Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

February 1, 2006

On June 17, 2013, the Energy Resources Conservation Board was succeeded by the Alberta Energy Regulator (AER). As part of this succession, the title page of this directive was changed to carry the AER logo. However, no changes were made to the main body of this directive.

Application Requirements for Activities Within the Boundary of a Regional Plan

The AER is legally obligated to act in compliance with any approved regional plans under the *Alberta Land Stewardship Act*. To ensure this compliance, the AER is requiring any applicant seeking approval for an activity that would be located within the boundary of an approved regional plan to meet the requirements below. These requirements will be formally incorporated into the directive at a later date.

A) For an activity to be located within the boundary of an approved regional plan, the applicant must assess

   I) whether the activity would also be located within the boundaries of a designated conservation area, a provincial park, a provincial recreation area, or public land area for recreation and tourism and, if so, whether the mineral rights associated with the activity are subject to cancellation;

   II) whether the activity is consistent with the land uses established in the applicable regional plan or with any of the outcomes, objectives, and strategies in that same plan; and

   III) how the activity is consistent and complies with any regional trigger or limit established under the management frameworks detailed under the applicable regional plan or any notices issued in response to the exceedance of a regional trigger or limit.

B) The applicant must retain the information for requirement A at all times and provide it on request unless otherwise indicated below. The information must be sufficient to allow the AER to assess an application under the applicable regional plan.

C) The applicant must submit the information from requirement A if the proposed activity to be located within the boundary of an approved regional plan

   I) is also within the boundaries of a designated conservation area, a provincial park, a provincial recreation area, or a public land area for recreation and tourism;

II) is inconsistent with the land uses established in the applicable regional plan or any of the outcomes, objectives, and strategies in that same plan;

III) may result in the exceedance of a trigger or limit or contravene a notice issued in response to an exceedance of a trigger or limit; or

IV) is “incidental” to previously approved and existing activities.

D) If any of the criteria in requirement C are met, the application must be submitted as nonroutine.

E) If the applicant believes that its proposed activity is permitted under the applicable regional plan because it is incidental to previously approved and existing activities, the applicant must provide information to support its position.

The AER has no authority to waive compliance with or vary any restriction, limitation, or requirement regarding a land area or land use under a regional plan. Applicants that wish to seek this type of relief must apply directly to Alberta’s Land Use Secretariat established under the *Alberta Land Stewardship Act*. The stewardship minister may, on application and by order, vary the requirements of a regional plan. For more information, contact Alberta’s Land Use Secretariat by phone at 780-664-7972 or by e-mail to LUF@gov.ab.ca.

For more information on the requirements above, refer to *Bulletin 2014-28: Application Requirements for Activities within the Boundary of a Regional Plan* or e-mail regional.plans@aer.ca. This bulletin rescinds and replaces *Bulletin 2012-22: Application Procedures for Approval of Activities Located In or Near the Boundaries of the Lower Athabasca Regional Plan*, which is an earlier bulletin that was issued regarding the AER’s compliance with approved regional plans under the *Alberta Land Stewardship Act*.

Oilfield Waste Management Requirements for the Upstream Petroleum Industry

November 1996, incorporating change of February 1, 2006

Appendix 8.1 and 8.2 replaced by Section 4 of *Directive 030*

Energy Resources Conservation Board

ENERGY RESOURCES CONSERVATION BOARD
Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

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FOREWORD

On 3 December 1992, a multi-stakeholder Steering Committee was established to oversee the work of several subcommittees that jointly prepared a draft of oilfield waste management requirements for the Energy Resources Conservation Board (ERCB), now the Alberta Energy and Utilities Board (EUB). These requirements were implemented on 1 September 1993 when the ERCB assumed jurisdiction for the regulation of upstream oilfield wastes.

The draft report, *Recommended Oilfield Waste Management Requirements*, and IL 93-8 were a compilation of the:

Alberta Environmental Protection and Enhancement Act (EPEA) and Regulations,
Alberta Environmental Guidelines,
Requirements written into Licences to Operate,
Oil and Gas Conservation Act and Regulations, and
ERCB Informational Letters, Interim Directives, and General Bulletins.

Following the release of the document, a new Steering Committee was established in January 1994 to oversee a broad public/government/industry review of the Recommended Oilfield Waste Management Requirements. Individuals who served on the Steering Committee are:

Don Beamer, Chairman	Alberta Energy and Utilities Board
Silver Lupul	Alberta Environmental Protection
Scott McClure	Alberta Special Waste Management Corporation
Kim Johnson	Canadian Association of Petroleum Producers
Harvey Hittel	Canadian Association of Petroleum Producers
Tim Taylor	Canadian Association of Petroleum Producers
Ken Byram	Alberta Oilfield Treating and Disposal Association
Ross Huddleston	Environmental Services Association of Alberta
Myles Kitagawa	Toxic Watch Society
Richard Chant	Pembina Institute for Appropriate Development

Input was also provided by Alberta Health and the Health Unit Association.

Following the completion of the review in April 1994, the Steering Committee compiled the responses and identified areas of the document that required further work. As the review of each area was completed, either by a subcommittee or independently by the EUB, the information was tabled with the Steering Committee for ratification and consolidation into the requirements. As a result, some of the requirements within this document, *Oilfield Waste Management Requirements for the Upstream Petroleum Industry*, represent new policy.

The Steering Committee would like to thank all of those who worked on the subcommittees and especially Susan Halla, Steve Skarstol, and Meg Bures of the EUB for their extensive work on various subcommittees and in compiling much of the document.

PART A

POLICIES AND RESPONSIBILITIES

Part A

Policies and Responsibilities

1.0 Introduction

This document addresses a wide range of waste management issues that apply to oilfield wastes. It represents a consolidation of information on all oilfield waste management matters that come under the jurisdiction of the Alberta Energy and Utilities Board (EUB) and other issues which indirectly affect the management of wastes that are produced by the upstream oil and gas industry in Alberta.

The principles and purpose of these requirements are to:

- Describe the EUB's expectations on how the Alberta upstream oil and gas industry should manage oilfield wastes.
- Identify the oilfield waste management responsibilities of the licensee and/or approval holder.
- Promote waste volume minimization involving reuse, recycle, reduce, and recover philosophies.
- Require the recording, retention, and submission of oilfield waste information that will assist in compliance with waste management practices.

2.0 Responsibilities and Enforcement

2.1 Responsibilities

1. Waste Generator

The oilfield waste generator (i.e. licensee and/or approval holder) is responsible for ensuring that:

- these requirements are followed,
- waste minimization is considered when appropriate,
- oilfield wastes are properly characterized,
- appropriate treatment and disposal practices are utilized,
- the capabilities and limitations of any waste treatment and disposal method are known,
- accurate and complete waste documentation and manifesting is maintained,
- waste carriers and receivers have been informed of the oilfield waste's properties, and
- the required approvals and operational requirements are in place for any on-site handling, treatment, and disposal method.

2. Waste Receiver

The oilfield waste receiver is responsible for ensuring that:

- the required approvals and operation requirements are in place for any on-site waste handling, treatment, and disposal method,
- the capabilities and limitations of their treatment and disposal facilities are known and waste generators are informed of the limitations,
- only waste is received for which their facility is approved to handle,
- accurate and complete waste documentation and manifesting is maintained,
- their operations are in compliance with licences and approvals, and

- equipment and operating practices are upgraded as necessary to comply with changes in regulatory requirements.

2.2 Enforcement

1. EUB

~~The EUB believes that enforcement is one part of a total program of regulation, information, distribution, and enforcement, all of which are designed to achieve:~~

~~*"An energy industry that understands, respects, and meets or exceeds regulations and standards often through the implementation of self-imposed guidelines."*~~

~~This vision states clearly that compliance is the responsibility of the energy industry. The EUB expects that all industry players will understand its requirements and have an infrastructure in place to ensure compliance. At the same time, the EUB believes that, on occasion, enforcement of regulations will also be required to ensure compliance and to meet the vision of the enforcement policy, as explained in the EUB's Enforcement Brochure, issued August 1996.~~

2. AEP

Oilfield waste facilities are specifically excluded from requiring an approval under Alberta Environmental Protection and Enhancement Act (EPEA). Some waste facilities may be part of a larger site, such as a sour gas plant, which also requires an approval from Alberta Environmental Protection (AEP). Because of this exclusion, the waste facilities will not be subject to the EPEA Waste Control Regulation. They may be subject to Environmental Protection Orders (EPOs) and Enforcement Orders (EOs) under a variety of sections of EPEA, including the Contaminated Sites section. EPOs are issued to persons deemed "responsible", and if the conditions of the order are not met, an EO under Section 200 of EPEA may be issued along with the associated fines.

3.0 Importation of Oilfield Waste

1. Wastes generated outside of Alberta resulting from the exploration and production of oil and gas and **exhibit** the properties that would classify the wastes as:

   - **dangerous waste** in accordance with the Transportation of Dangerous Goods Act (TDG),
   - **hazardous waste** in accordance with EPEA, and
   - **dangerous oilfield waste** in accordance with Section 5.0 of this document:

     (a) shall not be imported into Alberta for the purpose of direct disposal, or

     (b) shall not be imported into Alberta for the purpose of treatment or disposal at EUB approved facilities,

     (c) may be imported into Alberta for the purpose of treatment, provided the wastes are directed into the Alberta Special Waste Management System, which is under the jurisdiction of AEP, and

     (d) shall not be temporarily stored in Alberta for a period that exceeds 30 days.

2. Wastes that are generated outside of the province of Alberta during the exploration and production of oil and gas and **do not exhibit** the properties that would classify the wastes as **dangerous wastes, hazardous wastes, or dangerous oilfield wastes** may be imported into Alberta for purpose of treatment and/or disposal.

3. Licensees and/or Approval Holders of facilities under the jurisdiction of the EUB wanting to receive wastes identified in point (2) above, must:

   (a) for existing facilities, apply to the EUB to amend the current facility approval or licence to allow the receipt of imported wastes, or

   (b) for proposed facilities, include in their application for approval to construct and operate, the intention to receive imported wastes streams and the waste source.

PART B

WASTE CHARACTERIZATION AND CLASSIFICATION

Part B

Waste Characterization and Classification

4.0 Introduction to Waste Characterization

4.1 Overview

The waste generator is responsible for properly characterizing each waste (see Table 4.1a, *Properties of Dangerous Oilfield Wastes*). The waste characterization is then used in assessing the appropriate handling, treatment, and disposal of that waste. Waste characterization is the assessment of the physical, chemical, and toxicological characteristics (i.e. properties) of a waste. There are two primary reasons for characterization:

- to determine the dangers relating to transportation on public roads, and
- to determine the environmental consequences of the waste so that a disposal or management option that appropriately deals with those consequences may be used.

Once an oilfield waste has been characterized, it can be classified into one of two classifications; dangerous oilfield waste (DOW) or non-dangerous oilfield waste (non-DOW) (see Table 4.1a, *Properties of Dangerous Oilfield Wastes* and Table 4.1b, *Dangerous Oilfield Wastes*). Recommended test methods for waste characterization are provided in Appendix 3.0, *Recommended Test Methods*.

Figure 4.1 Characterization versus Classification

4.2 Responsibilities

It is expected that all reasonable efforts will be made by the waste generator to minimize the production of wastes prior to addressing the issue of disposal (refer to Appendix 6.0, *Waste Minimization*). The EUB strongly encourages the conservation of resources through minimization prior to the disposal of residual wastes.

In all cases, it is the responsibility of the waste generator to ensure that each waste has been properly identified, characterized and handled, treated, and disposed in a proper manner.

4.3 Transportation Requirements

The Federal Transportation of Dangerous Goods Act and Regulations (TDG) identifies requirements for the transportation of dangerous goods. The Alberta Department of Transportation and Utilities (ATU) administers TDG within Alberta utilizing the provincial Transportation of Dangerous Goods Control Act and Regulations (TDGC). Licensees and/or approval holders should ensure that their personnel have proper TDG training.

DOWs which are transported on public roads must be manifested as per the requirements in Part C, *Waste Manifesting and Tracking*. A waste's shipping name, product identification number (PIN), transportation class, and other important information necessary for manifesting DOWs can be found in the schedules of the TDG regulations.

A number of the waste handling and transportation classifications have been identified for wastes listed in Section 7.4 of Appendix 7.0, *Waste Management Table*.

Table 4.1a

Properties of Dangerous Oilfield Wastes

Flammability	• Waste has a flashpoint less than 61°C. • Waste ignites and propagates combustion in a test sample.
Spontaneous Combustion Potential	• Waste generates heat at a rate greater than it loses heat and reaches the auto-ignition temperature.
Water Incompatibility	• Waste generates flammable or explosive gases in contact with water.
Oxidizing Potential	• Waste contributes oxygen for combustion at a rate that is equal to or greater than that provided by either ammonium persulphate, potassium perchlorate or potassium bromate.
Toxicity	• Waste has an oral toxicity LD50 not greater than 5 000 mg/kg. • Waste has a dermal toxicity LD50 not greater than 1 000 mg/kg. • Waste has an inhalation toxicity LC50 not greater than 10 000 mg/m^3 at normal atmospheric pressure.
Corrosivity	• Waste has a pH value less than 2.0 or greater than 12.5.
PCB Content	• Waste contains polychlorinated biphenyls at a concentration equal to or greater than 50 mg/kg.
Leachate Toxicity	• Waste is a liquid or a solid that passes a 9.5 mm mesh opening, or a friable solid that can be reduced by grinding in a mortar and pestle to a particle size that passes a 9.5 mm mesh opening, or a mixture of these, and i) it contains at a concentration of 100 mg/L or higher any substance listed in Table 1 of the Schedule to the *Alberta Users Guide for Waste Managers*, published by AEP, ii) the leachate contains any substance listed in Table 2 of the Schedule to the *Alberta Users Guide for Waste Managers*, in excess of the concentrations listed in Table 2, or iii) contains any of the following substances in a concentration greater than 0.001 mg/L: hexachloro-dibenzo-p-dioxins pentachloro-dibenzo-p-dioxins tetrachloro-dibenzo-p-dioxins hexachloro-dibenzofurans pentachloro-dibenzofurans tetrachloro-dibenzofurans.

Table 4.1b

Dangerous Oilfield Wastes

Dangerous Oilfield Wastes	**The following are dangerous oilfield wastes:** i) waste types listed in Table 3 of the Schedule to the *Alberta Users Guide for Waste Managers*, published by AEP, ii) commercial products or off-specification products listed in Part A of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers*, iii) commercial products or off-specification products listed in Part B of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers*, iv) wastes with any of the properties as per Table 4.1a, *Properties of Dangerous Oilfield Wastes*, or v) containers as identified in Section 5.3, *Dangerous Oilfield Waste Containers*.

