberry, blueberry, Labrador tea, and lichens. White spruce, balsam fir, and trembling aspen occur in the warmer, moister sites in the southern section of the region. Drier sites have more open stands of black spruce and jack pine. Low, closed and open stands of black spruce, ericaceous shrubs, and sphagnum mosses dominate poorly drained, peat-filled depressions. Wetlands cover 25-50% of the ecoregion, and are characteristically peat plateau bogs, and ribbed and horizontal fens. Permafrost is extensive and discontinuous with medium ice content and is characterized by sparse ice wedges. Dominant soils in the ecoregion are Organic and Turbic Cryosols and Eutric and Dystric Brunisols with some Regosols that have developed on terraced to rolling morainal, alluvial, lacustrine, and organic deposits.

Characteristic wildlife includes moose, caribou, musk ox, grizzly bear, black bear, beaver, fox, wolf, hare, raven, grouse, and waterfowl. Limited forestry, oil production near Norman Wells, hunting, and trapping are the principal land use activities. The main communities include Norman Wells and Tulita.

The pre-disturbance for the site described it as gently sloping (2-5%), overall flat with some clods/humps and having low erosion potential. Given the original drilling and the proposed abandonment both will take place in the winter impacts to the location have and project to be limited.

3. Regulatory Framework

Managing oil and gas wastes in the NWT is challenging, due in part to the complex regulatory regime. Minimal waste facilities add to the complexity: if waste must be moved outside of the NWT for disposal, the regulatory regime becomes even more complex (see CAPP, 2009). In the past for the I-78 project area MGM received oil and gas approvals from the National Energy Board (NEB). Since devolution and the creation of the Oil and Gas Regulator for Oil and Gas Operations ("OROGO") in the NWT, MGM receives oil and gas approvals from OROGO. The Sahtu Land and Water Board (SLWB) regulates the use of land and water and the deposit of waste through the issuance of Land Use Permits (LUPs) and Water Licences (WLs).

3.1 Regulatory Approvals

To undertake the original activity, MGM sought and received, a Land Use Permit ("LUP") and Water Licence ("WL"). The original project was subject to a preliminary screening, the report can be found at Preliminary Screening.pdf. The LUP and WL are listed below in Table 1.

Table 1: Current LUPs and WLs

Regulatory Authorization	Registry Link
S22A-002	https://slwb.com/registry/s22a-002
S22L1-002	https://slwb.com/registry/s22l1-002

4. Waste Management Strategy

Poor waste management practices can result in direct or indirect adverse environmental effects and can pose health and safety risks to employees and members of the general public. Furthermore, poor waste management practices can ultimately result in substantial financial and legal liabilities. To prevent poor waste management practices and minimize potential adverse effects to environment, health and safety, MGM (a wholly owned subsidiary of Paramount Resources Ltd.) has developed this Waste Management Plan (WMP), which falls under Paramount's Health, Safety and Environment Policy (Appendix 2). The WMP is also a component of the Paramount Operational Excellence Management System (POEMS), which is required to fulfill regulatory requirements. MGM's EPP Program is developed and maintained, implemented and improved according to the POEMS (Management System). The POEMS sets procedures for how activities will be carried out while, at the same time, ensuring compliance with requirements for safety, environmental protection and conservation of resources.

The POEMS addresses the items listed below.

a) the policies on which the system is based;
b) the processes for setting goals for the improvement of safety, environmental protection and waste prevention;
c) the processes for identifying hazards and for evaluating and managing the associated risks;
d) the processes for ensuring that personnel are trained and competent to perform their duties;
e) the processes for ensuring and maintaining the integrity of all facilities, structures, installations, support craft and equipment necessary to ensure safety, environmental protection and waste prevention;
f) the processes for the internal reporting and analysis of hazards, minor injuries, incidents and near-misses and for taking corrective actions to prevent their recurrence;
g) the documents describing all management system processes and the processes for making personnel aware of their roles and responsibilities with respect to them;
h) the processes for ensuring that all documents associated with the system are current, valid and have been approved by the appropriate level of authority;
i) the processes for conducting periodic reviews or audits of the system and for taking corrective actions if reviews or audits identify areas of non-conformance with the system and opportunities for improvement;
j) the arrangements for coordinating the management and operations of the proposed work or activity among the owner of the installation, the contractors, the operator and others, as applicable; and
k) the name and position of the person accountable for the establishment and maintenance of the system and of the person responsible for implementing it.

The basis of MGM's waste management system is the waste management hierarchy (Figure 1). The overriding principle of the waste management hierarchy is the reduction, if not the elimination, of both the volume and toxicity of waste. In the waste management hierarchy, disposal is the least preferred waste management option. Disposal also involves the greatest potential liability.

4.1 Waste Minimization

Waste minimization includes source reduction (reducing the amount and/or toxicity of waste generated). In some cases, reduction at the source will not yet be technically possible or economically feasible. Therefore, opportunities for reuse (reusing materials without changing the physical properties), recycling (reusing materials by changing the physical properties) and recovery (extracting a useful component) will be investigated for all wastes that are unavoidably generated.

The concept of waste minimization is a cornerstone to the Environmental Protection Plan: waste that is not generated need not be managed. Waste that is generated but is of the lowest possible volume and/or toxicity, can be managed most cost-effectively. Potential benefits to a waste minimization program are:

- increased revenue;
- reduced costs of operating, materials, waste management and disposal,

- energy, and facility cleanup;
- improved operating efficiency;
- reduced regulatory compliance concerns;
- reduced potential for both civil and criminal liability; and
- enhanced public perception of the company and the industry as a whole.

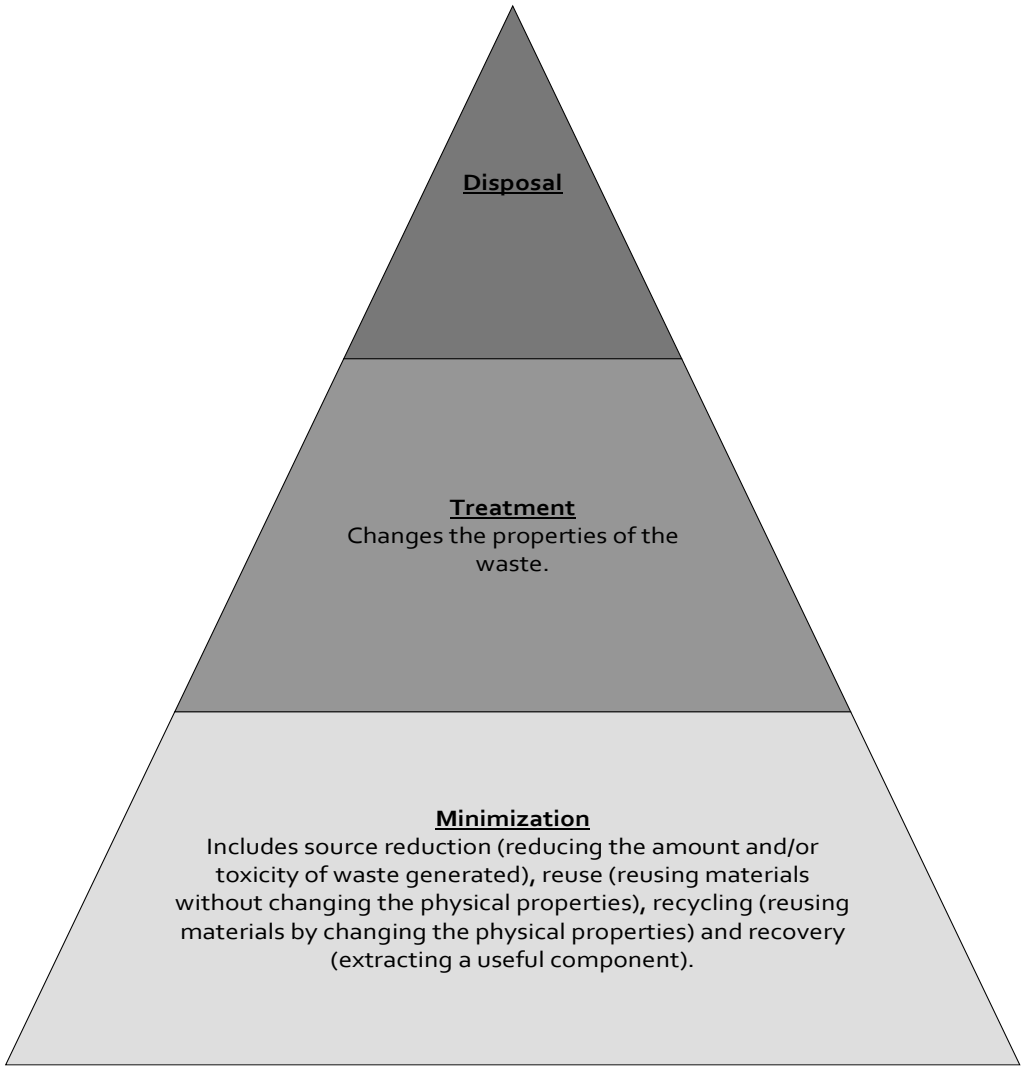


Figure 1: The waste management hierarchy presents options to minimize the amounts and hazard of waste.