5.0 Procedures for Classifying Wastes

5.1 General Procedure

Wastes must be classified as either DOW or non-DOW based on the criteria outlined in Table 4.1a, *Properties of Dangerous Oilfield Wastes* and Table 4.1b, *Dangerous Oilfield Wastes*. Figure 5.1, *Classification of Oilfield Waste,* is a graphical representation of the classification procedure for determining whether an oilfield waste is dangerous or non-dangerous.

Sufficient historical data exists for some waste streams whereby common acceptable treatment and disposal practices have been established. These oilfield waste streams are included in Section 7.4 of Appendix 7.0, *Waste Management Table.* It is important for generators to understand that Section 7.4 of Appendix 7.0 does not cover all cases and testing may be required before determining appropriate treatment and disposal methods. Where classification of a waste is unclear, refer to AEP's *Alberta Users Guide for Waste Managers* for further information.

5.2 Dangerous Oilfield Waste

Oilfield wastes with any of the properties defined in Table 4.1a or are classified as a DOW as per Table 4.1b are considered dangerous oilfield wastes. These wastes may have a variety of properties with varying safety and environmental consequences. Properties may include flammability, pyrophoric characteristics, oxidizing potential, water incompatibility, toxicity, corrosivity, etc. Wastes with these properties require special attention to ensure they are handled, treated, and disposed of properly. Test methods for the properties identified in Table 4.1a can be found in Appendix 3.0, *Recommended Test Methods.*

5.3 Dangerous Oilfield Waste Containers

Figure 5.1, *Classification of Oilfield Waste,* also includes information regarding the procedure to classify oilfield waste containers. Further information on containers is described below.

1. Any container or collection of containers with an aggregate internal volume greater than 5 litres (L) must be handled and disposed of as DOW if:

   (a) it contains a substance listed in Part A of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers,* published by AEP, and it is not an empty container, or

   (b) it contains or did contain a substance listed in Part B of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers* and it is not a rinsed empty container.

2. An empty container means a container that contains less than 2.5 centimetres (cm) of residue remaining at the bottom of the container or less than 3 per cent of the original contents, whichever is the lesser amount.

3. A rinsed empty container means a container that has been rinsed three times using for each rinse a clean solvent that is in an amount equal to 10 per cent of the container volume and that is capable of removing the contained waste, or an equivalent method. If it is not tested, the rinsate should be classified the same as the container waste or the rinse solvent, whichever is more stringent.

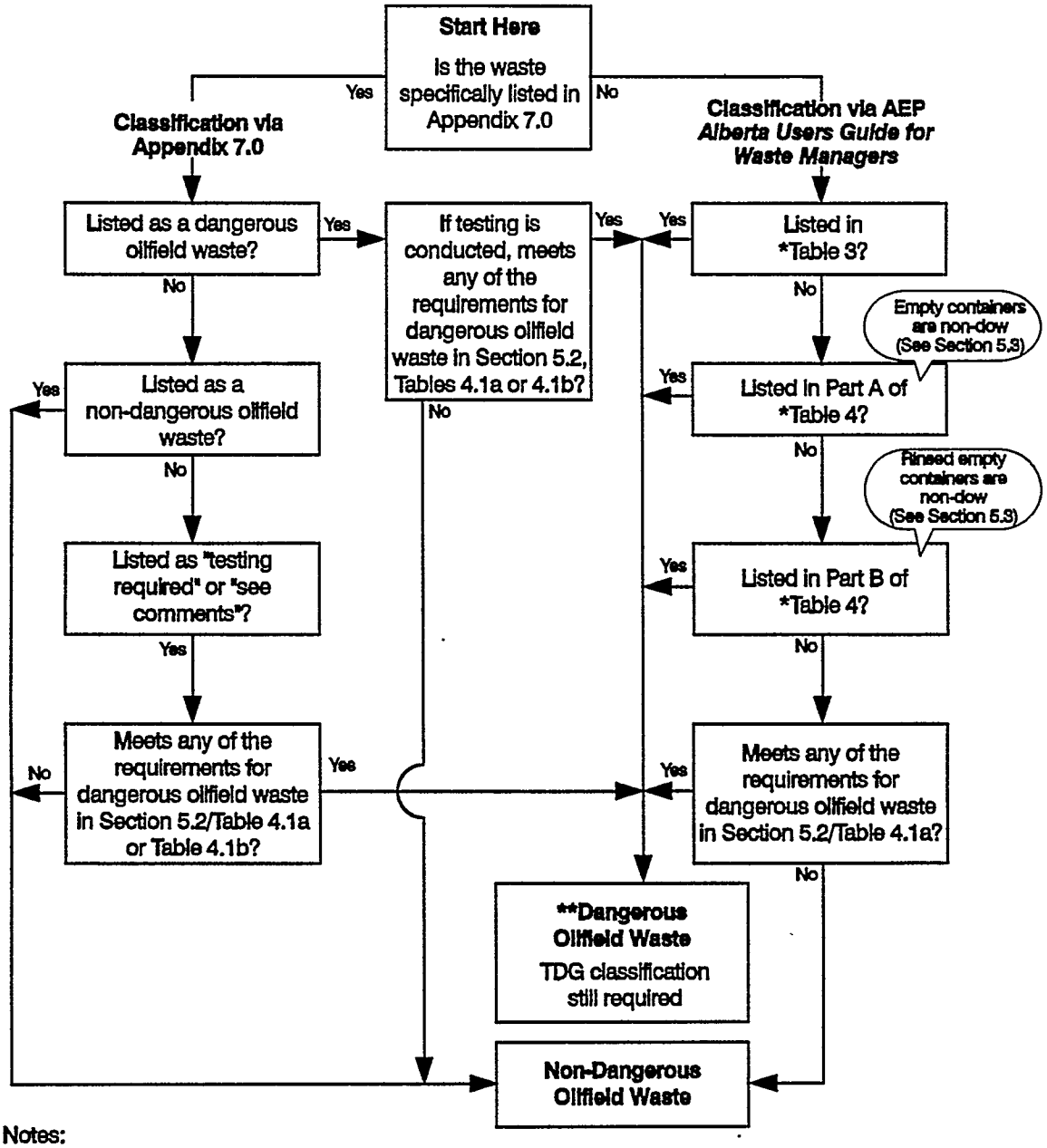
5.4 Small Volumes

For the purposes of these requirements, oilfield wastes (other than those substances listed in Part B of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers* published by AEP) are not considered dangerous if they are produced at any single site in an amount less than 5 kilograms (kg) per month if a solid or 5 litre (L) per month if a liquid, and the total quantity accumulated does not exceed 5 kg or 5 L at any time.

5.5 Mixing and Dilution

Oilfield waste must **not** be mixed with any solid or liquid for the primary purpose of dilution to avoid any Alberta regulatory requirements.

Figure 5.1 Classification Of Oilfield Waste



Notes:

* Refers to schedules listed at the back of the *Alberta Users Guide for Waste Managers.*

** Not considered DOW if produced at a single site in volumes <5 kg or <5 L per month and does not exceed this amount at any time when accumulated (does not apply to Part B, Table 4 listed wastes in the *Alberta Users Guide for Waste Managers*).

- Classify container rinsate as per container waste or the rinse solvent, whichever is more stringent.
- For complete classification requirements see Section 5.2, Tables 4.1a and 4.1b and Section 5.3 for containers.

6.0 Wastes Banned from Disposal via Injection into Pipeline Systems

Upstream oilfield wastes that can be separated from the production stream and can be harmful to downstrean oil handlers must not be diluted by injection into pipelines. Pipelines must not be thought of as a "mixing vessel" for waste dilution.

For safety, environmental, corrosion, operational, and economic reasons, the oilfield wastes identified in this subsection are **banned** from direct injection into any pipeline system. The rationale for this decision is based on the wastes':

non-hydrocarbon content,
chemical composition,
water content,
solids content, and/or
the availability of practical, cost effective waste treatment methods.

6.1 Banned Waste Types

- All motor, engine, driver, and compressor hydrocarbon and synthetic lubricating oils, unless specific written agreements have been made with the receiving refinery. Alternative acceptable waste management methods such as recycling and reclaiming are available. It is the responsibility of the pipeline company to confirm that the wastes were received by the refinery.
- All non-hydrocarbon based wastes.
- All solid wastes.
- All non-hydrocarbon based drilling fluids.
- All fracturing sands.
- All radioactive wastes.
- All halogenated solvents and halogenated organic chemicals (i.e. organic chlorides).
- All water based wastes including, but not limited to, produced water, acid water, process water, water based methanol hydrotest fluids, other water based hydrotest fluids, wash fluids, boiler blowdowns, filter wash fluids, and oily water.
- All chemical based sludges including, but not limited to, glycol sludges, gas sweetening sludges, and other process sludges.

- All chemical wastes, whether "unused" pure, spent, or contaminated. This includes, but is not limited to, all caustics, acids, laboratory chemicals, PCBs, gas sweetening agents, non-hydrocarbon based surface and downhole treating chemicals, glycols, methanol, and treating or softening salts.

PART C

WASTE MANIFESTING AND TRACKING

Part C

Waste Manifesting and Tracking

7.0 Introduction To Waste Manifesting and Tracking

This section outlines the manifesting and tracking requirements for generators and receivers of oilfield waste in Alberta.

An integral component of proper waste management is the use of documents (manifests) to ensure wastes are safely transported and received at their intended point of treatment and/or disposal.

Waste tracking is an equally important component of proper waste management. For the purpose of these requirements, waste tracking refers to a system by which the handling, movement, treatment, and disposal of wastes are monitored by the waste generator.

7.1 System Summary

Dangerous oilfield waste (DOW) transported on public roads in Alberta must be manifested (see Section 8.2, *When to Use a Manifest*). The EUB's Alberta Oilfield Waste Manifest is to be used for the transportation of DOWs within Alberta. If the oilfield waste is transported into or out of Alberta (i.e. crosses a provincial or federal border), generators must classify, name, and label their waste in compliance with TDG. This includes usage of the federal manifest (regulated by AEP in Alberta). The EUB Oilfield Waste Manifest is replaced by the federal manifest for shipments of oilfield waste into or out of Alberta.

Oilfield waste generators must implement a waste tracking system that ensures the quantities and characteristics of all generated wastes, both dangerous and non-dangerous, as well as their final treatment and disposal methods are known. Generators are responsible for the safe and proper handling, treatment, and disposal of all generated waste.

Selected licensees and/or approval holders of wells or other facilities will be required to prepare an annual oilfield waste disposition report. These reports must contain summarized information pertaining to the type, quantity and ultimate treatment and/or disposal of oilfield wastes, including those treated and/or disposed on-site. Some oilfield wastes are exempt from this waste disposition report requirement. All DOWs must be included. In addition, Table 9.1, *Reportable Oilfield Wastes*, lists the other waste types, which may or not be dangerous, that must be included in the waste dispostion report. All miscellaneous DOWs, as well as any miscellaneous non-DOWs which represent a risk to

the environment or public safety, must be reported. There is a section in Section 7.4 of Appendix 7.0, *Waste Management Table*, for miscellaneous waste codes which can be used to report these unlisted waste types.

The reporting requirements identified in this section in no way exclude generators or receivers from any other requirements outlined in EUB legislation, Interim Directives, Informational Letters, or General Bulletins.

8.0 Manifesting

8.1 Background

Manifests include specific information about the waste, its source and its destination. These documents provide detailed information to first responders in the event of an accident, and serve as a tool for confirming that shipments of dangerous wastes are properly handled, transported, and disposed.

Many oilfield wastes are classified as dangerous waste (see Section 5.2, *Dangerous Oilfield Waste*) and are required to be manifested if transported on public roads (see Sction 8.2, *When to Use a Manifest*). The EUB Alberta Oilfield Waste Manifest was designed to meet the document requirements of TDG for shipments of DOW occurring entirely within Alberta.

The Alberta Oilfield Waste Manifest is a 5- page EUB form (see Figure 8.1, *Manifest, [Front Page]*). This form will be available from Information Services (EUB) on the ground floor of the Energy Resources Building. Specific instructions for the completion of the Alberta Oilfield Waste Manifest are also included with each manifest (see Figure 8.2, *Manifest, [Back page]*).

8.2 When to Use a Manifest

1. EUB Alberta Oilfield Waste Manifest

(a) The EUB Alberta Oilfield Waste Manifest must be completed and accompany the waste shipment when transporting DOWs on public roads in Alberta. The shipment must occur entirely within the province of Alberta. This includes shipments transported to AEP approved facilities. For shipments not occurring entirely within the province of Alberta, the federal manifest (regulated by AEP in Alberta), must be used (see federal manifest section).

(b) The EUB Alberta Oilfield Waste Manifests are **not** required for the following:

i) when the quantity of DOW transported does not exceed 5 kg or 5 L,

ii) when the waste is a non-DOW*,

* companies wishing to use the EUB Alberta Oilfield Waste Manifest as a tracking document for non-DOWs must indicate on the manifest that the waste is non-dangerous.

Copies of the manifests completed for non-DOWs are **not** to be sent to the EUB.

iii) when the oilfield wastes are treated/disposed on-site,

iv) when the waste is uncontaminated produced water (contaminants which would make the produced water a DOW, must not be present),

v) when the DOW is transported from the site of origin to another site, provided the licensee or approval holder of both sites are the same, and

- the person in charge of the vehicle transporting the DOW displays on the vehicle a placard that corresponds to the placard set out as Figure 19 in Part II of Schedule V of the Federal Regulations, and

- the shipment is accompanied by a shipping document that shows the hazard class, the emergency response contact, the total mass or volume of the DOWs to which the shipping document relates, and the number of packages where applicable, or

vi) when the manifest documentation requirements for the DOWs are exempted by a valid and appropriate Permit for Equivalent Level of Safety (see Section 8.4, *Permits for Equivalent Level of Safety*).

2. Federal Manifest (Regulated by AEP in Alberta)

The following waste shipments require completion of the federal manifest (copies submitted to AEP and/or Environment Canada):

(a) DOWs transported across provincial/territorial/international boundaries (copies must be submitted to the appropriate Federal and/or State and/or Provincial governments, as required), and

(b) DOWs, which have been received at a transfer station approved by AEP for the receipt of industrial waste, and which are subsequently consolidated and transported for treatment and/or disposal (copies of the federal manifest must be submitted to AEP). When DOWs are received at AEP approved transfer stations, they are considered "Industrial Wastes" for the purpose of further transportation.