4.2 Waste Treatment and Disposal

Waste treatment is any method, technique, or process that changes the physical, chemical, or biological character of a waste. Treatment renders the waste less hazardous and, therefore, recyclable or safer to transport, store, and dispose of. Treatment should be investigated for any waste that is unavoidably generated and that cannot be reused, recycled or recovered. Waste disposal generally is the discharge, deposition, injection, dumping or placing of any waste into or on land, water or air.

4.3 Waste Characterization and Classification

Waste characterization is the assessment of the physical, chemical and toxicological characteristics (e.g., properties) of the waste. Refer to and Directive 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry (AER, 1996); Waste Profile Sheets (CAPP, 2006) and Oilfield Waste Management in the Northwest Territories (CAPP, 2009) to assist with the characterization of common waste. Once a waste has been characterized, it can be classified into one of two classes: hazardous waste and non-hazardous waste (Figure 2).

Given that the project areas are in states of deactivation, suspension or abandonment waste generation is limited. Waste will be created during further short-term activities such as suspension, abandonment and reclamation. The majority of wastes created will be either from camp operations or well operations. Waste would be stored for a short amount of time at well sites and camp sites, then transported to an approved facility outside of the Northwest Territories. Estimates for volumes of waste are as follows:

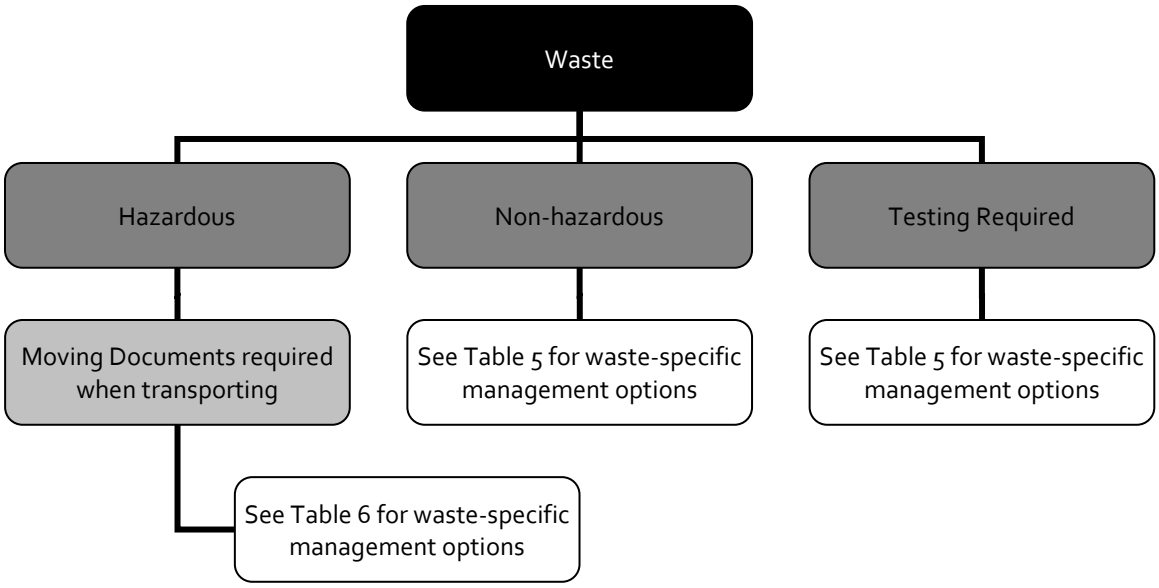
- $15m^3$ of cement returns per well for abandonment/suspension activities;
- $15m^3$ of well fluid per well for abandonment/suspension activities;
- $20m^3$ garbage per abandonment or suspension;
- Camp garbage of 15 m^3 per well abandonment or suspension;
- Temporary camp grey/black water is estimated at 0.33m3 per person per day;

Waste will be stored as per Table 5 and any conditions in project approvals.

Table 2: Treatment / Disposal Options for the I-78 Abandonment Project.

Waste Stream	Discharge Location
Completions fluids and generated solids (milling of cement plugs, bridge plugs and possible casing debris)	Trucked out to approved waste facility, **Location:** Alberta or British Columbia **Facility Type:** Non-HAZ Industrial Landfill/ Special Waste Treatment **Facility Owner:** TBD
Minor amounts of sweet natural gas (casing head gas)	Vent to atmosphere

Figure 2: Waste identification, classification and segregation flowchart.



4.4 Waste Segregation

Waste segregation is an important step towards minimizing waste, as it prepares the waste for further processing. Through waste segregation, recyclable wastes can be separated from disposable wastes and hazardous wastes can be separated from non-hazardous wastes, which is important as hazardous waste is always more difficult to manage. Waste segregation will create a variety of options, other than disposal, resulting in environmentally conscious waste management. Ultimately, these options will allow MGM Energy to reduce waste disposal costs. Figure 3 and Table 3 illustrate the segregation strategy and provides insight into how waste will be processed.

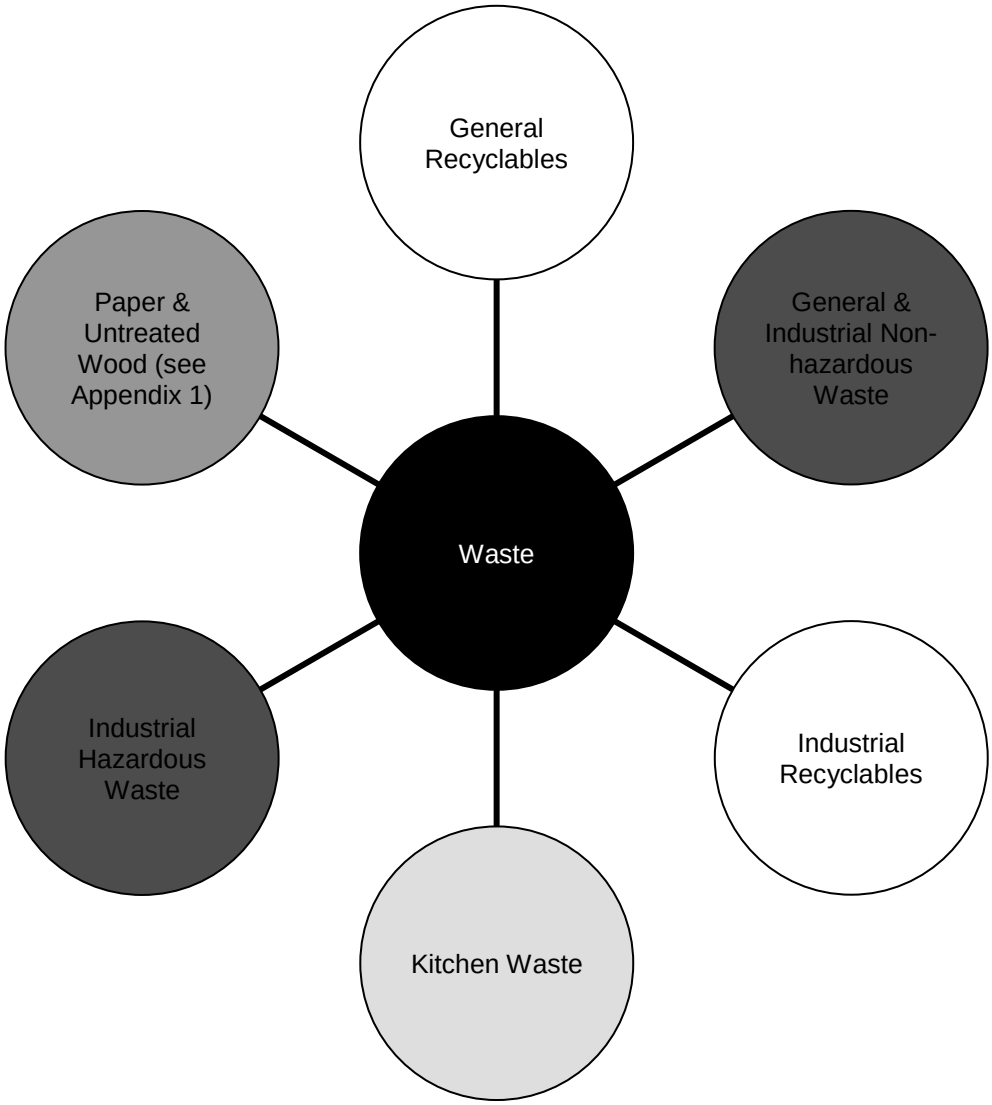


***Figure 3**: Segregation diagram for generated waste (see table 2 for details).*

LEGEND

- Recycled at appropriate and approved facilities (see Table 3)
- Incinerated locally or disposed at an appropriate facility
- Recycled or Disposed at appropriate and approved facilities (see Table 3)
- Disposed at appropriate and approved facilities (see Table 3)

Table 3: Waste Segregation Details

Container Label		Container Type	Details
General & Industrial Non-hazardous Waste	Various	Wildlife proof waste Receptacle	General & Industrial Non-hazardous Waste
	Kitchen Waste	Wildlife proof waste Receptacle	Foodstuff, paper products, plastic film wrapping, *etc*.
	Untreated Wood	Temporary stockpiles	Excess slash, construction material, *etc.*
General Recyclables	Beverage Containers	Wildlife proof waste Receptacles	General Recyclables
	Plastic Grocery Bags	Wildlife proof waste Receptacles	Keep clean and dry in a big disposal bag.
	Various	Wildlife proof waste Receptacles	Household hazardous waste [aerosol paint/sprays; acetone; air fresheners (aerosol); ammonia; all-purpose cleaners; antifreeze; barbeque starters; batteries (household and vehicle); brake fluid and lining; butane refills; degreasers; car waxes/polishes; disinfectants; furniture polish/wax; gasoline; drain cleaners; insecticides; kerosene; lacquers; nail polish and remover; oven cleaners; paint thinners; photographic chemicals; paint and varnish; rust remover; turpentine; smoke detectors; spa and pool chemicals; waxes; wood preservatives/finishes]; cell phones; electronics; ink cartridges; milk jugs and cartons and tires
Industrial Hazardous Waste	--	Oilfield waste bin	Industrial Hazardous Waste
Industrial Recyclables	Plastic	Oilfield waste bin	Industrial Recyclables
	Scrap Metal	Oilfield waste bin	--

Container Label		Container Type	Details
	Used Oil	Oilfield Waste Bin;	--
	Used Oil Filters	Oilfield Waste Bin	--

4.5 Waste Storage

Because of local treatment/disposal and access limitations, waste may need to be stored for short periods while awaiting transport to appropriate and approved facilities. Wastes could be stored at any location in the project areas where activities are taking place. MGM will identify where waste will be stored in a given activity season to Inspectors and the SLWB as part of the commencement of the land- use operation notification, the most likely places being the camp site and wellsite. Waste should be removed from project locations and areas as soon as practical and in the same season as activities when feasible. Therefore, storage areas and containers become important considerations. General principles for the storage of non-hazardous waste are listed below.

1. The regular collection, grading and sorting of waste contribute to good housekeeping practices.
2. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. The location of the stockpiles should not interfere with work but they should still be readily available when required.
3. Storing kitchen waste in a manner likely to attract wildlife is a violation of the NWT *Wildlife Act*. The following recommendations will minimize the attraction of carnivores to a camp:
   - Kitchen wastes should be incinerated daily. If kitchen wastes must be stored, airtight, sealed containers to prevent wildlife from being attracted to odors must be used.
   - All food in the camp should be stored in the kitchen or in a building attached to the kitchen, to ensure that there is only one area where food odors occur.
   - Storing all food, waste, recyclables and debris that may attract wildlife within sealed animal proof containers until final disposal.
   - Ensuring sealed animal proof containers are cleaned once emptied to minimize the attraction of wildlife
   - All grey water pits should utilize a grease trap, have lime added to them every second day and be covered to minimize odors and the potential attraction of carnivores.
   - No wildlife should be purposefully encouraged to habituate to human presence (*i.e.*, do not feed wildlife).
4. All waste receptacles should be clearly labeled and in good condition, not leaking and protected from the weather.
5. Inspect waste receptacles weekly and note any deterioration or corrosion in an inspection log. Clean-up any messes immediately.

General principles for the storage of hazardous waste are listed below [from the *Guideline for Hazardous Waste Management* (GNWT, 2017)].

1. Drainage into and from a waste storage site should be controlled to prevent spills or leaks from leaving the site and to prevent run off from entering the site.
2. Access to a waste storage site should be controlled. Only persons authorized to enter and trained in waste handling procedures should have access to the waste storage site.
3. Waste storage sites should have emergency response equipment appropriate for the waste stored on site. Furthermore, hazardous waste storage sites are expected to meet all local bylaw and zoning requirements. It is recommended that the local Fire Chief be advised of the storage facility and its content for emergency planning and response purposes.
4. Where long term storage of hazardous waste is required, quantity requirements (see Schedule I *Guideline for the General Management of Hazardous Waste in the NWT*) should be recognized. If quantity requirements are exceeded, the hazardous waste storage site should be registered in accordance with Section 3.4 of *Guideline for the General Management of Hazardous Waste in the NWT*.
5. Be sure that waste storage containers are compatible with chemical waste. Use containers that are made of or lined with materials which will not react with, and are otherwise compatible with, the waste to be stored. The original containers should be used, where possible.
6. Be sure that waste storage containers are sound, sealable and not damaged or leaking. Regular inspections for signs of leaks or deterioration should be performed and recorded.
7. Any container used to store hazardous waste must be labeled according to the requirements of the *Work Site Hazardous Materials Information System* (WHMIS) of the Safety Act (2006) or the relevant Transport Authority, if transport is planned.
8. Waste containers must be closed at all times, except when being filled. Do not leave funnels in the containers.
9. Maintain a record of the type and amount of waste in storage.

Waste will be temporary stored at locations where it is generated, this includes the wellsite and camp site identified on the Project Maps found in Appendix A. Waste will be removed in the same season during and at the conclusion of operations.

4.6 Determining Destinations for Waste

Since local treatment and disposal options are limited, distance and shipping become the key considerations when determining the best waste management options. Table 4 lists waste management facilities currently closest to the I-78, NWT Project area that may be used by MGM.

4.7 Waste Transporting and Tracking

4.7.1 Waste Contractors

Transportation means will be carefully selected and checked with respect to health, safety and environment (HSE) requirements. Transporters of waste will be provided with instructions on how to handle emergency situations. When using waste contractors, the following details will be verified.

• Contracts with waste contractors contain appropriate provisions regarding HSE.

• 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 MGM Energy.
• Waste materials transferred to contractors are packaged and labeled appropriately.
• Shipping documentation is completed in accordance with approved procedures and rests with MGM Energy at the end of the project.
• Waste consignments reach the specified final disposal site and are disposed of at an approved facility.
• Transportation costs and tipping fees are a major component of the waste management program and require close monitoring and control.

4.7.2 Trucking

At its most efficient, trucking occurs on a "back haul" when goods have been transported to I-78. The ideal situation is to take advantage of the back haul. Therefore, anyone responsible for arranging the transport of goods to I-78 will be responsible for arranging a back-haul load. The Operations Manager (see Appendix 4 for contact information) can be consulted for assistance in identifying back haul loads.

4.7.3 Tracking Hazardous and Non-Hazardous Waste

MGM Energy's hazardous waste generator registration number is NTG 000329. The Federal Transportation of Dangerous Goods Act and Regulations (TDG) identify requirements for the transportation of dangerous goods. According to these regulations, MGM Energy is responsible for the safe handling and transport of all hazardous material. It is MGM's responsibility to ensure that anyone involved in the handling, offering for transport or transporting dangerous goods must be trained and certified or working under the direct supervision of a trained and certified individual.

MOVEMENT DOCUMENTS

When completed, project produced Movement Documents provide:
• detailed information on the types and amounts of wastes being shipped;
• a record of various firms or individuals involved in the shipment; and
• information on the treatment storage, and/or disposal of wastes when they reach their final destination.

A Movement Document must be used for all shipment of hazardous wastes as defined in the province or territory of destination or origin and Interprovincial Movement of Hazardous Waste Regulations. Paramount will utilize Movement Documents for non-hazardous wastes as well.

Movement Document completion instructions are provided in Figure 4 and Table 4 as well as on the reverse side of each Movement Document. Further assistance in completing a Moving Document may be obtained by referring to the DRAFT - Instructions for Completing Each Item on the Movement Document (Environment Canada, 2017) or by contacting the Motor Carrier Services of the GNWT Department of Transportation.

MOVEMENT DOCUMENT DISTRIBUTION

All Movement Documents must be tracked through their cycle by the waste generator. Movement Documents must be kept on file for a minimum period of two (2) years.