8.3 General Manifest Requirements

Notwithstanding the requirements of Section 8.2, *When to Use a Manifest*, a manifest is required for each load of DOW being transported. However, where a single truck must make several trips to move the entire quantity of a specific oilfield waste, a single manifest may be used with attachments documenting each load. Where more than one truck is used to move a quantity of the specific oilfield waste, each truck must carry a manifest, with attachments for repeat trips if necessary.

If the information requirements in any particular case exceed the limitations of the manifest, it is acceptable to use attachments provided their existence is indicated on the manifest.

Note: Copies of all attachments must be made for, and kept with each page to which they apply.

8.4 Permits for Equivalent Level of Safety

TDG allows a Permit for Equivalent Level of Safety to be granted to a waste generator (or association) for the purpose of reducing manifest documentation requirements where appropriate. The Alberta Department of Transportation and Utilities (ATU) may grant such a permit upon receipt of a satisfactory application.

8.5 Mixed Wastes

Shipments of mixed wastes comprised of several waste types must be manifested as the most dangerous waste contained if the individual quantities of each waste type are not known. Indicate the total volume of the waste on the manifest. The waste generator should indicate on the manifest or attachment the waste types included in the mixed waste shipment.

8.6 Waste Identification

The shipping name identified on the EUB Alberta Oilfield Waste Manifest, which is used to describe the waste, **must** be determined in accordance with TDG. The corresponding oilfield waste code must be determined from Section 7.4 of Appendix 7.0, *Waste Management Table*. In all cases, the product identification number (PIN) identified on the manifest must correspond to TDG.

8.7 Manifesting System

Figure 8.3, *Manifesting Procedure*, shows the responsibilities of all parties relative to manifesting, along with the movement and distribution of the manifest document.

8.8 Reconciliation of Discrepancies - EUB Manifest

Discrepancies between waste details entered by the waste generator in Part A of the EUB manifest and waste details entered by the receiver in Part C of the manifest must be reconciled by the generator.

1. Serious Discrepancies

If the receiver notes a **serious** discrepancy regarding the quantities or characteristics of the waste shipped relative to what was received, the receiver must notify the generator and the transporter within **24 hours** of the time received. A **serious** discrepancy is one which may have resulted in an impact to the environment (i.e. spills, leakage, waste does not arrive at intended receiver) or one where the waste received differs **significantly** from the waste sent by the generator. In cases where a **serious** discrepancy is the result of an action by the transporter (i.e. accident, leak, etc.) the transporter must notify the generator within **24 hours** of the occurrence. In the event of being notified of or becoming aware of a **serious** discrepancy, the waste generator must notify the EUB as soon as possible by the quickest, most effective means available (during normal work hours, 8:00 am - 4:30 pm, Monday to Friday, phone the *Waste Manifest Coordinator*, Facilities Division, Calgary Office and during weekends or evenings, phone the appropriate EUB Field Office).

The EUB does not have jurisdiction over many of the waste disposal facilities (AEP approved) or the transporters. As a result, the EUB expects the waste generators to have procedures in place between themselves and the transporters and receivers regarding this **24 hour** notification requirement.

2. All Discrepancies

The Generator is to send the completed Page 1 of the manifest to the EUB within **60 days** of the shipment date. In situations where the generator is not able to reconcile any discrepancy within **60 days** from the date of shipment, the *EUB Waste Manifest Coordinator* must be notified.

It is recognized that the accurate measurement of waste quantities in the field is difficult and may vary depending on the waste type and method of containment/transportation. Waste generators must use sound judgement when recording waste quantities on the manifest and when reconciling discrepancies (see Section 10.0, *Waste Accounting*, for additional information on measurement).

8.9 Retention of Manifests

Manifest copies and supporting documentation must be retained by all parties (generator, transporter, and receiver) for a minimum of **two years** from the date of shipment. All documentation is subject to EUB audit.

Figure 8.1 Manifest (Front Page)

EUB Alberta Energy and Utilities Board

Alberta Oilfield Waste Manifest

Manifest No.

A) GENERATOR (CONSIGNOR)

COMPANY NAME | OPERATOR CODE (GENERATOR)

ADDRESS | PROV

CITY | POSTAL CODE

SOURCE SITE LOCATION

BATTERY/FACILITY CODE | OPERATOR CODE (FACILITY)

INTENDED RECEIVER

ADDRESS | PROV

CITY | POSTAL CODE

RECEIVING SITE LOCATION | BATTERY/FACILITY CODE

B) TRANSPORTER (CARRIER)

COMPANY NAME | ADDRESS

CITY | PROV | POSTAL CODE

DATE | UNIT NO | TELEPHONE | FAX

Certification - I declare that I have received wastes as offered by the Generator in PART A for delivery to the Intended Receiver and that the information contained in PART B is correct and complete.

NAME (PRINT) | SIGNATURE

C) RECEIVER (CONSIGNEE)

COMPANY NAME | ADDRESS

CITY | PROV | POSTAL CODE

RECEIVING SITE LOCATION | BATTERY/FACILITY CODE | OPERATOR CODE

No of D	SHIPPING NAME/DESCRIPTION OF WASTE	ALTA PERMIT NUMBER	WASTE CODE	TDGA/PIN	CLASS	PACKING GROUP	HANDLING CODE	QUANTITY SHIPPED	UNITS	OIL %	WATER %	SOLID %	QUANTITY RECEIVED	UNITS	OIL %	WATER %	SOLID %	HAND CODE	TRANS DECON

SPECIAL HANDLING/EMERGENCY INSTRUCTIONS

IF HANDLING CODE '02' OR '21' SPECIFY

DATE SHIPPED | TIME SHIPPED | SCHEDULED ARRIVAL DATE

DATE RECEIVED | TIME RECEIVED

Certification - I declare that the information in PART A is correct and complete.

NAME OF AUTHORIZED PERSON (PRINT) | SIGNATURE | FAX | CELLULAR | TELEPHONE | 24HR EMERGENCY NO

IDENTIFY DISCREPANCIES BETWEEN WASTE RECEIVED AND DETAILS LISTED IN PART A (USE ATTACHMENTS IF NECESSARY)

D) GENERATOR (CONSIGNOR): COMPLETE UPON RECEIPT OF MANIFEST FROM RECEIVER

EXPLANATION OF REASON FOR DISCREPANCIES NOTED BY RECEIVER (IF ANY), AND WHAT CORRECTIVE ACTION HAS BEEN TAKEN (Use attachments if necessary):

Certification - I declare that the information contained in PART C is correct and complete.

NAME OF AUTHORIZED PERSON (PRINT) | TELEPHONE

NAME OF AUTHORIZED PERSON (PRINT) | SIGNATURE | DATE | TELEPHONE

SIGNATURE

EP MANI 96 10 **Press Firmly and Print Clearly**

Distribution White EUB, Yellow - Generator, Pink - Receiver, Goldenrod Transporter, Blue - Generator (see back for details)

Alberta Energy and Utilities Board 640 - 5 Avenue SW, Calgary, Alberta Canada T2P 3G4

Alberta Authority Responsible for Oilfield Waste Manifests - ALBERTA ENERGY AND UTILITIES BOARD
Facilities Division
640 - 5 Avenue SW, Calgary, Alberta T2P 3G4
[redacted]

MANIFEST INSTRUCTIONS

Distribution:

1. Generator completes PART A and has Transporter complete PART B. Generator detaches and retains Page 5 (blue).
2. Transporter carries Pages 1 (white), 2 (yellow), 3 (pink) & 4 (goldenrod) with shipment and gives them to the Receiver. **Note: If a serious discrepancy is the result of an activity by the Transporter (e.g. truck spill) the Transporter must notify the Generator within 24 hours.**
3. Receiver completes PART C, noting any discrepancies, then returns Page 4 (goldenrod) to Transporter and Pages 1 (white) and 2 (yellow) to Generator (**to be sent no later than 30 days after the waste shipment date**) and retains Page 3 (pink). **Note: If a serious discrepancy is noted, the Generator and Transporter must be notified within 24 hours.**
4. Upon being notified of a serious discrepancy or receipt of Pages 1 (white) and 2 (yellow), Generator investigates any discrepancies noted by the Receiver and takes corrective action. **The EUB must be notified immediately if a serious discrepancy is noted. If the generator cannot reconcile discrepancies within 60 days after the date of the waste shipment, the EUB must be notified.** Investigation results and corrective action are to be reported in Part D (or Attachment). Generator sends page 1 (white) to the EUB (**to be sent no later than 60 days after the waste shipment date**).
5. Companies wishing to use the manifest for non-dangerous oilfield wastes must indicate on the manifest that the waste is non-dangerous. **Copies of the manifests used for only non-dangerous oilfield wastes are not to be sent to the EUB.**

NOTE: All parties must retain MANIFEST copies and supporting data for a minimum of 2 years.

Completion: some information listed below may not be applicable in all situations.

Part A - Generator (Consignor)

- Identify **Company Name, Operator Code** (EUB assigned codes), and **Business Address.**
- Identify **Source Site Location** (reported as **LSD - Sec - Twp - Rge - W M**), **Battery/Facility Code** (EUB assigned codes), and **Operator Code** (Licencee/Waste Generator may be different than facilty operator).
- Identify **Intended Receiver, Business Address, Receiving Site Location** (reported as **LSD - Sec - Twp - Rge - W M**,) and **Receiving Battery/Facility Code** (EUB or AEP assigned codes).
- Identify if the waste is Non Dangerous (**N**) or Dangerous (**D**).
- **Shipping Name/Description of Waste** - From Transportation of Dangerous Goods Regulations (TDG).
- **Alberta Permit No.** - Obtained from Alberta Transportation & Utilities.
- Identify **Waste Code** (EUB assigned codes - see Appendix 7.0 of Guide 58).
- **TDGA/PIN and Classification** - Obtained from TDG.
- **Packing Group:** I - Very Dangerous; II - Dangerous; III - Moderately Dangerous
- **Handling Code** - See Part C Receiver (Consignee) for appropriate Handling Code.
- **Quantity Shipped** - Report to nearest 0.1 m^3 or 0.1 tonne.
- Indicate **Units** of shipment (t = tonne, m = m^3).
- Identify **Oil/Water/Solid %** where applicable.
- **Special Handling/Emergency Instructions** - Self Explanatory.
- Identify **Date, Time Shipped,** and **Scheduled Arrival Date.**
- Print **Name, Telephone/Fax/Cellular Numbers,** and **Sign** form.
- Identify **24 Hour Emergency Telephone Number.**

Part B - Transporter (Carrier)

- Identify **Company Name, Business Address, Date, Truck Unit No.,** and **Telephone and Fax Number.**
- Print **Name** and **Sign** form.

Part C - Receiver (Consignee)

- Identify **Company Name** and **Business Address.**
- Identify **Receiving Site Location** (reported as **LSD - Sec - Twp - Rge - W M**), **Battery/Facility Code** (EUB or AEP assigned codes), and **Operator Code.**
- **Quantity Received** - Report to nearest 0.1 m^3 or 0.1 tonne.
- Indicate **Units** of shipment (t = tonne, m = m^3).
- Identify **Oil/Water/Solid %** where applicable
- **Handling Code** - Enter code for method of handling: (refer to Definitions in Appendix 8.0 of Guide 58).

01 Storage Facility	**12** Thermal Treatment
02 Transfer Station (specify intended treatment/disposal)	**13** Biodegradation Facility
03 Oilfield Waste Processing Facility	**14** Small Oilfield Waste Incinerator
04 Class Ia Disposal Well	**15** Used Oil Recycler
05 Class Ib Disposal Well	**16** Recycling Facility (excluding used oil)
06 Class II Disposal Well	**17** Swan Hills Facilty
07 Cavern	**18** Road Spreading
08 Class Ia Landfill	**19** Biodegradation (on site)
09 Class Ib Landfill	**20** Burial (on-site)
10 Class II Landfill	**21** Other (specify)
11 Class III Landfill	

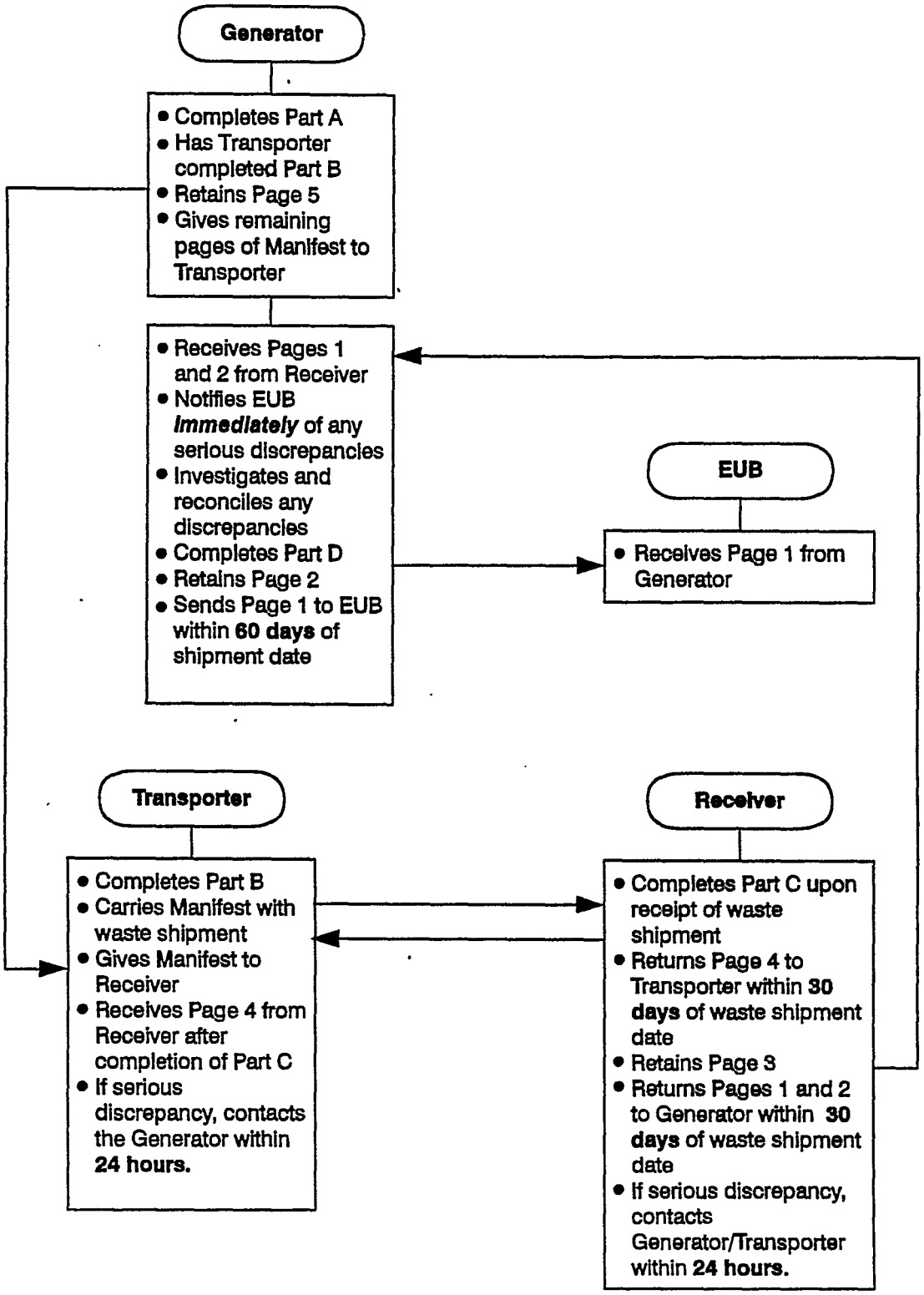
- **Transporter Decontaminated** - Enter Yes or No.
- **If Handling Code 02 or 21 - Specify** - Describe treatment/disposal (i.e., location/method)
- **Identify Date and Time Received**
- **Identify Discrepancies** - Self Explanatory
- Print **Name** and **Telephone Number,** and **Sign** form.