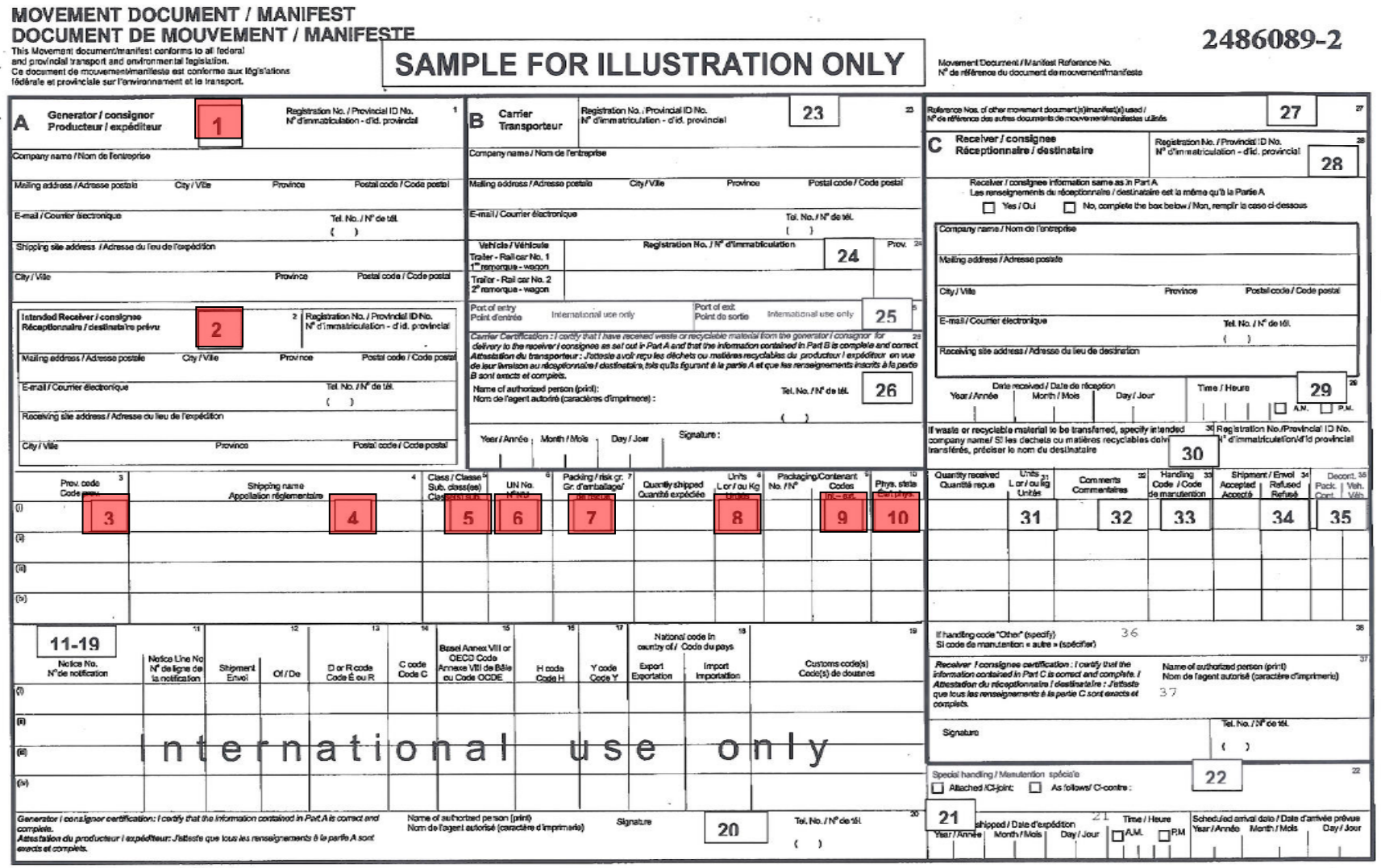
• Consignor (i.e., MGM) forwards copy 1 (white) to the appropriate territorial authority and retains copy 2 (green).
• The carrier takes copies 3, 4, 5 and 6 with the shipment to give to consignee/receiver (i.e., facility).

• The consignee completes part C and forwards copy 3 (yellow) to the appropriate authority.
• The consignee gives copy 4 (pink) to the carrier, retains copy 5 (blue) and forwards copy 6 (brown) to the consignor. The consignor forwards a photocopy of copy 6 (or faxes copy 6) to MGM's Environmental Specialist, HSE Department (see Appendix 5 for contact information). Once the HSE Department receives a photocopy of copy 6, information is entered and stored in a database for Paramount's use.

5. Waste Specific Management Options

Management options for wastes generated by the oil and gas sector in the Northwest Territories are very limited because of little to no waste infrastructure. Therefore, waste generated by the I-78 Project is primarily treated or disposed off-site.

Figure 4 *Movement Document Completion Instructions*



:

Table 4: Movement Document Completion Instructions

<table>
<tr><th>BOX #</th><th>Box label</th><th colspan="3">Instructions for Box Entries</th></tr>
<tr><td>1</td><td>Generator & Registration No.</td><td>MGM Energy
Suite 4700 888 3rd Street SW
Calgary, AB T2P 5C5
Telephone No.:
403.290.3600</td><td colspan="2">Registration No.: NTG000329</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">Intended Receiver</td><td>Town of Norman Wells</td><td colspan="2"></td></tr>
<tr><td>Secure Northern Rockies</td><td colspan="2" rowspan="2">See waste facility brochures below.</td></tr>
<tr><td></td></tr>
<tr><td>3</td><td>Provincial Code</td><td colspan="3" rowspan="5">See Table 5</td></tr>
<tr><td>4</td><td>Shipping Name</td></tr>
<tr><td>5</td><td>Class</td></tr>
<tr><td>6</td><td>UN No.</td></tr>
<tr><td>7</td><td>Packing Risk Group</td></tr>
<tr><td>8</td><td>Quantity Shipped and Units</td><td colspan="3">Enter the quantity of waste being shipped in metric units. Indicate the units used as with either kilograms (kg) or litres (L). If the exact amount of waste is not known enter “est.” Before the number for an estimated amount.</td></tr>
<tr><td rowspan="10">9</td><td rowspan="10">Packaging</td><td colspan="3">Enter the number of individual packages used to ship waste in the column head “No.”</td></tr>
<tr><td rowspan="9">Enter the codes for the type of packaging used in the shipment in the column headed “Codes”.</td><td>Code</td><td>Container</td></tr>
<tr><td>01</td><td>Drum</td></tr>
<tr><td>02</td><td>Tank</td></tr>
<tr><td>03</td><td>Bulk (e.g., Vac Truck, End Dump, etc.)</td></tr>
<tr><td>04</td><td>Carton</td></tr>
<tr><td>05</td><td>Bag</td></tr>
<tr><td>06</td><td>Roll off or lugger</td></tr>
<tr><td>07</td><td>Other (e.g., pail, palette, etc.)</td></tr>
<tr><td>10</td><td>Physical state</td><td colspan="3">Enter the physical state of the waste as solid (s), liquid (l) or gas (g).</td></tr>
</table>

Table 5 MGM Energy NWT Abandonment Waste Stream and Waste Management Plan.

Because of the small volume of various wastes which may be generated during this activity, a combination waste bin will be provided, and a specialized waste management contractor will handle disposal of the contents at the end of the project

Waste	Storage	NWT Classification	BC Classification	AB Classification	AER Code	Shipping Name	Class	UN #	Packing Group	Disposal
Aerosol Cans (flammable)	Waste Bin-HAZ	HAZ	HAZ	DOW	WSTCGS	AEROSOLS, flammable	2.1	UN1950	-	Turnkey management ofHAZ waste provided by contractor
Aerosol Cans (non-flammable)	Waste Bin-HAZ	HAZ	HAZ	DOW	EMTCON	AEROSOLS, non - flammable	2.2	UN1950	-	Turnkey management ofHAZ waste provided by contractor
Barrels, Pails (Completely Empty)	Waste Bin	Non-HAZ	Non-HAZ	Non-DOW	EMTCON	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Batteries (Dry Cell)	General Recyclable – Various [see *Guideline for the Management of Waste Batteries* (GNWT, 1998) for recommendation]	Non-HAZ	Non-HAZ	Non-DOW	BATT	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Batteries (Dry Cell)		HAZ	HAZ	DOW	BATT	Batteries, dry, containing potassium hydroxide solid, electric storage	8	UN3028	III	Turnkey management of non-HAZ waste provided by contractor
Boiler Blowdown Water (contaminated with HAZ material - dependent on boiler chemicals)	Steel Tank	HAZ	HAZ	DOW	BLBDWT	Environmentally hazardous substance, liquid, N.O.S.	9	UN3082	III	Service rig contractor to arrange transport & disposal at licenced facility in BC or AB
Boiler Blowdown Water (non-contaminated with HAZ material)	Steel Tank	Non-HAZ	Non-HAZ	Non-DOW	BLBDWT	-	-	-	-	Service rig contractor to arrange transport & disposal at licenced facility in BC or AB
Cardboard	Stockpile	Non-HAZ	Non-HAZ	Non-DOW	-	-	-	-	-	Incinerate daily
Cement Returns	Retarded or diluted in steel tank	Non-HAZ	Non-HAZ	Non-DOW	Cement	-	-	-	-	Transport & disposal at licenced facility in BC or AB
Chemicals (inorganic)	Original Containers	HAZ	HAZ	DOW	INOCHM	Dependent on specific waste characteristics (consult TDG Regulations)				Contact Chemical Waste Exchange
Construction and Demolition Material (uncontaminated)	Stockpile	Non-HAZ	Non-HAZ	Non-DOW	CONMAT	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Contaminated Debris and Soil (Chemical/Solvent/Oil/ Produced Water)	**Contact Paramount Environmental Dept**				SOILCH SOILCO SOILPW	Dependent on specific waste characteristics (consult TDG Regulations)				Contact Paramount Environmental Dept for approved landfill location
Corrosion Inhibitor/Oxygen Scavenger Solutions	Original Containers	HAZ	HAZ	DOW	CORINH	Dependent on specific waste characteristics (consult TDG Regulations)				Turnkey management of HAZ waste provided by contractor
Filters – Lube Oil	Waste Bin-HAZ	HAZ (depending on flash point and BTEX content)	HAZ (depending on flash point and BTEX content)	DOW (depending on flash point and BTEX content)	FILLUB	Environmentally Hazardous Substance, Solid N.O.S. (lead)	9	UN3077	III	Turnkey management of HAZ waste provided by contractor

Waste	Storage	NWT Classification	BC Classification	AB Classification	AER Code	Shipping Name	Class	UN #	Packing Group	Disposal
Grease Cartridges (Completely Empty)	Waste Bin- non HAZ	Non-HAZ	Non-HAZ	Non-DOW	EMTCON	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Hydraulic and Transmission Oil	Waste Bin- non HAZ				HYDOIL	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Kitchen Waste	Temporary Waste Receptacle	Non-HAZ	Non-HAZ	Non-DOW	-	-	-	-	-	Incinerate daily or Turnkey management of non-HAZ waste provided by contractor
Incinerator (kitchen waste)	General & Industrial non- HAZ Waste	Non-HAZ	Non-HAZ	Non-DOW	INCASH	-	-	-	-	Turnkey management of non-HAZ waste (ash) provided by contractor
Lead Based Products (Pipe Dope/Greases)	Waste Bin-HAZ	HAZ	HAZ	DOW	LDDOPE	Dependent on specific waste characteristics (consult TDG Regulations)				Turnkey management of HAZ waste provided by contractor
Lubricating Oil (Hydrocarbon and Synthetic)	Above ground disposal tanks; L&P Disposal Receptacles	Non-HAZ (unless containing heavy metals such as Vanadium or Lead	Non-HAZ (unless containing heavy metals such as Vanadium or Lead	Non-HAZ (unless containing heavy metals such as Vanadium or Lead	LUBOIL	-	-	-	-	Turnkey management of HAZ waste provided by contractor
Metal (Scrap) (uncontaminated)	Industrial Recyclable – Scrap Metal	Non-HAZ	Non-HAZ	Non-DOW	SMETAL	-	-	-	-	Recycle location - TBD
Mud Sacks – Completion/Abandonment	Waste Bin- non HAZ	Non-HAZ	Non-HAZ	Non-DOW	EMTCON	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Pipe Dope Containers/Brushes (Completely Empty & Dry)	Waste Bin- non HAZ	Non-HAZ	Non-HAZ	Non-DOW	EMTCON	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Sewage (Temporary Camps)	Sewage Sump or Storage Tank	Non-HAZ	Non-HAZ	Non-DOW	-	-	-	-	-	Transport & disposal at Norman Wells or licenced facility in BC or AB
Thread Protectors – Casing/Tubing	Waste Bin- non HAZ	Non-HAZ	Non-HAZ	Non-DOW	THPROT	-	-	-	-	Turnkey management of non-HAZ waste provided by contractor
Water - Grey (Temporary Camp)	Sewage Sump or Grey water holding tank	Non-HAZ	Non-HAZ	Non-DOW	-	-	-	-	-	Transport & disposal at Norman Wells or licenced facility in BC or AB

DOW: Dangerous Oilfield Waste HAZ: Hazardous
Packing Group: A group in which dangerous goods are included based on the inherent danger of the dangerous goods.
Packing Group I indicates great danger
Packing Group II indicates medium danger
Packing Group III indicates minor danger

6. References

Canadian Association of Petroleum Producers (CAPP). 2006. Waste Profile Sheets. Prepared by Wotherspoon Environmental Inc., Calgary, AB. 59pp.

Canadian Association of Petroleum Producers (CAPP). 2009. Oil and Natural Gas Waste Management – Northwest Territories. Prepared by Priddis Environmental Solutions Ltd., Calgary, AB.

Energy Resources Conservation Board (AER). September 2007. Draft Directive 50: Drilling Waste Management. Calgary, AB.

Energy Resources Conservation Board (AER). 1996. Directive 50: Drilling Waste Management. Calgary, AB.

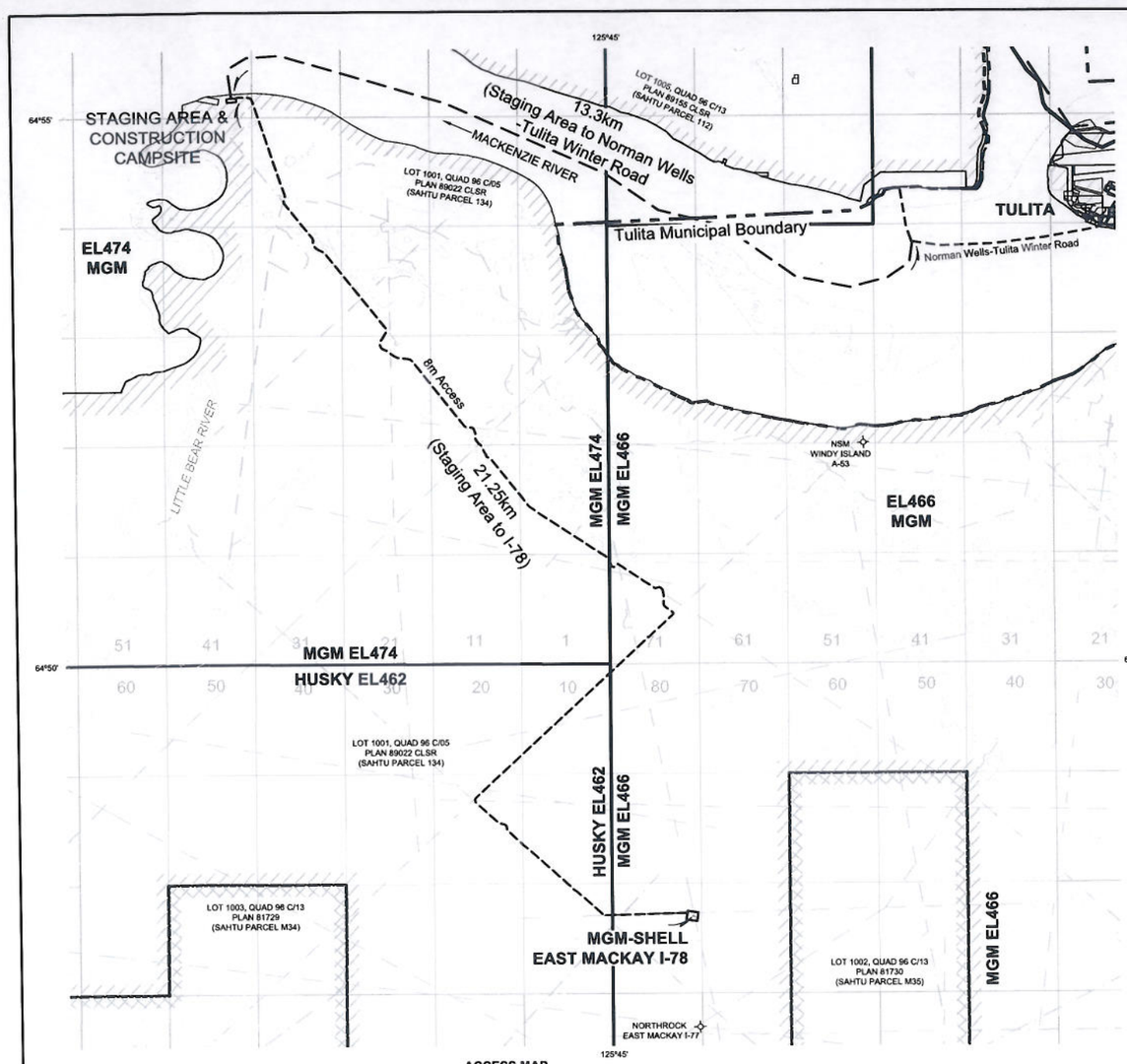
Energy Resources Conservation Board (AER). 1996. Directive 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry. Calgary, AB. 138pp+ apps.