Part D - Generator (Consignor)

- Upon receipt of pages 1 (white) & 2 (yellow) - Enter **Discrepancy Reconciliation Details** (if any) and **Corrective Action**
- Print **Name, Date, Telephone No.,** and **Sign** form.

Figure 8.2 Manifest (Back Page)

Figure 8.3 Manifesting Procedure



9.0 Tracking

9.1 Background

Waste tracking is required from the time of initial generation of the waste through to final disposition (cradle to grave). The effective tracking of oilfield waste is essential to aid the waste generator in ensuring the proper handling, treatment, and disposal of oilfield wastes. The tracking system must enable the generator to demonstrate compliance.

9.2 Generator Responsibilities

Waste generators are responsible for tracking their wastes from "cradle to grave". In keeping with this philosophy, generators must be aware of the quantities and types of waste they generate, how they are handled, and where and how they are ultimately disposed. Therefore, in the case of waste being delivered to a facility between the generator's site and the final disposal site (delivery to a transfer station), the waste generator is responsible for obtaining details of final disposition from the transfer station operator. The generator is responsible for ensuring appropriate treatment and disposal of the waste occurs.

All waste generators are required to implement and maintain a waste tracking system. The development and type of system used is solely their choice and preference. All tracking systems must be effective and capable of displaying due diligence. The system must also be capable of providing information required for the oilfield waste disposition report (see below).

Tracking system data is to be maintained for a minimum of two years and is subject to EUB audit.

1. Oilfield Waste Disposition Reports

The oilfield waste disposition report is a summary of the types and quantities of disposed oilfield wastes, the point(s) of generation/consolidation and the specific disposal method(s) utilized. All DOWs and many non-DOWs which are treated/disposed must be included.

Specific licensees and/or approval holders of wells or other facilities will be selected each year and notified that their annual oilfield waste disposition report for the previous calendar year must be submitted to the EUB. Companies selected will be notified by 15 January and will be given until 28 February to comply with this request. Therefore, the EUB expects that all licensees and/or approval holders of wells or other facilities will collate their tracking data to enable the 43-day request for the report to be met. Furthermore, at anytime after

28 February of each year, the EUB could request the annual report (or portion thereof), from any company. This company would be given only 30 days to comply.

2. Report Submission and Processing Information

(a) The oilfield waste disposition report must include summary data which identifies all the sources (facilities or locations) of waste disposed. Sources include:

i) point of generation - the facility or location where the waste was generated. This refers to sites where waste was treated/disposed on-site or sent directly for disposal.

ii) point of consolidation - the facility or location where the waste was consolidated from a number of sites prior to disposal.

(b) The waste disposition report must include summary data regarding the waste types, quantities disposed and disposal method(s) utilized.

(c) All DOWs as well as those wastes listed in Table 9.1, *Reportable Oilfield Wastes,* which are disposed, including those treated and/or disposed on-site, are to be included in the waste disposition report. Miscellaneous DOWs and non-DOWs which represent a risk to the environment or public must also be included in the report. Oilfield waste treated in-situ does not have to be reported.

(d) Appendix 8.0, *Oilfield Waste Disposition Report,* shows the required data elements for the oilfield waste disposition report. Descriptions of the data elements can be found in Section 8.1 of Appendix 8.0, *Instructions to Complete the Oilfield Waste Disposition Report.* The report computer data format can be found in Section 8.2 of Appendix 8.0, *Computer Data Format.* This is the format the file must be in for submission to the EUB.

(e) Requested waste disposition reports must be submitted to the EUB on 3.5" computer diskettes. Paper copies of reports will not be accepted.

(f) Reprocessing fees will be charged for errors, missing data, and late/missing reports.

(g) The waste generator must include in their report, any waste disposed by service companies which was generated in association with the generator's operations.

3. Reporting Oilfield Wastes Not Listed in Waste Management Table (Section 7.4 of Appendix 7.0)

Section 7.4 of Appendix 7.0, *Waste Management Table*, is a reasonably comprehensive list of oilfield wastes generated in the upstream oil and gas industry. However, some wastes generated in the oil and gas industry will not be captured by this list. A section in the *Waste Management Table* has been included for Miscellaneous Wastes. These wastes are based on the TDG class system (i.e. Class 4 for flammable solids). The main purpose of this section is to provide waste codes under which these wastes can be tracked and reported. The generator selects the miscellaneous waste code which corresponds to the TDG class of the waste and then uses this code for reporting.

Table 9.1

Reportable Oilfield Wastes

All DOWs must be included in the annual oilfield waste disposition report. Additionally, the following oilfield wastes which may or may not be dangerous, must be included in the report. Non-DOW that are not included in this list, but are specified in the *Waste Management Table*, Section 7.4 of Appendix 7.0 are exempted from the waste disposition report unless they are determined to be dangerous.

This list is only for the annual oilfield waste disposition report requirement. (It is **not** intended to be used for classifying oilfield wastes.)

- Absorbants
- Activated Carbon
- Asbestos
- Boiler Blowdown Water
- Catalyst (non•sulphur)
- Catalyst (sulphur)
- All Contaminated Debris and Soils
- Crude Oil/Condensate Emulsions (Residuals after treatment)
- Desiccant
- Filters (media) • water treatment
- Filters • air pollution control
- Filters • lube oil
- Frac Sand (radioactive and non•radioactive)
- Glycol Solutions (no heavy metals)
- Hydraulic and Transmission Oils
- Incinerator Ash (if incinerated material is reportable)
- Ion Exchange Resin
- Ion Exchange Resin Regenerant Liquids
- Lubricating Oil
- Pigging Waste
- Contaminated solids less than 50 ppm Polychlorinated Biphenyls (PCBs)
- Produced Sand
- Sludges • (flare pit, hydrocarbon, lime, process, and sulphur)
- Sweetening Agents • (solids and liquids)
- Treater Hay
- Wash Fluids (organic)
- Water•Process (with organic chemicals)
- Water•Process (neutralized solutions with heavy metals)
- Water•Produced (if contaminants are present which make the solution a DOW)
- Well Workover Fluids
- Wood • chemically treated/cooling tower
- Unlisted Wastes (if they present a risk to the environment or the public)

10.0 Waste Accounting

10.1 Measurement

The accurate measurement of waste is often difficult, if not impossible, due to the varied nature of waste and the difficulties caused by the presence of solid materials. The best available measurement technology for the given circumstances should be utilized.

Whenever possible, volume determinations should be made using metres, tank gauges or weigh scales. In situations where the use of such devices is not possible, estimated volumes should be based on the dimensions of the container used to store or transport the waste.

Where appropriate, the components of a waste should also be determined (i.e. oil, water, and solids). Representative samples should be centrifuged to determine the proportionate quantities of each component.

10.2 Units for Manifesting and Waste Disposition Report

The oilfield waste disposition report and the EUB oilfield manifest require the waste to be reported in either tonnes or cubic metres. Often the waste is contained in drums or other various containers which can make quantity determination difficult. The following criteria is suggested to enable consistent reporting:

1. **Drummed liquid waste**: For the manifesting and reporting requirements, sum the volume of waste in all the drums and convert to m^3.

   Example: 6 drums of liquid waste (205 litre drums).
   Calculation: 6 drums x 205 L/drum x $1m^3$/1000 L = 1.23 m^3.

2. **Drummed solid waste**: For the manifesting and reporting requirements, sum the weight of waste in all the drums and convert to tonnes. If the density of the solid waste is known, calculate using the actual density.

   If the weight of the solid waste is not known, assume the density = 1 kg/L

   Using the assumption of 6 drums (205 L each)
   Calculation: 6 drums x 1 kg/L x 205 L/drum x 1 tonne/1000 kg = 1.23 tonnes.

3. **Bulk packaged waste**: For other bulk packaged wastes, report the solid waste in tonnes and liquid waste in cubic metres. If the weight of the bulk solid waste is unknown but the volume of the container is known apply 1 L = 1 kg for general conversion/estimation.

PART D

OILFIELD WASTE MANAGEMENT FACILITIES

PART D

11.0 Oilfield Waste Management Facilities

11.1 Introduction

The **purpose** of this section is to outline the general requirements for oilfield waste management facilities to ensure that public health and the environment are adequately protected and that the site can be readily restored for the next intended land use.

An oilfield waste management facility may consist of one or more of the following components:

waste storage area/facility,
waste transfer station,
waste processing facility,
surface facilities associated with waste disposal wells,
waste disposal well (Class Ia or Ib),
cavern,
landfill,
biodegradation facility,
thermal treatment facility, and
other oilfield waste management technology or facility.

Applicants considering any of the waste management components listed above should review the following subsections, 11.2 - 11.9, for general requirements that are applicable to all oilfield waste management components/facilities. Although the text tends to refer to waste management facilities, the general requirements are also applicable to licensees and/or approval holders who intend to integrate a waste management component into an EUB approved oil and gas or oil sands facility. Additional requirements that are specific to a particular type of waste management component/facility are addressed in Sections 12 to 17. These sections also indicate whether the integration of a waste management component into an existing EUB approved facility requires notification or application. Refer to Part E for the information that is required in an application for approval to construct and operate an oilfield waste management facility.

11.2 Siting Issues

Siting considerations must be incorporated into the design of oilfield waste management facilities. The following site related factors must be considered when locating a possible site for an oilfield waste management facility:

1. minimizing the risk of environmental damage including any impact to the quality of surface water and groundwater, and the health of humans, animals, and plants during construction, operation, and closure of the facility,

2. avoid drainage ways and areas subject to seasonal flooding,

3. not to be located within 100 metres (m) of the normal high water mark of a body of water, permanent stream, or water well used for domestic purposes, and

4. avoid environmentally sensitive areas or areas where the public is directly impacted.

11.3 Safety Issues

1. An oilfield waste management facility shall be designed, constructed, and operated such that it complies with the regulations stipulated under the following Acts and associated Regulations:

   Oil and Gas Conservation Act,
   Occupational Health and Safety Act (and the Workplace Hazardous Material Information System),
   Safety Codes Act (Alberta Fire Code), and
   Environmental Protection and Enhancement Act.

2. Notwithstanding the requirements stated in Section 11.3 (1), oilfield waste must be handled in such a manner that it does not:

   (a) produce fugitive air emissions or uncontrolled gases which exceed AEP Ambient Air Quality Guidelines,
   (b) produce uncontrolled fumes or gases sufficient to pose a risk of fire or explosion, or
   (c) threaten public health, safety, or the environment through other means.

3. A perimeter fence shall be installed to prevent public and wildlife access to the waste management facility.

4. An oilfield waste management facility shall bear signs as per Section 6.020 and Schedule 12 of the Oil and Gas Conservation Regulations, at the entrance of the facility identifying facility name, operator name, emergency phone number, and legal description.

5. All waste management facilities shall comply with equipment spacing requirements identified in Sections 8.030 (2), 8.080 (2) and (3), and 8.090 of the Oil and Gas Conservation Regulations.

6. A corporate response plan shall be maintained on-site at all times which describes appropriate measures to follow in the event of any emergency such as a fluid spill, tank fire or any other hazard. Employees must be trained in respect to normal and emergency situations. All phone numbers and contacts should be updated periodically. For information regarding preparation of a corporate-level response plan, refer to ID 91-2, *Preparation of Corporate Level Response Plan*, or any subsequent publication issued.

7. Licensees and/or approval holders must ensure their facilities meet the Noise Control Directive, ID 94-4.

8. As per Informational Letter IL 96-10, *A Memorandum of Understanding Between Alberta Environmental Protection and the Alberta Energy and Utilities Board Regarding Coordination of Release Notification Requirements and Subsequent Regulatory Response*, all unrefined product spills must be reported to the local EUB field office. Refined product and chemical spills are the responsibility of the Pollution Control Division of AEP.

11.4 Waste Characterization

Licensees and/or approval holders of waste management facilities are responsible for knowing the capabilities and limitations of their treatment technologies and as such, must only accept wastes exhibiting the properties their facility is approved to handle. Generally, this will require waste characterization, unless the stream is sufficiently well known through either prior testing or an in depth knowledge of the origin of waste. Refer to Appendix 3.0 for *Recommended Test Methods*.

11.5 Environmental Impact Assessment (EIA)

It is the applicant's responsibility to determine the need for an EIA. AEP is the government agency responsible for the EIA process. Refer to section 19.0, *Environmental Impact Assessments*, for the administrative process to follow.

11.6 Design and Operation

Licensees and/or approval holders must design and operate the facility to minimize impact to the air, groundwater, surface water, or soils on or around the site. The following factors must be taken into consideration at the design stage and during operation of the facility:

1. Material storage in accordance with EUB ID 95-3 and Guide G-55, *Storage Requirements for the Upstream Petroleum Industry*. This includes adherence to the construction, secondary containment, leak detection, and weather protection provisions outlined for above-ground tanks, underground tanks, oily waste storage facilities, containers, and bulk pads.