Environment Canada. 2017. Movement documents for hazardous waste or recyclables. Available online at: https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/permit-hazardous-wastes-recyclables/fact-sheets-international-movement/movement-documents.html

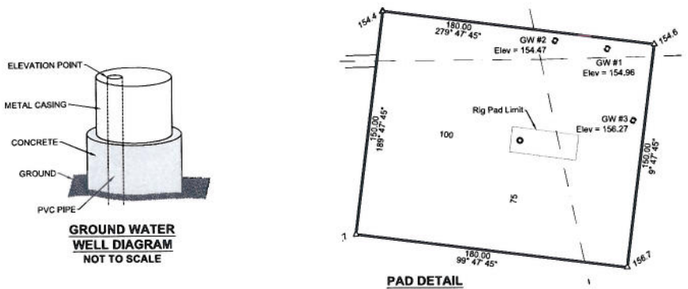
Government of the Northwest Territories. 1998. Guideline for the Management of Waste Batteries. Available online at: https://www.enr.gov.nt.ca/sites/enr/files/guidelines/batteryguideline.pdf

Government of the Northwest Territories. 2017. Guideline for Hazardous Waste Management. https://www.enr.gov.nt.ca/sites/enr/files/resources/128-hazardous_waste-interactive_web_0.pdf

Appendix 1: Project Maps and Surveys

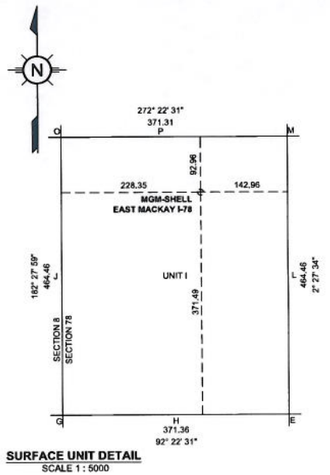


ACCESS MAP
SCALE 1 : 50 000



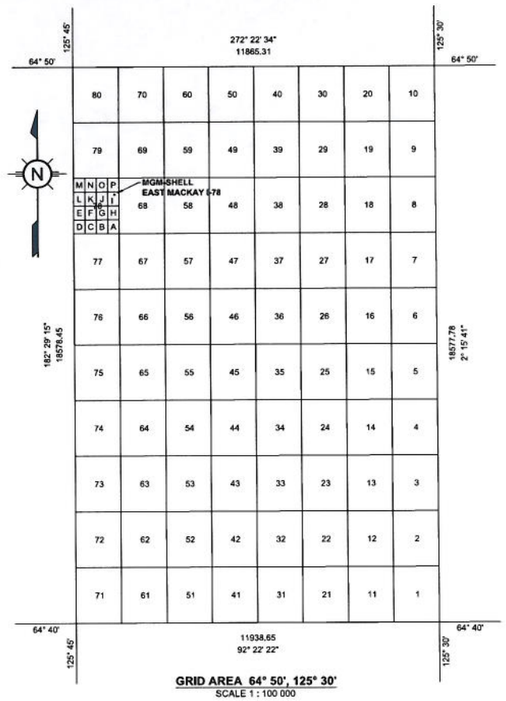
PAD DETAIL
SCALE 1 : 2000

GROUND WATER WELL DIAGRAM
NOT TO SCALE

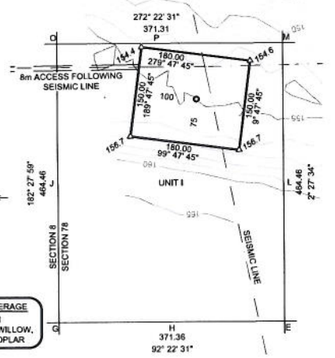


SURFACE UNIT DETAIL
SCALE 1 : 5000

NOTES:	NO	YES
-The proposed well is at least 300m from any privately owned land or structures.	☐	☒
-The proposed well is at least 100m from the ordinary high water mark of a permanent water body.	☐	☒
-The proposed well and related areas are 100m from an archaeological/historical/traditional land use site.	☐	☒



GRID AREA 64° 50', 125° 30'
SCALE 1 : 100 000



WELLSITE DETAIL
SCALE 1 : 5000

WELLSITE COVERAGE
OLD BURN
SCRUB SPRUCE, WILLOW, TAMARACK & POPLAR

REVISION NOTES:			
No.	DATE	DESCRIPTION	By
4	2013-03-26	AS-BUILT OF WELLSITE	MB
3	2013-02-06	ADDED MONITORING WELLS, PAD & FLANGE ELEVATIONS	MB
2	2012-10-25	UPDATED WELL NAME	MB
1	2012-10-16	ADDED UTM ZONE 9 COORDINATES FOR WELL CENTRE	MB
0	2012-09-17	PLAN ISSUED	MB

Sahtu GeoMatics Ltd.

CHALLENGER GEOMATICS LTD.
EDMONTON (780) 424-5511
CALGARY (403) 253-4151
FORT MCMURRAY (780) 743-4697
WHITEHORSE (867) 668-6940

MGM ENERGY CORP.

AS-BUILT WELLSITE PLAN (MARCH 2013)
OF
MGM-SHELL EAST MACKAY I-78
IN UNIT I, SECTION 78
GRID AREA 64°50', 125°30'
EXPLORATION LICENCE 466

SAHTU SETTLEMENT AREA, TULITA DISTRICT
2012 NORTHWEST TERRITORIES RON ROBINSON C.L.S.

AREAS
WELL SITE = 2.70 ha.

ELEVATIONS
ORIGINAL GROUND AT WELL
LOCATION =155.1m
PAD ELEVATION =155.92m
AT TOP OF FLANGE =155.9m

SURVEY DATES
AUGUST 18-19, 2012 & FEBRUARY 2-3, 2013

UTM CO-ORDINATES
AT WELL CENTRE

NAD 27 (UTM Zone 10)	NAD 83 (UTM Zone 10)
N. 7188196.19	N. 7188403.92
E. 370694.01	E. 370615.72
NAD 27 (UTM Zone 9)	NAD 83 (UTM Zone 9)
N. 7189449.02	N. 7189648.73
E. 655726.91	E. 655635.83

GEOGRAPHIC CO-ORDINATES
AT WELL CENTRE

NAD 27	NAD 83
LAT. : 64°47'42.1" N.	LAT. : 64°47'42.4" N.
LONG. : 125°43'18.3" W.	LONG. : 125°43'24.7" W.

LEGEND
Lands to be Dealt with outlined thus
Proposed MGM Access shown thus
Aboriginal Surface Rights shown thus
Aboriginal Sub-Surface Rights shown thus
0.25m spikes placed shown thus △
Ground water monitoring wells are shown thus ○ GW #3

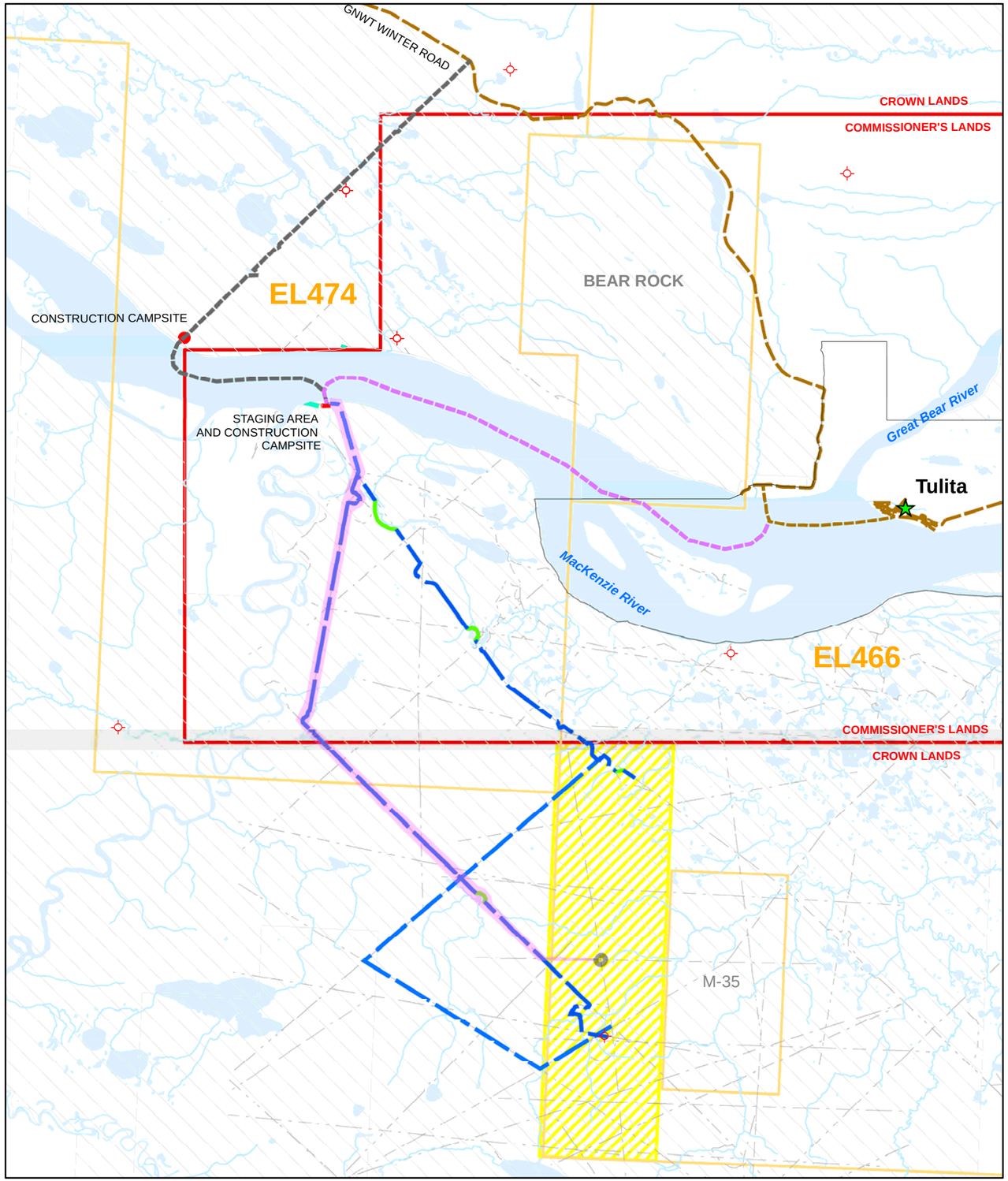
NAD 27 UTM coordinates are converted from surveyed NAD 83 values and are derived from NRCAN Precise Point Positioning (PPP) website.
Elevations are orthometric and were derived using the HTv2.0 geoid model.
Bearings are UTM grid (NAD 27) Zone 10 and are referred through C.M. 123° W.
Distances are in metres and decimals thereof.
Contour interval is 1.0m
Position of foreign wells is based on NEB records.