2. Provision of surface water run-on and run-off control systems. The surface water run-off control system must be able to accommodate the volume of water from a 1 in 10 year, 24-hour storm. Collected surface run-off water can be:

   (a) used in the facility process if a water diversion permit is obtained from the Water Resources Division of AEP,

   (b) surface discharged provided it is field tested and meets the following criteria prior to being released, in a controlled fashion, to adjacent lands:

      i) chloride content: 500 mg/L maximum (i.e. test strips),
      ii) pH: 6.0 to 9.0, (i.e. test strips and/or meter readings),
      iii) no visible hydrocarbon sheen,
      iv) no other chemical contamination,
      v) landowner consent,
      vi) water must not be able to flow directly into any watercourse, and
      vii) each release must be recorded including the pre-release test data and the estimated volume of water released, or

   (c) deep well disposed.

3. Provisions to control odours during receiving, processing, treating, and disposing of waste materials. If the facility is approved to handle sour fluids, extra precautions must be in place to ensure that odours are controlled.

4. Acceptance of only characterized materials that the facility's process is capable of handling. This may involve analyzing the waste materials prior to acceptance. Licensees and/or approval holders should implement a quality control/quality assurance program to verify composition of incoming waste materials.

5. Development of a waste management plan for the handling and disposing of residuals (i.e. solids and liquids) resulting from the process. Licensees and/or approval holders must ensure that residuals are characterized, and appropriate disposal methods/options are selected based on the characterization.

11.7 Site Assessment and Groundwater Protection

Certain oilfield waste management facilities will be required to have in place a monitoring system that will provide an early indication of potential groundwater impact. This may involve implementation of a comprehensive groundwater monitoring program for the site.

The waste management or disposal methods described in the following sections will indicate if groundwater monitoring is required for that specific method. When it is required, background data shall be submitted to the EUB as part of the application for approval of the facility. Once established, the groundwater monitoring system shall be

sampled twice per year and the results must then be compiled into an annual report. Refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection.*

11.8 Record Keeping

The approval holder of an oilfield waste management facility shall:

1. retain copies of all dockets for materials received and shipped for a minimum of 2 years,

2. where applicable, retain groundwater and leachate monitoring information for a minimum of 5 years, and

3. keep copies of approvals at each facility.

11.9 Closure

It is expected that with good operating practices, the site on which an oilfield waste management facility is situated will be capable of being reclaimed to conditions suitable for the next intended land use. The EUB IL 96-3, *Suspension and Reclamation of Upstream Oil and Gas Facilities*, introduces a Memorandum of Understanding (MOU) that outlines an agreement reached between AEP and the EUB on these activities.

As per the MOU, all decontamination and land reclamation activities, regardless of whether the sites are active or inactive, are the regulatory responsibility of AEP. If contamination has occurred, licensees and/or approval holders are required to contact AEP directly to determine if further delineation or remediation is required. Licensees and/or approval holders must consult with AEP regarding appropriate remediation criteria and any in situ remediation work. Any materials excavated during remediation activities (i.e. contaminated soil) must be treated and/or disposed in a manner that is satisfactory to AEP. It is expected that this document will be used as a basis for storage, treatment, and disposal of the contaminated material. Options that are available include on-site treatment, sending the material to an AEP or EUB approved waste facility, or any other treatment/disposal method as directed or approved by AEP.

At the time of closure of either part or the whole facility, all inventories must be eliminated, surface equipment and structures must be dismantled, and if applicable, pipelines and wells must be properly abandoned. Complete closure of an oilfield waste management facility, as a minimum, shall involve:

1. elimination of the inventory,

2. dismantling of the structures and equipment,

3. abandoning wells or pipelines in accordance with EUB requirements,

4. conducting a detailed site assessment which shall clearly identify potential sources, nature and extent of any contamination,

5. implementation of a reclamation program that will render the site compatible with the next intended land use,

6. implementation of a post closure monitoring program, if necessary, and

7. documentation of the work undertaken, including independent verification to ensure that the reclamation objectives were achieved.

Prior to implementation of the reclamation program, companies need to consult with AEP regarding remediation objectives for the site.

It is expected that waste management components constructed on EUB approved oil and gas or oil sands facilities will be closed along with the production facilities or in some situations, when the sites are going through partial closure. Therefore, with the exception of fixed incinerators that require an approval and landfills, financial assurance will not be required for waste management components integrated into EUB approved production facilities.

The application process for an oilfield waste management facility which is to be constructed and operated on a stand-alone site, requires the applicant to submit a plan detailing how both planned or unplanned closure of the facility or any part of it, at any point during its active life would be performed. If the application is approved, the company will be required to post financial security to cover the cost of planned or unplanned closure (refer to Section 20.0, *Financial Security*).

12.0 Waste Storage Areas/Facilities and Waste Transfer Stations

12.1 Introduction

The **purpose** of this section is to identify the requirements for the storage of oilfield wastes at either an operating production facility or at a stand-alone facility that is dedicated to the storage of oilfield wastes.

Oilfield wastes, whether dangerous or non-dangerous, are generally stored in one of three locations:

- in a storage area on an EUB approved oil and gas or oil sands facility,
- at a waste storage facility (stand-alone site) operated by an oil and gas company for collection of their own wastes, or
- at a waste transfer station operated by an independent company as a third party waste receiver.

Filter and container crushing, as well as liquid removal by gravity settling can be performed at a storage area or facility, or at a waste transfer station. However, if there is any additional waste treatment being performed, then the facility is referred to as a waste processing facility and the requirements of Section 14.0, *Waste Processing Facilities*, apply.

Waste treatment means to apply any method, technique or process, including, without limitation, neutralization and stabilization, that is designed to change the physical, chemical, or biological character or composition of a substance.

Operating approvals are required for storage facilities and transfer stations. A storage area on an EUB approved oil and gas or oil sands facility would be included under the facility approval. The application requirements to obtain an approval for storage facilities, transfer stations, and waste processing facilities are contained in Part E.

12.2 Storage Areas

Waste storage areas are defined as sites on existing EUB approved oil and gas or oil sands facilities used for the purpose of collecting oilfield wastes or oily wastes from one or more of a company's facilities. The licensee and/or approval holder of the facility on which the storage area is located must be the same as that of the facilities from which the collected wastes are generated.

The storage areas must meet the requirements of EUB ID 95-03 and the accompanying Guide G-55, *Storage Requirements for the Upstream Petroleum Industry*.

Licensees and/or approval holders constructing a storage area on an existing EUB approved production facility must, as outlined in EUB Guide G-55, submit written notification to the local EUB Field office. Licensees and/or approval holders who intend to integrate a storage area with a new production facility shall include the following information in the facility application:

- design of the storage area,
- type(s) and volume(s) of stored materials,
- duration of storage, and
- final disposal/treatment methods of the stored waste materials.

12.3 Waste Storage Facilities and Transfer Stations

A stand-alone facility, which has been constructed for the purpose of collecting and storing oilfield wastes until volumes are sufficient for economic transfer to treatment and disposal facilities, is considered either a storage facility or a transfer station.

A waste storage facility is considered a first party receiver (i.e. receives only those wastes generated by one oil and gas company, but can come from various sites). The licensee or approval holder of the storage facility must be the same as that of the facilities from which the wastes are collected. **A waste transfer station** is considered a third party receiver (i.e. receives wastes generated by various companies and from various sites).

Waste storage facilities and transfer stations shall comply with the requirements (siting, safety, waste characterization, EIA, design and operation, record keeping, and closure) outlined in Section 11.0, *Oilfield Waste Management Facilities*.

If dangerous oilfield wastes are being stored, a comprehensive groundwater monitoring program must also be implemented. Refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection*.

12.4 Reporting and Record Keeping

In addition to the record keeping requirements outlined in Section 11.8, *Record Keeping* the following requirements also apply:

1. Monthly Documentation

Operators of waste storage facilities and waste transfer stations must document the following information and retain it on-site for a minimum of 2 years. The following information must be made available to EUB staff upon request:

(a) a balance of opening inventory for each month,

(b) for each receipt of waste material, the volume, source, generator, type (characterization), and date received, and

(c) a closing inventory balance for each month identifying total volumes of waste materials received, volumes of waste materials sent for treatment and/or disposal, and the name and location of the treatment and/or disposal facility.

2. Annual Report

Licensees and/or approval holders of **waste transfer stations** must summarize the monthly information and prepare an annual report by the 31 March of each year. This report, which must be retained on site for a minimum of 2 years and be made available to EUB staff upon request, shall contain as a minimum:

(a) monthly totals of each waste type received,

(b) monthly totals of each waste type sent for treatment and/or disposal, and the name and location of the treatment and/or disposal facility, and

(c) a summary of the results of groundwater monitoring (if any).

13.0 Surface Facilities Associated with Disposal Wells

13.1 Introduction

The **purpose** of this section is to outline environmentally sound operating practices and principles for surface facilities that receive upstream oilfield wastes prior to deep well injection and are not covered under an existing EUB facility approval.

The deep well disposal of oilfield waste fluids involves the regulatory requirements for both the disposal well and the surface facility that is associated with the disposal well. Surface facilities include above ground tanks, underground tanks, and any container or group of containers with an aggregate volume larger than 1 cubic metre, as well as associated piping, processing equipment, and pumps.

Requirements for the disposal wells are contained in EUB IL 94-2, Guide G-51, *Injection and Disposal Wells, Well Classifications, Completion, Logging, and Testing Requirements*.

Specific disposal well regulations are contained in the Oil and Gas Conservation Regulations Sections 8.040 (water disposal requirements) and 15.070 (application requirements).

Surface facilities used for the receipt of industrial wastes (i.e. downstream wastes such as those generated at refineries or petrochemical plants) prior to deep well injection, as well as the waste streams being disposed down the well, must be approved by AEP. The plan to manage any residuals (solids or organics) that separate from the industrial wastes fluids within the surface facilities (tanks) must also be approved by AEP.

The requirements for the surface facilities used for the receipt of upstream oilfield wastes prior to injection down waste disposal wells are addressed in this section.

An approval for a surface facility associated with a waste disposal well is required when:

- the disposal well is a stand alone Class Ia or Ib well, or
- the surface facilities associated with the well are not covered by an EUB facility approval.

Disposal wells tied into a pipeline originating from an approved waste processing facility will not require a surface facilities approval, provided there is no additional tankage at the well site. The application for approval of surface facilities associated with a waste disposal well can be made in conjunction with the disposal well application.

Class Ia wells can be approved for the disposal of oilfield and/or industrial fluids. Class Ib wells are typically approved for the disposal of produced water, specific common oilfield waste streams, and waste streams meeting specific criteria as outlined in Guide G-51.

Any solid or organic fractions that separate from the waste fluids within the surface facilities (tanks) associated with disposal wells must be treated and/or disposed of appropriately.

13.2 General Requirements

Surface facilities that receive upstream oilfield wastes and are associated with waste disposal wells, and are not covered under existing EUB facility approval, shall comply with the requirements (siting, safety, waste characterization, design and operation, record keeping, and closure) outlined in Section 11.0, *Oilfield Waste Management Facilitities*.

13.3 Groundwater Monitoring

Surface facilities associated with a Class Ia well, must have a comprehensive groundwater monitoring program in place. Refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection*.

13.4 Class Ia Wells Accepting Upstream and Downstream Fluids

Class Ia wells which receive fluids generated within the upstream petroleum industry as well as waste fluids generated within other industries (downstream), must segregate the upstream fluids from the industrial fluids. The surface facilities used for the receipt of industrial wastes, the industrial waste streams, and the plans to manage any residuals must be approved by AEP.

Skim oil from the upstream tanks may enter the crude oil stream provided it is sent to an approved oilfield waste processing facility for treatment prior to entering the pipeline for sales, or the protocol outlined in Section 31.0, *Waste Transport by Pipelines* is followed. Any tank bottoms must be sent to an EUB or AEP approved facility for treatment and/or disposal.

13.5 Reporting and Record Keeping

In addition to the record keeping requirements outlined in Section 11.8, *Record Keeping* the following requirements also apply.

The S-18 form, *Monthly Injection/Disposal Statement,* shall be used to report the source, volume, and type of all wastes disposed by deep well injection, for both Class Ia and Class Ib wells. Any recovered crude oil must also be reported.

14.0 Waste Processing Facilities

14.1 Introduction

The **purpose** of this section is to provide minimum requirements for the design and operation of an oilfield waste processing facility.

Waste processing means to apply any method, technique, or process that is designed to change the physical, chemical, or biological character or composition of a substance.

A waste processing facility is defined as a system of surface equipment designed for the purpose of collecting and treating oilfield waste material from any gas, oil, oilfield, or oil sands operation.

The techniques or methods applied by facilities designed specifically for the recovery of crude oil often include a combination of retention time, gravity separation, heat application, chemical application, mechanical mixing, centrifuging, and water washing.

A cavern is typically approved as a disposal well. In cases where waste streams are injected into the cavern for purposes of separation and oil recovery, it will also require approval as a waste processing facility.

Other waste processing facilities include those designed to collect oilfield waste and apply methods or techniques to reduce volumes, alter chemical characteristics, and/or remove dangerous components prior to final disposal.

Waste processing facilities accepting wastes generated within the upstream petroleum industry only require approval from the EUB. Facilities that accept a combination of upstream and downstream waste or industrial waste only require approval from AEP and do not require EUB approval.

14.2 General Requirements

All oilfield waste processing facilities shall comply with the requirements (siting, safety, waste characterization, EIA, design and operation, site assessment and groundwater protection, record keeping, and closure) outlined in Section 11.0, *Oilfield Waste Management Facilities*.

14.3 Groundwater Monitoring

Licensees and/or approval holders of oilfield waste processing facilities must implement a comprehensive groundwater monitoring program for their site (refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection*).

14.4 Reporting and Record Keeping

In addition to the record keeping requirements outlined in Section 11.8, *Record Keeping*, the following requirements also apply.

The operator of a waste processing facility will be required by the approval to operate, to submit a S-25 form, *Monthly Waste Plant Statement*. This report as a minimum shall include:

1. an opening monthly inventory balance of wastes, residuals (liquids and solids), and/or products (recovered crude oil),

2. type, volume, origin, generator of each receipt of waste material,

3. the volume and deliveries (name and location of facility) of residuals and/or recovered crude oil, and

4. a closing monthly inventory balance of wastes, residuals (liquids and solids), and/or products (recovered crude oil).

15.0 Oilfield Landfills

15.1 Introduction

The **purpose** of this section is to establish the minimum requirements for the design and operation of oilfield landfills, and to identify the types of non-EUB regulated landfills which may accept oilfield waste.

Oilfield landfills are:

- operated by an oil and gas company for the purpose of disposing of oilfield wastes produced from their own operations,
- operated as part of an oilfield waste processing facility for the purpose of disposing of residual wastes resulting from their treatment process, or
- operated by an independent company for the purpose of disposing of third party waste generated by the upstream petroleum industry.

An oilfield landfill shall not receive municipal, non-upstream petroleum nor other industrial wastes. All oilfield landfills, including those to be integrated into an EUB approved production facility, require approval from the EUB to construct or expand. The application requirements to obtain the approval are contained in Section 21.0, *General Information Required in Applications,* and Section 25.0, *Oilfield Landfills - Specific Application Information.*

15.2 AEP Regulated Landfills Versus Oilfield Landfills

The Government of Alberta recently approved the transfer of regulatory responsibility for municipal waste management facilities from the Public Health Act to the Environmental Protection and Enhancement Act (EPEA). AEP's Code of Practice for Landfills establishes the requirements for Class II and Class III landfills receiving less than 10 000 tonnes of waste per year, and will form the basis for approvals for larger landfills.

In order for there to be a consistent approach toward the design of landfills and the landfilling of waste in Alberta, EUB oilfield landfill requirements are consistent with the Waste Control Regulation of EPEA and AEP's Code of Practice for landfills.

15.3 Disposal of Oilfield Waste at AEP Regulated Landfills

The disposal of oilfield waste at AEP regulated landfills, which are designed primarily for other sources or types of waste, such as municipal waste, may not be an effective use of that landfill's capacity, and may represent a potential environmental problem depending on the specific characteristics of the waste.

If a waste generator wishes to dispose of their oilfield waste at a landfill which is not under the jurisdiction of the EUB, the onus is placed on the waste generator to ensure that the destination landfill is of appropriate design and is approved to accept the type of waste in question (refer to Subsection 15.8, *Waste Criteria* and Section 2.1, *Responsibilities*).

The disposal of any liquid oilfield waste in landfills is prohibited.

Dangerous oilfield waste shall only be deposited in appropriately designed EUB approved oilfield landfills, or AEP regulated landfills which are approved to accept hazardous waste.

15.4 General Requirements for Oilfield Landfills

All oilfield landfills shall comply with the general requirements in Section 11.0, *Oilfield Waste Management Facilities*.

15.5 Landfill Siting Criteria

In addition to the general siting criteria in Section 11.2 for all oilfield waste management facilities, the following criteria also apply:

1. Prior to construction or lateral expansion of a landfill, the approval holder shall ensure the following:

   (a) An investigation shall be designed and conducted by a professional geologist or engineer registered with the Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA) to assess the geological and hydrogeological conditions specific to the landfill and its surrounding area,

   (b) After an investigation is designed and conducted in accordance with Section 15.5(1)(a), a landfill design shall be prepared by a professional geologist or engineer registered with APEGGA, and the approval holder shall construct the landfill according to the design,

   (c) The approval holder shall conduct a soil survey to determine the depth and volume of topsoil and subsoil available at the landfill site, and

   (d) Prior to construction or lateral expansion of a landfill, the approval holder shall determine storage locations of salvaged topsoil, and measures to be taken to prevent the use or loss of salvaged topsoil during storage.

2. No person shall construct or operate an oilfield landfill within:

   (a) 300 m of the shore of a natural area that permanently contains water, such as a river, lake, or creek,

   (b) 300 m of the shore of a man-made surface feature that permanently contains water, such as an irrigation canal or drainage ditch, but not a roadside ditch, dugout, or reservoir,

   (c) wetlands, critical wildlife habitats, or areas immediately adjacent, where the natural drainage from the landfill would flow directly onto the wetland or critical wildlife area,

   (d) 100 m of any land subject to slope failure which would compromise the landfill's structural integrity, or any other land with similar unsuitable characteristics, or

   (e) 300 m of the perimeter of a wellhead protection zone of a municipal or community water supply.

3. The topography in the immediate vicinity of the landfill site shall be level to gently rolling. Terrain with steep slopes, ravines, gullies and coulees, low-lying areas, flood plains and lake shores are unsuitable.

4. The approval holder shall ensure that no waste is deposited within 100 m of a highway, railroad right-of-way, municipal road, or street.

5. The following geological and hydrogeological criteria shall be applied when choosing a site for an oilfield landfill. The site shall not be within:

   (a) 30 m vertically of an aquifer,

      (i) capable of yielding water meeting domestic use quality standards, and
      (ii) having a transmissivity of 5×10^{-4} m^2/sec or greater,

   (b) 10 m vertically of fractured bedrock, or

   (c) a recharge area of an unconfined aquifer.

6. The bottom of a landfill trench or cell shall be at least 1.5 m above the seasonal high water table.

15.6 Design and Operation

Oilfield landfills are divided into four classes (Class Ia, Ib, II, and III). Design Requirements and Operating Procedures apply to all classes of oilfield landfills. The specific waste streams that may be disposed in each class of landfill are outlined in Section 15.8, *Waste Criteria*.

Approval holders are cautioned that if they intend to construct a new oilfield landfill to accept dangerous oilfield waste, it should be designed to comply with Class Ia criteria.

1. Design Requirements

In addition to the design and operation requirements listed in Section 11.6 for all waste management facilities, the following requirements also apply:

(a) Reclamation design and the proposed post reclamation use of the landfill site must be incorporated into the overall design of the landfill, starting at the initial site assessment phase.

(b) A comprehensive groundwater monitoring program (see Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection*) must be included in the design, operation, and decommissioning of an oilfield landfill. Data reflecting background conditions must be obtained prior to commencement of operation. Groundwater monitoring during the operational life of the landfill, as well as after closure of the landfill, must provide sufficient information to assess and quantify potential impact on the surrounding groundwater. Evidence of adverse impact shall result in implementation of remedial action.

(c) During the construction phase of the landfill, the approval holder may be required to provide evidence that exhibits compliance with the proposed design criteria. The evidence may be in the form of engineering and geological studies, survey plots, technical data, or other means.

(d) A financial assurance program is required for the life of the landfill, including post closure reclamation (see Section 20.0, *Financial Security*).

2. Operating Procedures

(a) The approval holder shall develop, maintain, and implement an operations plan that ensures landfill operations are consistent with the design and includes as a minimum:

(i) operational procedures such as waste control, soil cover operations, surface water management, and nuisance controls,

(ii) waste acceptance procedures and policies,

(iii) an emergency response program covering fires, releases, and medical concerns, and

(iv) for Class Ia, Ib, and II landfills, a remediation program to be implemented if groundwater quality fails to meet performance standards set out in Section 15.6(2)(j).

(b) Incompatible wastes shall be disposed in a manner that does not create hazardous conditions.

(c) Approval holders of Class Ia, Ib, and II landfills shall cover wastes with at least 15 cm of soil, or an alternative cover material approved by the EUB, to control litter, prevent spread of fires, minimize propagation of disease vectors, reduce odours, and minimize infiltration of moisture. Waste shall be covered within at least:

(i) 30 days from the last cover operation at landfills that receive less than 1 000 tonnes of waste per year,

(ii) 15 days from the last cover operation at landfills that receive between 1 000 and 3 000 tonnes of waste per year,

(iii) 7 days from the last cover operation at landfills that receive between 3 000 and 5 000 tonnes of waste per year, and

(iv) 48 hours from the last cover operation at landfills that receive between 5 000 and 10 000 tonnes of waste per year.

(d) If soil is used as cover material, the approval holder is not required to apply the required soil cover during the period between 15 November and 15 April, if the necessary soil cover material cannot reasonably be obtained.

(e) The EUB may require increased frequency of cover, where deemed necessary.

(f) The approval holder for a Class III landfill shall cover wastes as necessary to control nuisances such as litter, fires, disease vectors, odors, and dust.

(g) The landfill shall be operated to minimize production of leachate, and prevent the uncontrolled release of leachate from the site.

(h) Water that accumulates in a landfill trench shall be removed to avoid contact with the waste.

(i) Leachate, contaminated surface water, and contaminated groundwater shall be treated and appropriately disposed.

(j) Throughout the active life and post-closure period of a Class Ia, Ib, or II landfill, the approval holder shall ensure that the groundwater quality meets the performance standards listed in Table 15.1 in the uppermost formation(s) at all groundwater monitoring wells.

Table 15.1

Performance Standards for Landfills

Parameter	Concentration or Level
Total dissolved solids	2 000 mg/L
Chloride	250 mg/L
Sodium	200 mg/L
Sulphate	500 mg/L
Electrical Conductivity	2 dS/m
Total Metals	CCME Interim Assessment Criteria for Water
Mineral Oil and Grease	site-specific
pH	6.5 to 8.5 units

(k) The approval holder shall ensure that each groundwater monitoring well location includes one groundwater monitoring well designed to allow collection of groundwater samples from the uppermost formation(s).

(l) The EUB may require the approval holder to construct and maintain additional groundwater monitoring wells at each groundwater monitoring well location, if there is more than one significant uppermost formation underlying the landfill site.

(m) The EUB may require the approval holder to construct and maintain additional groundwater monitoring wells, if it is deemed necessary due to the size, area, or hydrogeology of the landfill, or the nature of the waste proposed to be accepted at the landfill.

(n) The groundwater monitoring wells for a Class II landfill shall be:

(i) at least 20 m inside the property boundary, and

(ii) at least 10 m but not more than 60 m from the designed boundary of the landfill.

(o) During construction and operation of a landfill, the approval holder shall selectively salvage and stockpile all topsoil as follows:

(i) all topsoil stockpiles shall be located on undisturbed topsoil in a location that is not affected by the landfill operations,

(ii) topsoil shall not be used to meet daily cover requirements, and

(iii) all topsoil stockpiles shall be contoured, stabilized, and seeded to prevent soil loss by wind and water erosion.

(p) A system must be in place to measure quantities of waste being placed in the oilfield landfill. Weigh scales are one method (refer to Section 15.10(1), *Annual Reports*).

(q) Approval holders of oilfield landfills shall institute a program for detecting and preventing the disposal of dangerous wastes at Class II or Class III landfills. Approval holders of Class III landfills shall institute a program for detecting and preventing the disposal of dangerous oilfield wastes and non-inert wastes at the landfill. For example, by:

- randomly inspecting incoming loads to ensure that they do not contain wastes that are not authorized for the landfill, and by maintaining records of these random inspections at the landfill, and.

- Continuous supervision of all off-loading operations and training landfill personnel to recognize potentially dangerous oilfield wastes.

(r) Burning of wastes at oilfield landfills is prohibited.

(s) The approval holder shall post signs at the landfill boundary providing the following information:

(i) the name of the approval holder,

(ii) the landfill class,

(iii) any waste restrictions, and

(iv) telephone numbers for:

- the approval holder,
- the local fire department,
- Alberta Environmental Protection, Pollution Emergency Response Team (1-800-222-6514)
- applicable EUB Field Centre address and phone number, and
- the local police department.

(t) The approval holder shall ensure that fires are extinguished immediately upon detection.

(u) The approval holder shall establish and maintain litter controls to minimize the escape of litter and shall retrieve litter that is washed or blown onto adjacent properties or accumulates on the landfill site.

(v) The approval holder shall use artificial or natural barriers to control public access to the landfill and prevent unauthorized vehicular traffic and illegal dumping of wastes.

(w) The approval holder shall ensure that no waste is deposited between the property line and the designated boundary of the landfill.

(x) The approval holder must notify the EUB immediately in writing if dangerous oilfield waste is discovered at a Class II landfill, or if dangerous oilfield waste or non-inert waste is discovered at a Class III oilfield landfill.

15.7 Oilfield Landfill Classes

1. Class Ia Oilfield Landfill

This class of oilfield landfill can accept solid oilfield waste, both dangerous and non-dangerous, provided that the waste criteria in Section 15.8 are met. A Class Ia oilfield landfill shall include, as a minimum, the following engineered features:

(a) Two liners of which at least one is a geo-synthetic liner. The liner used for primary containment must be compatible with all potentially accepted waste types, and must exhibit hydraulic conductivity of 1×10^{-8} m/sec or less. Liners used for secondary containment must be compatible with all potentially accepted waste types and must exhibit hydraulic conductivity

of 1 x 10^{-8} m/sec or less. An engineered compacted clay liner, if used as secondary containment, shall have a minimum thickness of 0.5 m.

(b) The approval holder shall ensure that the natural geologic materials surrounding the secondary containment, together with the local hydrogeologic flow regime shall be sufficient to retard the movement of any potential containments.

(c) A leachate collection and removal system above the primary liner.

(d) A leak detection system between the two liners.

(e) A run-on control system to prevent flow onto the active portion of the landfill for events up to at least the peak discharge from the larger of a 1 in 25-year storm or snow melt event.

(f) A run-off control system for the active portion of the landfill to collect and control at least the run-off water volume resulting from the larger of a 1 in 25-year storm or snow melt event.

(g) A site specific groundwater monitoring system consisting of groundwater monitoring wells located in areas hydraulically upgradient and downgradient of the landfill. The completion of the observation wells shall be at adequate depths to provide an indication of the impact of the landfill on water-bearing zones.

(h) The landfill shall be developed and managed to prevent the production of leachate by minimizing the amount of moisture that enters the waste fill.

(i) A suitable gas detection, interception, and venting or recovery system, where gas generation is expected, so that all emissions meet AEP Ambient Air Quality Guidelines.

2. Class Ib Oilfield Landfill

This class of oilfield landfill can accept solid oilfield waste, both dangerous and non-dangerous, provided that the waste criteria in Section 15.8 are met. A Class Ib oilfield landfill shall include, as a minimum, the following engineered features:

(a) Primary containment consisting of a geosynthetic or engineered, compacted clay liner which is compatible with all potentially accepted wastes, and has a hydraulic conductivity of 1 x 10^{-8} m/sec or less.

(b) The approval holder shall ensure that natural geologic materials surrounding the primary containment, together with the local hydrogeolgic flow regime, shall be sufficient to retard the movement of any potential containments.

(c) A leachate collection and removal system above the primary liner.

(d) A run-on control system to prevent flow onto the active portion of the landfill for events up to at least the peak discharge from the larger of a 1 in 25-year storm or snow melt event.

(e) A run-off control system for the active portion of the landfill to collect and control at least the run-off water volume resulting from the larger of a 1 in 25-year storm or snow melt event.

(f) A site specfic groundwater monitoring system consisting of groundwater monitoring wells located in areas hydraulically upgradient and downgradient of the landfill. The completion of the observation wells shall be at adequate depths to provide an indication of the impact of the landfill on water-bearing zones.