OPERATOR: MGM ENERGY CORP.

WITNESS

RON ROBINSON
CANADA LANDS SURVEYOR

SCALE:	DRAWN/CHECKED:	DATE:	CALC NO.:
AS SHOWN	MB/IC/RR	2012-09-17	39002
			ACAD NO.: 39002_I-78



Legend

- Existing Wells
- Access Option 2
- Access Option 1
- Access New Cut
- Alternative Site Access Options
- GNWT Winter Road
- Cutlines
- watercourse
- Chosen Access Route from the Staging Area
- Selected Drillsite / Campsite Location
- Commissioner's Lease
- Area of Interest
- Staging Area/Construction Campsite
- Commissioner's Lands Boundary
- Tulita Municipal
- MGM EL's
- Aboriginal Surface
- Water Body

N

0 1.25 2.5 5 7.5 10

Kilometers

1:120,000

DOT WINTER ROAD DISTANCES		
FROM	TO	DISTANCE(km)
NORMAN WELLS	Access Option 1	80
TULITA	Access Option 1	3
NORMAN WELLS	Access Option 2	60
TULITA	Access Option 2	23
TULITA	WRIGLEY	248

MGM ENERGY CORP.

MGM EAST MACKAY

PROJECT AREA MAP

Projection: NAD83 UTM Z10
Date: July 17, 2012

Appendix 2: Paramount HSE Policy

Health, Safety and Environment Policy

Paramount Resources Ltd ("Paramount") is committed to a culture where prevention of incidents that may cause harm to people, property loss or an adverse impact on the environment is of the highest importance.

We believe that promoting operational discipline and consistency as detailed in the Paramount Operational Excellence Management System (**POEMS**) is of critical importance in fulfilling our commitments in the areas of health, safety and environmental protection. Our commitments include:

Worker Health and Safety: We will endeavor to ensure that all work performed for Paramount is done so in a safe manner by competent workers using appropriate equipment It is a requirement that work should only proceed once hazards have been identified and appropriate controls put in place to prevent/minimize any potential incidents or loss.

All employees and contractors conducting work for Paramount have the right to stop or refuse work that they consider to be unsafe or environmentally irresponsible without fear of repercussion.

Environmental Protection: We are committed to achieving a high standard of environmental stewardship. We ensure that environmental protection is an integral component of our decision making by identifying the potential environmental impacts associated with our activities and taking prudent actions to prevent/minimize these impacts and reduce our environmental footprint.

Regulatory Compliance: We are committed to complying with all applicable Federal and Provincial laws and regulations and recognized industry standards and practices. Individuals who violate applicable laws and regulations will be held responsible for their actions.

Continuous Improvement: Incidents and potential incidents are reported and analyzed to determine causes and identify corrective actions and shared learnings in order to reduce the risk of recurrence. We review the adequacy and effectiveness of all our policies, processes, programs and procedures on a regular basis to ensure they remain appropriate and up to date.

Paramount believes that its interests and those of its stakeholders, including the communities in which we operate, are best served by diligently applying the principles, practices and procedures set out in POEMS in all of our operations, and we will take steps to ensure that everyone working for Paramount supports and conducts themselves in accordance with this management system.

J.H.T. Riddell
President and Chief Executive Officer

January 2018

Appendix 3: Beverage Container Preparation

Container Type	Picture	Instructions
Aluminum Can		Empty container Do not need to crush
Glass Bottle		Remove cap Empty container Leave label on Do not break or crush
Plastic Bottle		Remove cap Empty container Leave label on
Juice Box and Drink Pouch		Empty container Take straw out
Juice Carton		Remove cap Empty container
Bi-metal Can		Empty container Leave label on Do not break or crush
Bag-in-a-Box		Empty container Keep the bag and box together
Large Milk Containers		Remove cap Empty container Rinse container out Squash container
Small Milk Containers		Remove cap Empty container Rinse container out Leave label on

https://www.enr.gov.nt.ca/en/services/beverage-container-program/faq-beverage-container-program

Appendix 4: MGM Energy Contact Information

Title	Name	Contact
Completions Field Supervisor	TBD	
Completions Supervisor	Corey Thomson	
Construction Field Supervisor	TBD	
Construction Supervisor	Boyd Stewart	
Director, Asset Management	John Hawkins	
Environmental Coordinator	Ian Keir	
Director, Drilling & Completions	Andre Poitras	
Manager, Drilling and Completions	Tim Wood	
Regulatory and Community Affairs Advisor	Terence Hughes	

- Contact information will be provided to the SLWB and Inspectors prior to the commencement of activities. MGM Energy will request that this information not be posted on the Public Registry due to privacy and security concerns for the individuals and MGM Energy.

Appendix 5: Environment Canada Technical Document for Batch Waste Incineration

Environment Canada Environnement Canada

Technical Document for Batch Waste Incineration:

Executive Summary and Overview of the Six-Step Process for Batch Waste Incineration

January 2010

Canada

Acknowledgements:
Environment Canada would like to acknowledge the work of A.J. Chandler & Associates Ltd. in the preparation of this technical document.

En14-17/2-2010E-PDF
978-1-100-14951-6

Aussi disponible en français.

EXECUTIVE SUMMARY

Incineration is recognized as an effective and environmentally sound disposal method for a wide range of wastes, and is used in facilities and jurisdictions across Canada. Waste generators located in remote areas may have limited options for cost-effective and environmentally sound waste management, and incineration may therefore be considered an appropriate waste management option. Remote commercial activities, such as exploration and development of natural resources, can create large volumes and varieties of wastes that must be managed appropriately. Residual wastes from industry, research activities, and the health care sector may require thermal treatment as an environmentally sound method to control the spread of disease from plants, animals or humans. Furthermore, there are certain locations in Canada where incinerating waste is an important means of avoiding potentially dangerous interactions between humans and wildlife. In all cases, reduction and diversion should be the primary waste management objectives, prior to considering any disposal option.

There are, however, some important potential environmental concerns associated with waste incineration that must be addressed through proper equipment selection, operation, maintenance and record keeping. These include potential releases of mercury, as well as dioxins and furans (PCDD/F), which are persistent organic pollutants (POPs). Mercury and POPs bio-accumulate in the environment and may cause adverse effects to human health and the environment. They can also be transported over long ranges; data from measurements in the North reveal concentrations far greater than what might be explained by local production. Dioxins/furans can be generated when inadequate incineration technology is used or when an incinerator is improperly operated. Mercury is not created in an incineration system; emissions are directly related to the presence of mercury in certain waste materials. Therefore, the best method to control mercury emissions is to limit the quantity of mercury in the waste fed to the incinerator.

The *Stockholm Convention on Persistent Organic Pollutants (POPs)* (which entered into force in May 2004 and to which Canada is a Party), identifies incineration as a potential source of POPs, and establishes a range of measures to reduce and, where feasible, eliminate their release. It also requires that the best available techniques (BAT) and best environmental practices (BEP) be applied for both new and substantially modified sources of POPs. Additionally, the Canadian Council of Ministers of the Environment (CCME) adopted the Canada-wide Standards for Dioxins and Furans in 2001, identifying incineration for action to reduce emissions, and adopting specific air emission standards. The CCME also adopted the Canada-wide Standards for Mercury Emissions in 2000 which include limits on mercury emissions from incinerators. Both mercury and dioxins/furans are on the List of Toxic Substances in Schedule 1 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999).

The Technical Document for Batch Waste Incineration was developed to provide guidance for owners and operators on proper system selection, operation, maintenance and record keeping, with the goals of achieving the intent of the Canada-wide Standards for dioxins/furans and mercury, and reducing releases of other toxic substances. The document includes:

- A discussion of the importance of reducing, reusing and recycling to divert wastes from disposal;
- Methods for the selection of appropriate incineration technologies to meet specific waste management requirements;
- Operational requirements that should allow batch incinerators to meet the intent of the Canada-wide Standards for dioxins/furans and mercury, and to reduce the release of other toxic substances; and

- Recommendations on record keeping and reporting.