(g) The landfill shall be developed and managed to prevent the production of leachate by minimizing the amount of moisture that enters the waste fill.

(h) A suitable gas detection, interception, and venting or recovery system, where gas generation is expected, so that all emissions meet AEP Ambient Air Quality Guidelines.

3. Class II Oilfield Landfill

This class of oilfield landfill can accept only non-dangerous solid oilfield waste. A Class II oilfield landfill shall include, as a minimum, the following engineered features:

(a) Primary containment consisting of a geosynthetic or engineered, compacted clay liner which is compatible with all potentially accepted wastes, and has a hydraulic conductivity of 1×10^{-8} m/sec or less, and a leachate collection and removal system.

(b) A run-on control system to prevent flow onto the active portion of the landfill for events up to at least the peak discharge from the larger of a 1 in 25-year storm or snow melt event.

(c) A run-off control system for the active portion of the landfill to collect and control at least the run-off water volume resulting from the larger of a 1 in 25-year storm or snow melt event.

(d) A groundwater monitoring system consisting of at least one groundwater monitoring well location hydraulically upgradient from the landfill, and two groundwater monitoring well locations hydraulically downgradient from the landfill. The completion of the observation wells shall be at adequate depths to provide an indication of the impact of the landfill on water-bearing zones.

(e) The landfill shall be developed and managed to prevent the production of leachate by minimizing the amount of moisture that enters the waste fill.

(f) A suitable gas detection, interception, and venting or recovery system, where gas generation is expected, so that all emissions meet AEP Ambient Air Quality Guidelines.

(g) An approval holder constructing or expanding a Class II landfill may develop a landfill design with an alternate feature to that required in Section 15.7(3)(a) if:

(i) the following hydrogeological conditions are met:

- there is a 5 m thick layer of a clayey deposit having a hydraulic conductivity less than 1×10^{-8} m/sec immediately beneath all waste disposed at or below the original grade, and

- the hydraulic conductivity of the natural geologic materials beneath the clayey deposit is less than 1×10^{-8} m/sec to a depth of at least 6 m beneath the clayey deposit or provides equivalent protection, or

(ii) the approval holder provides evidence in writing to the EUB that groundwater quality will not exceed the performance standards set out in Table 15.1 at all groundwater monitoring wells.

4. Class III Oilfield Landfill

This class of oilfield landfill can accept only non-dangerous, chemically inert and non-leachable, solid oilfield wastes. Examples include demolition debris, concrete, asphalt, glass, cement returns, scrap metal, brush and non-chemically treated dry timber or wood. A Class III oilfield landfill shall include as a minimum, the following features:

(a) Construction that provides for containment of the waste disposed.

(b) a run-on control system to prevent flow onto the active portion of the landfill for events up to at least the peak discharge from the larger of a 1 in 25-year storm or snow melt event.

(c) A run-off control system for the active portion of the landfill to collect and control at least the run-off water volume resulting from the larger of a 1 in 25-year storm or snow melt event;

(d) Materials should be crushed, chipped, or otherwise broken into small pieces to facilitate compaction.

(e) Groundwater monitoring may be required, where deemed necessary by the EUB.

15.8 Waste Criteria

1. Waste Deposition Limitations

(a) Landfilling of liquid oilfield wastes is prohibited,

(b) Oilfield wastes may be deposited in landfills approved by AEP, such as landfills commonly described as municipal, regional, or industrial landfills, provided that the landfill has design criteria appropriate for the oilfield wastes being disposed,

(c) It is the responsibility of the waste generator to determine the characteristics of the waste. Based on that information, and the corresponding landfill design characteristics specified in Sections 15.6 and 15.7, the waste generator must then determine which class of oilfield landfill or AEP approved landfill has the appropriate design criteria for that type of waste, and

(d) Solid dangerous oilfield wastes shall only be deposited in an approved Class Ia or Ib Oilfield Landfill, or an AEP regulated landfill which is approved to accept hazardous wastes.

2. Dangerous Oilfield Wastes

Only the following types of dangerous oilfield waste may be disposed in Class Ia or Class Ib oilfield landfills, or AEP regulated landfills which are approved to accept hazardous waste, as outlined in Section 15.6, *Oilfield Landfill Classes*.

(a) Solid dangerous oilfield waste containing one or more halogenated organic compounds in a combined concentration less than 1 000 milligrams per kilogram (mg/kg) of which no more than 50 mg/kg is polychlorinated biphenyl; or

(b) Solid dangerous oilfield waste containing one or more of the following compounds in a combined concentration **less** than 1 000 mg/kg:

- acetone,
- benzene,
- n-butyl alcohol,
- carbon disulphide,
- cresol and cresylic acid,
- cyclohexanone,
- ethyl acetate,
- ethyl benzene,
- ethyl ether,
- isobutanol,
- methanol,
- methyl ethyl ketone,
- nitrobenzene,
- 2-nitropropane,
- pyridine,
- toluene,
- xylene, or

(c) dangerous oilfield waste with a pH greater than 12.5, or

(d) Any substance or mixture of substances that ignites and propagates combustion according to the test methods that describe spontaneously combustible dangerous wastes, provided that those substances or mixtures of substances are not liable to ignite and propagate combustion under the conditions of disposal, and are not liable to emit flammable gases under the conditions of disposal, or

(e) Solid dangerous oilfield waste producing a waste extract which contains one or more of the following substances in a concentration **less** than the value for that substance shown below:

-	arsenic	500 mg/kg,
-	beryllium	100 mg/kg,
-	cadmium	100 mg/kg,
-	chromium (Cr^{6+})	500 mg/kg,
-	lead	500 mg/kg,
-	mercury	20 mg/kg,
-	nickel	500 mg/kg,
-	selenium	200 mg/kg,
-	silver	100 mg/kg,
-	thallium	200 mg/kg.

15.9 Monitoring and Analysis

1. The approval holder shall conduct groundwater monitoring on a semi-annual basis as required by the EUB throughout the active life, and by AEP throughout the post-closure period of the landfill. The approval holder shall analyze the samples for the parameters set out in Section 15.6(2)(j). The post-closure period of a landfill is defined as the period of 25 years from the final closure of a landfill, or as long as leachate that does not meet the performance standards for landfills (listed in Table 15.1), is generated at a landfill after final closure.

2. The EUB may:

   (a) require that groundwater samples be analyzed for parameters other than those set out in Section 15.6(2)(j),

   (b) change the frequency of groundwater monitoring and analysis required under section 15.9(1), or

   (c) require the approval holder to install additional groundwater monitoring wells where it is deemed necessary due to the characteristics of waste received at the landfill, changes in groundwater quality at the landfill, or other evidence that suggests an impact on groundwater quality.

3. Where groundwater at the landfill fails to meet the performance standards set out in Section 15.6(2)(j), the approval holder shall notify the EUB and shall implement the groundwater remediation plan developed under Section 15.6(2)(a)(iv).

4. Where groundwater monitoring is required, the approval holder shall:

   (a) ensure that all groundwater monitoring wells are protected from damage and are locked except when being sampled, and

   (b) clean, repair, or replace groundwater monitoring wells, which have been damaged or are no longer able to produce representative groundwater samples, prior to the next scheduled sampling date.

5. The approval holder shall conduct analyses of samples collected to meet these requirements in the following manner:

   (a) for water and leachate samples, in accordance with the recommended test methods listed in Appendix 3.0, and

   (b) for solid wastes samples, in accordance with the recommended test methods listed in Appendix 3.0.

15.10 Reporting Requirements

1. Annual Reports

The approval holder of an oilfield landfill will be required by the approval to operate, to prepare by 31 March of each year, a report containing the following items and to make it available to EUB staff upon request:

(a) the type and volume of each major waste stream that was placed in the landfill, and the locations of disposal of wastes requiring special handling,

(b) the groundwater monitoring data pursuant to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection,*

(c) survey records and as-built records for the landfill showing the location and development of excavations, fill areas, final grades and structural components,

(d) the current version of design and operation plans for the landfill,

(e) records of random inspections carried out under Section 15.6(2)(q),

(f) records of personnel training carried out under Section 15.6(2)(q),

(g) copies of any notices given to the EUB under Section 15.6(2)(x) regarding hazardous or non-inert waste,

(h) results of gas monitoring,

(i) records of the quality of surface water released to the environment,

(j) volumes of leachate generated, if any, characterization of the leachate and the method of disposal,

(k) an interpretation of the requested data which should include identification of any change in the quality of the groundwater, and

(l) a remedial plan to correct any changes identified in (k) above. Enforcement action may result if remedial action has not been instituted in a timely fashion.

2. Record Keeping

In addition to the record keeping requirements outlined in Section 11.8, the approval holder shall maintain the following records until the end of the post-closure period:

(a) waste generator identification, type of major waste stream, volume, and approximate location where the material was landfilled, and

(b) initial site assessment groundwater sample data.

3. Closure, Post-Closure, and Reclamation Requirements

The reclamation plan, as laid out during the initial design of the landfill, is to be incorporated throughout the operational life of the landfill. Prior to final closure of the landfill, the approval holder shall notify the EUB in writing of the intent to close the landfill. The approval holder shall begin closure no later than 180 days after the landfill or trench reaches its final design elevation, and complete closure no later than 180 days after the beginning of closure.

The post-closure period of a landfill is defined as the period of 25 years from the final closure of a landfill, or as long as leachate that does not meet the performance standards for landfills (listed in Table 15.1) is generated at a landfill after final closure.

Upon final closure of landfills, the jurisdiction transfers to AEP for post-closure and reclamation requirements. Upon final closure of the landfill, the following components must be included, and/or any other requirements deemed necessary by AEP:

(a) The approval holder must maintain records of the type of materials buried on-site, and the burial location and depth. These records shall be made available to AEP staff upon request.

(b) All monitoring and analysis data shall be made available to AEP staff on request.

(c) The closure and reclamation plan, which is laid out during the initial design of the landfill and submitted as part of the original application, shall be completed and include the following information:

(i) a description of the proposed final cover system, and the installation methods, and procedures,

(ii) an estimate of the maximum quantity of wastes on-site over the active life of the landfill,

(iii) a description of how the following elements have been or will be dealt with:

- the final use of the reclaimed areas,
- drainage restoration,
- soil replacement,
- final cover slopes,
- erosion control,
- revegetation and conditioning of the site, and
- subsidence remediation.

(iv) a schedule for completing closure and reclamation, and

(v) a detailed landfill site assessment which shall clearly identify landfill impacts, nature, and extent of any contamination.

(d) At closure of the landfill or any trench, the approval holder shall install a final cover system designed to and constructed to:

(i) provide long term minimization of migration of liquids through the closed landfill,

(ii) function with minimum maintenance,

(iii) minimize erosion or abrasion of the cover, and

(iv) accommodate settling and subsidence and be resistant to burrowing activity of animals and root penetration so that the cover's integrity is maintained.

(e) The approval holder shall ensure that the final cover system meets the following requirements, and shall construct the layers in the following order:

(i) the final cover system shall include a barrier layer of 0.6 m of a maximum permeability of 1×10^{-7} m/sec, or of alternate material that will achieve equivalent protection,

(ii) subsoil shall be placed as the second layer of the final cover system and salvaged topsoil as the third layer of the final cover system as follows:

- required subsoil shall be spread evenly over the barrier layer, and

- all salvaged topsoil shall be spread evenly over the replaced subsoil,

(iii) the depths of the replaced topsoil and subsoil shall be equal to the depths determined at the landfill site prior to its construction, or shall meet the following minimum requirements:

- for pasture or recreational uses, 0.20 m of topsoil and 0.35 m of subsoil, and

- for cultivated land use or forestry, 0.20 m of topsoil and 0.80 m of subsoil,

(iv) after the subsoil and topsoil are replaced,

- water permeability and rooting in topsoil or subsoil shall not be restricted, and

- vegetation shall be established with a suitable seed mixture compatible with the intended land use,

(v) the final cover system shall have a final topography that ensures that water does not pool over the landfill area with a minimum final grade of 5 per cent, and a maximum final grade of 30 per cent.

(f) Following final closure of the landfill, the approval holder shall notify the EUB in writing, verifying that:

(i) closure has been completed in accordance with the closure and reclamation plan and these requirements, and

(ii) the landfill area is compatible with the proposed end land use.

(g) After final closure of the landfill and during the post-closure period, the approval holder shall:

(i) maintain the integrity of the final cover system and diversion and drainage structures, and make repairs to the cover system as necessary to correct the effects of settling, subsidence, erosion, or other events,

(ii) maintain, operate, and monitor the groundwater monitoring, leak detection, leachate collection, and gas venting or recovery systems, where such systems or structures are installed,

(iii) protect and maintain surveyed benchmarks, and

(iv) anything else deemed necessary by AEP.

16.0 Biodegradation

16.1 Introduction

The **purpose** of this section is to establish minimum requirements for the design and operation of techniques and facilities used for the biodegradation of oilfield wastes.

These requirements will ensure that:

- effective waste treatment occurs rather than dilution,
- there is minimal potential for the transfer of contaminants to another medium, and
- extensive clean-up of the facility or treatment site will not be necessary at the time of closure.

The biodegradation techniques and facilities addressed by this document include:

- on-site land treatment of a single application of hydrocarbon contaminated soil or pit/pond sludge, and
- biocell/biopile treatment or facilities.

Land treatment, biopile, and biocell are techniques commonly used to aerobically biodegrade hydrocarbon contaminated soils and sludges. Biodegradation is a catabolic process conducted by soil residing microorganisms, in which hydrocarbon is used as a source of carbon to satisfy the microorganisms' energy and cellular growth needs.

As the process is microbiologically driven, the strategy for successful biodegradation involves optimizing conditions for microbial activity, such as temperature, pH, moisture, nutrient, and oxygen levels. In addition, the hydrocarbon must be biodegradable and not toxic to the microorganisms. Carbon dioxide, water, and non-toxic residue compounds are the expected products of the microbiological process.

As oilfield wastes can contain more than one type of contaminant, some of which may be poorly degradable or non-degradable, the potential for successful biodegradation of oilfield wastes varies. Within the upstream petroleum industry, hydrocarbon contaminated soils and sludges have been successfully biodegraded. Biodegradation success is typically greatest when the hydrocarbon contaminant consists of low molecular weight aromatics and aliphatics. Hydrocarbon contaminants containing a large fraction of asphaltenes or nitrogen and sulphur rich heterocyclic compounds may take a long time to degrade and may even produce toxic intermediates.