This Technical Document focuses on minimizing dioxins/furans and mercury emissions from batch waste incinerator systems ranging in size from 50 kg to 3000 kg of waste/batch, the latter representing the largest batch incinerator currently in use in Canada. 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). Air emission testing completed by Environment Canada in 2002 using a modern Canadian-built batch waste incinerator demonstrated that, when properly operated and maintained, these systems are capable of meeting the Canada-wide Standards for dioxins/furans (80 pg I-TEQ/Rm^3 @ 11% O_2) and mercury (20 µg/Rm^3 @ 11% O_2). Stack testing can be carried out as required by the regulatory authorities (e.g. federal, provincial/territorial) to verify that these standards are met.

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 process will assist owners and operators of batch waste incinerators to achieve the intent of the Canada-wide Standards for dioxins/furans and mercury, and reduce the potential for releases of other toxic substances to the environment.

OVERVIEW OF THE SIX-STEP PROCESS FOR BATCH WASTE INCINERATION

Step 1: Understand Your Waste Stream

The first step in managing waste is to understand the quantity and composition of the waste that is generated. A waste audit should be completed, where practical, to:

- Determine the quantity of waste generated in the various parts of an operation;
- Characterize the waste from each type of operation;
- Examine the waste stream to determine what opportunities exist for:
    - Reducing the quantity of waste generated;
    - Reusing materials; and
    - Recycling as much as possible before considering disposal.

Where waste audits are not practical, it is still necessary to develop an estimate of the waste quantities and characteristics before a strategy for waste diversion and disposal can be completed. Owners should investigate waste generation and diversion data from similar operations/facilities in order to estimate the waste types and quantities that will be generated at their own facilities. Sources of such information may include industry associations, waste industry consultants, provincial/territorial authorities and other regulatory bodies.

Based on the results of the waste audit/characterization, an assessment of appropriate disposal options should be undertaken. Where possible, disposal alternatives (other than incineration) for the residual waste stream (i.e. post 3Rs – Reduce, Reuse, Recycle) should be examined. When assessing disposal options, it is important to note that waste should neither be open-burned nor burned in a barrel. In both cases, the appropriate temperatures for a clean burn will not be achieved, and toxic contaminants, in particular dioxins and furans, will be released.

Step 2: Select the Appropriate Incinerator (or Evaluate the Existing System)

The characteristics of the residual waste stream destined for incineration should be incorporated into a call for proposals from incinerator manufacturers. Specifying the quantity and composition of the waste stream will ensure that proposals include suitable incinerators. It should be noted that incinerators built for a specific waste stream, such as animal carcasses, liquid wastes and hazardous wastes, are available and should be used as required.

For facilities with existing incinerators, owners/operators should reassess the suitability of the existing system to manage the current waste stream.

For facilities incinerating **more than 26 tonnes of waste per year,** dual chamber controlled air incinerators are the recommended configuration. These systems are capable of incinerating a wide range of wastes and, when properly maintained and operated, will achieve emissions of PCDD/F and mercury below the level of the Canada-wide Standards. These systems should be equipped with a large secondary chamber sized to provide a residence time of at least one second at a temperature higher than $1000^{O}C$, to ensure complete combustion and minimize PCDD/F emissions.

For facilities incinerating **less than 26 tonnes of waste per year**, “determined efforts”

as defined in the Canada-wide Standards for dioxins and furans[1] should be undertaken. Should circumstances restrict the ability to use a dual-chamber incinerator with a large secondary chamber, a single chamber incinerator with an afterburner should be used. It should be noted that such systems are less likely to be able to meet the emission standards than dual chamber incinerators.

Step 3: Properly Equip and Install the Incinerator

Building Considerations

- Incinerators should be installed inside a building to protect the equipment and the operators from weather conditions.
- In designing the installation site, care should be taken to maximize clearance between incinerator components, including the stack, and combustible construction materials.
- Insulation should be used to protect combustible building materials.
- The building should be equipped with sufficient fresh air inlet capacity for the incinerator. Both combustion air and dilution air for the barometric damper are required. Care should be taken to introduce air in a manner that does not lead to low-temperature operating problems.

Equipment Considerations

The incinerator system should come complete with the following equipment to monitor and record performance parameters:

- A scale to measure the weight of all materials charged to the incinerator; and
- A computerized process control and data acquisition system to store operating data from the incinerator.

Operational data should be collected and stored, at a minimum, every minute that the system is operating. The intent is to be able to summarize operating parameters during start-up, operation and cool-down for every cycle. If the required operating conditions are not achieved these data will allow the operators, the manufacturers and the regulator to identify the contributing factors for the failure. From this information, operating procedures can be adjusted to improve performance. Provisions should be made for the manufacturers to be able to remotely access and review the operating data for trouble shooting purposes.

It is highly recommended that batch incinerators not be equipped with heat recovery devices. The temperature of the stack gases in heat recovery systems will be lower than in systems without heat recovery, and may be in a temperature range that can lead to the formation of greater quantities of PCDD/F. Similarly, air pollution control systems are not recommended for batch waste incineration systems to control PCDD/F emissions. Stack gases should be released directly to the atmosphere at temperatures higher than 700^{O}C to reduce the chances of the inadvertent formation of PCDD/F through the *de novo* synthesis process.

If it is necessary to introduce additional waste to the incinerator during the burn cycle, the incinerator should be equipped with a ram charge system to limit the disruption of combustion in the primary chamber during the waste charging process.

[1] Available on-line at: http://www.ccme.ca/ourwork/air.html?category_id=97

Step 4: Operate the Incinerator for Optimum Combustion

Operational Considerations

Wastes received at the incinerator building should be separated according to their heating value characteristics: wet or low-energy wastes (e.g. food waste); mixed wastes with average energy values; and other materials with high energy values, such as oily waste materials. To facilitate this separation, all waste should be collected in transparent bags. To further assist with separation, wastes could be collected in coloured-coded bags.

Batch incinerators are designed to accept wastes within a specified range of energy (i.e. calorific) values. The operator should select waste from each category and mix it to achieve the manufacturer's specified input calorific value. Each bag should be weighed, its source should be noted, and the total weight of each category should be tallied before completing the loading. This information should be recorded by the computerized data acquisition equipment installed with the incinerator. (Refer to step 6 for further record keeping requirements).

Batch incinerator systems have limited charging capacity (both in terms of waste quantity and the calorific value of the waste charge). To assist the operator with the charging task, particularly for smaller incinerators, several batches could be weighed and placed in their own containers prior to loading the incinerator. The same weighing and logging procedures should be used for each batch and, once recorded, the batch can be charged when appropriate.

When the incinerator is charged with the appropriate mix and quantity of waste, the operator should close the door, ensure all interlocks are engaged, and start the burn cycle. The operator should observe the burn for at least 15 minutes after ignition of the primary chamber burner to ensure the volatility of the waste charged is not creating too much gas for the secondary chamber to handle. The rate of combustion can be slowed by reducing the quantity of under-fired air. The primary chamber should be operated in the temperature range specified by the manufacturer (typically $500^{O}C$ to $800^{O}C$).

When satisfied that the burn is proceeding in a controlled manner, the operator may leave the incinerator area while the equipment completes the burn cycle.

The burn cycle should not be interrupted by opening the charging door until after the burn is complete and the unit has cooled down. No additional waste should be added to the primary chamber unless the incinerator is equipped with an appropriate ram feed device.

When the burn is complete and the unit has cooled, the operator should open the door only when wearing protective equipment such as gloves, dust mask, face shield and goggles.

The operator should remove the ash from the previous burn cycle before reloading the incinerator. Any unburned materials found in the ash should be recharged to the primary chamber after the operator has cleaned the air ports, and before putting a fresh charge into the incinerator.

Training Considerations

Operators should be properly trained by the incinerator manufacturer. The training course should include, as a minimum, the following elements:

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

Managers should be involved in the training session so that continuity can be maintained with different operators.

Step 5: Safely Handle and Dispose of Incinerator Residues

Ash from the primary chamber of the incinerator can contain materials deleterious to the operator's health and the environment. Operators should use personal protective equipment when handling this material. The material should be carefully removed from the hearth and placed in covered metal containers suitable for transporting the ash to an approved disposal site. The operator should weigh, and maintain records of, the quantity of ash produced.

Step 6: Maintain Records and Report

To demonstrate appropriate operation and maintenance of the incinerator, the facility should maintain records and prepare an annual report containing at least the following information:

- A list of all staff who have been trained to operate the incinerator; type of training conducted and by whom; dates of the training; dates of any refresher courses;
- All preventative maintenance activities undertaken on the equipment;
- Records of operation of the incinerator - in electronic format with full data backup;
- Summarized annual auxiliary fuel usage;
- A list of all shipments of incinerator residues, including the weight transported and disposed of by type if necessary, and the location of the disposal site;
- Results of any emissions measurements or any ash sampling data collected during the period.

All raw data records from the operation of the incinerator should be retained for inspection by the appropriate authorities for the period designated by those authorities, or for at least 2 years. The owner should work with the incinerator manufacturer or supplier and the regulators to determine the appropriate level of summary data that should be sent to the regulatory body (e.g. federal, provincial/territorial). The reports should be approved by the facility's senior management before submission.