Sites receiving multiple applications of oilfield wastes are considered dedicated land treatment facilities, which in the past the EUB approved as a component or type of oilfield waste management facility. In late 1995 a task group was established to review

and update the AEP document *Guidelines for Land Treatment of Industrial Waste.* The EUB is a member of this task group and during the interim, while these guidelines are being revised to reflect today's legislation, policy, and environmental science, the EUB will not accept, review, or approve any applications for new dedicated land treatment facilities. However, previously approved dedicated land treatment facilities will be allowed to continue to operate provided they are operated in accordance with their EUB approval. As well, during this interim period the EUB will not accept, review, or approve applications for the expansion of existing approved land treatment facilities.

16.2 On-Site Land Treatment of a Single Application of Non-Refined Hydrocarbon Contaminated Soil or Pit/Pond Sludge on an Active Oil and Gas Site

1. Introduction

Land treatment is defined as a planned and controlled mixing of the waste and surface soil in which the inherent soil processes are used to biodegrade, transform, and assimilate waste constituents. The oilfield wastes that are appropriate for this technique are limited to non-refined hydrocarbon contaminated soils resulting from spills/leaks and non-refined hydrocarbon contaminated pit/pond sludges. As previously described in section 11.9, all decontamination and land reclamation activities, regardless of whether the sites are active or inactive, are the regulatory responsibility of AEP. Approval holders and licensees must comply with the one-time-only land treatment protocol described in the following subsections unless otherwise directed or approved by AEP. Approval holders and licensees wanting to deviate from this protocol (i.e. use a risk approach or Tier II approach) must obtain approval from AEP.

Considerations for using land treatment include:

- The wastes must be susceptible to biodegradation in the soil environment, create no offensive odours at the site boundaries, and not pollute groundwater.
- On-site land treatment is limited to those situations where non-refined hydrocarbon contaminated soils resulting from spills/leaks and non-refined hydrocarbon contaminated pit/pond sludges are land treated in a single application of the waste.
- The wastes must be land treated on the site on which they were generated and the licensee or approval holder of the site must address the procedures in the following sub-sections to ensure that no adverse environmental or health consequences occur.
- On-site land treatment operations must not compromise the ability to restore the site to meet reclamation certification requirements.

- Land treatment is not an option if more than one application is required to accommodate the volume of waste.

Licensees and/or approval holders of oil and gas sites must keep in mind that other treatment and disposal options such as soil washing, solvent extraction, biopile, biocell, thermal treatment, stabilization/solidification, and approved landfill disposal may be more applicable in some situations.

2. Assessment Information

Approval holders or licensees are not required to submit applications or information to the EUB for on-site, one-time land treatment operations occurring on active oil and gas sites. The approval holder or licensee of the site must document their activities, and supply this documentation to EUB or AEP staff upon request.

Because inappropriate spreading of wastes on land can damage soil that currently is not degraded, approval holders or licensees must ensure that on-site land treatment operations will not compromise future land capability. The framework described in this section is guided by the environmental objective of preservation or restoration of equivalent capability of the land and is designed to minimize the occurrence of unnecessary environmental damage. It is not acceptable, in the process of dealing with a volume of concentrated waste to create a second, larger albeit less concentrated, contaminated site.

Appropriate and comprehensive site and waste characterization are required to determine whether the site and receiving soil are conducive to land treatment and whether the waste is susceptible to biodegradation. Parameters that have proven to be of concern historically include hydrocarbon content, salt content, pH, metal concentrations, and environmentally persistent compounds such as halogenated organics.

A representative sample of the waste and receiving soil must, as a minimum, be analyzed for the following:

- pH
- electrical conductivity (EC)
- major soluble ions (Ca, Mg, Na, and Cl,)
- total metals (as per AEP Tier I Criteria)
- sodium adsorption ratio (SAR)
- texture (soil only)
- bulk density (waste only)
- hydrocarbon concentration (waste only)
- extractable organic halogen (waste only)
- assessment of the waste for suitability of biodegradation (i.e. hydrocarbon fractionation, treatability study, waste characterization)

On-site land treatment of oilfield waste as once-only application is possible if the following factors are met:

(a) The waste material contains less than 2 ppm organic halogen.

(b) The land treatment site does not have a slope that exceeds 5 per cent and is at least 100 meters away from any permanent body of water.

(c) The receiving soil (0-15 cm depth) does not exceed AEP Tier I Criteria for EC, SAR, metals, and pH.

(d) The maximum depth of the treatment zone must be at least 1 metre above the seasonally high water table. For groundwater protection the hydraulic conductivity of the subsurface soil below the treatment zone should be low. It is recommended that the subsoil exhibit a hydraulic conductivity of 10^{-5} cm/sec or less.

(e) Available area of receiving soil will result in a maximum spread rate of 75 kg waste per square metre (750 tonne per ha) or a waste to soil mix ratio of 1:4 by volume. This rate of application is not to be exceeded. Contaminated materials in excess of this capacity must be dealt with by other treatment means.

(f) After mixing the waste material with the receiving soil (assuming maximum mixing depth of 15 cm) the treatment zone meets the following:

  (i) maximum metal concentration does not exceed AEP Tier I Criteria,
  (ii) EC does not exceed 4 dS/m,
  (iii) maximum hydrocarbon concentration does not exceed 2 percent by mass,
  (iv) SAR does not exceed 6 (Note: if waste material alone does not exceed 2 then SAR determination after mixing is not required), and
  (v) pH is between 6.5 and 8.5.

(g) The maximum predicted time required to reduce the hydrocarbon concentration in the treatment zone to less than 0.1 per cent by mass does not exceed 5 years.

(h) Application of wastes does not occur during the period from October 15 to the next April 30, during rainfall periods, or at other times when the soil is saturated with water, ice-covered, snow-covered, or frozen.

3. Information Documentation

Information to verify that the factors listed in points (a) through (h) in subsection 2, Assessment Information above have been met, must be documented. Other information that must be documented for on-site land treatment of a single application of oilfield waste includes:

(a) soil horizon used for the treatment zone (Note: Land treatment conducted on subsoils, i.e. C horizon, may have reduced potential in meeting the 0.1 per cent hydrocarbon treatment target.),

(b) soil classification of the treatment site to the subgroup level (Agriculture Canada Expert Committee on Soil Survey 1987),

(c) number, location, and depth of samples taken to characterize the treatment area,

(d) sketch of the site identifying the treatment area and other key features such as slope, topography, and drainage features,

(e) area of land available for land treatment,

(f) volume of waste land treated (cubic metres),

(g) waste application rate,

(h) date of application,

(i) photo of the treatment area,

(j) estimated biodegradation period (years),

(k) description of application method and depth of application,

(l) amendments added to the treatment area (types, rates, and frequency), and

(m) confirmation treatment zone analyses (hydrocarbon concentration, pH, and EC) to verify successful biodegradation.

The documented information must be retained until a reclamation certificate for the site has been issued, and must be made available to EUB or AEP staff upon request.

16.3 Biocell and Biopile Treatment or Facilities

1. Introduction

Biocell or biopile techniques refer to the processes where oilfield wastes are biologically degraded in a contained and controlled environment, whether it is in an impermeable cell structure or piled on an impermeable liner. These techniques should be considered as alternatives to land treatment.

Biopile and biocell treatments may be of particular interest when:

- Site conditions are not suitable for land treatment.
- The volume of waste precludes one-time, on-site land treatment.
- Biodegradation of the organic contaminant is an intermediate step to make the waste suitable for another treatment or disposal option.
- The waste is intended to be used as fill material after successful biodegradation (i.e. material is excavated, treated, and then replaced).

Once the biodegradation process is complete the material must be removed from the contained system and forwarded for further treatment or disposal, or returned to the originating site to be used as fill material if it meets acceptable criteria. Biocells and biopiles must not be used for final disposition of waste materials.

2. General Requirements

Approval holders or licensees choosing to use biocells or biopiles for a one-time, on-site treatment of an oilfield waste on an active oil and gas or oil sands site are not required to apply to the EUB for approval. However, approval holders or licensees must document their activities including the system design, the type, volume, and characterization of the waste treated, and the final disposition of the treated material. Upon request, this information must be made available to EUB staff.

Approval holders or licensees constructing permanent biocells or biopiles on an existing EUB approved oil and gas or oil sands site for the purpose of biodegrading oilfield wastes generated at one or more of that approval holder's or licensee's facilities must submit an application for approval of modification to the facility. The application for modification shall address the information required in Section 26.0, *Biodegradation Facilities - Specific Application Information*.

Permanent biopiles or biocells constructed on a stand alone site require EUB approval as an oilfield waste management facility. Facilities that accept material from various sites as well as various companies will be considered third party waste receivers.

While this section outlines the primary criteria considered appropriate for biocell or biopile treatment, operators should refer to Sections 21.0 and 26.0 for the information required in an application for approval to construct or operate an oilfield biocell or biopile.

All biopiles and biocells shall comply with the requirements (siting, safety, waste characterization, design and operation, record keeping, and closure) outlined in Section 11.0, *Oilfield Waste Management Facilities*.

3. Siting

Although conducting the biodegradation process in a controlled system minimizes the potential for the transfer of contaminants to the soil, groundwater, and perhaps even the atmosphere, biopiles and biocells shall comply with the siting requirements outlined in Section 11.2, *Siting Issues*. In addition, potential sites shall be chosen so that the seasonally high water table is at least 1 metre below the base or bottom of the biopile or biocell.

4. Design and Operation

Although the key treatment process occurring within biocells and biopiles is biodegradation of the organic contaminant, if designed for it, these facilities may also be potentially used to leach and collect water soluble contaminants, such as salts, from the waste.

Biopiles typically are constructed on grade (the ground surface) and the waste material is laid in a pile or in windrows on an impervious liner or base pad. The material may be aerated by physically turning over the pile or windrows. Nutrients and moisture may be topically applied, or some designs may incorporate perforated pipes throughout the pile as the waste material is being laid down for the purpose of adding air, nutrients, or moisture. Some designs may also cover the pile for collection of off-gases such as highly volatile organics or CO_2.

Monitoring the CO_2 level can provide insight to the activity levels of the microorganisms responsible for biodegradation and may aid in determining when additional nutrients, air, or moisture is required or when the degradation process is nearing completion.

Within the scope of this document, the main difference between a biopile and a biocell is that a biocell consists of a walled containment system that may be constructed on grade or below grade. The waste material is then laid within the containment system.

In addition to the general design and operation requirements outlined in Section 11.6, *Design and Operation* the following requirements also apply.

(a) Biopiles and Biocells Used for One-Time Treatment

Biopiles and biocells used for a one-time, on-site treatment of oilfield waste shall, as a minimum, consist of a containment device and a leachate collection system.

(i) Containment Device

The containment device shall consist of a curbed (at least 15 cm in height) impermeable liner that is chemically resistant to the material being treated and exhibits a hydraulic conductivity of 10^{-7} cm/sec or less (i.e. an engineered compacted clay liner with a minimum thickness of 0.5m, a minimum of 30 mil geosynthetic liner, or current accepted standards), or of a steel, plastic, fibreglass reinforced plastic, or concrete vessel.

(ii) Leachate Collection System

The leachate collection system shall be designed to allow for the collection of any generated leachate, or in systems open to the atmosphere, precipitation.

Note: In situations where the soil conditions of the lease exhibit limited permeability (i.e. hydraulic conductivity of 10^{-6} cm/sec or less) and the contaminants within the waste material are relatively non-leachable, the waste material may be biodegraded on a prepared surface of the lease. This includes preparation of a base for the containment system (i.e. removal of A horizon and B horizon soils, and preparation of the C horizon soil for the base pad) and incorporation of the leachate collection system.

To use this option operators must verify that the hydraulic conductivity of the prepared surface is 10^{-6} cm/sec or less and assess the leachability of the waste. The waste material must not exceed an EC of 4 dS/m, SAR of 6, and hydrocarbon concentration of 2 per cent by mass. As well, a leachate of the waste prepared using the TCLP method, must not exceed the

concentrations for BTEX and metals (As, Ba, Cd, Cr, Co, Cu, Pb, Hg, Mo, Ni, Se, Zn) in the CCME Interim Assessment Criteria for Water.

(b) Permanent Biopiles and Biocells

Permanent biopiles and biocells shall consist of a:

- primary containment device, a secondary containment system, a leachate collection system, and a leak detection system, or
- primary containment device, a leachate collection system and a groundwater monitoring system.

(i) Primary Containment Device

The primary containment device for a biocell shall consist of a impermeable liner or a steel, plastic, fibreglass reinforced plastic, or concrete tank or vault, while that for a biopile may consist of a curbed (at least 15 cm in height) impermeable liner or a curbed asphalt or concrete base pad.

Licensees and/or approval holders must be able to verify that liners used for primary containment meet the criteria specified in Section 16.3(4)(a)(i), on Containment Devices.

(ii) Secondary Containment System

The secondary containment system shall consist of an impermeable clay or synthetic liner that is chemically resistant to the material being treated and exhibits a hydraulic conductivity of 10^{-6} cm/sec or less (i.e. 0.5 metres or more of an engineered compacted compacted clay liner, a minimum of 30 mil geosynthetic liner or current accepted standards). Licensees and/or approval holders must be able to verify that the liner meets the above criteria.

(iii) Leachate Collection System

The leachate collection system shall meet the requirements outlined in Section 16.3(4)(a)(ii), on Leachate Collection System.

(iv) Leak Detection System

Licensees and/or approval holders must be able to monitor the interstitial space between the primary containment device and the

secondary containment device to ensure the primary containment device is not leaking (i.e. incorporation of engineered seepage pathways flowing to a monitoring well).

When the biopile or biocell is in use, the leak detection system must be sampled on a monthly basis and if any liquid is present, it must be field tested for pH, chlorides, hydrocarbon odour, and visible hydrocarbon sheen. If there is indication of a problem from the monthly tests, then laboratory analysis should be performed for verification and then followed by appropriate corrective measures if necessary.

(v) Groundwater Monitoring

Applicants wishing to construct a permanent biopile or biocell that consists of only a primary containment system and leachate collection system shall be required to incorporate into the design, a groundwater monitoring system that will provide an early indication of potential groundwater impact. Refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection.*

(c) Other Operational Requirements

The following operational requirements also apply to all biopiles and biocells (permanent as well as those used for one-time treatment):

(i) Prior to treatment, a representative sample of the oilfield waste must, as a minimum, be analyzed for the following:

- pH
- EC
- major soluble ions (Ca, Mg, Na, and Cl,)
- total metals (as per AEP Tier I Criteria)
- hydrocarbon concentration
- extractable organic halogens

(ii) The success of the treatment shall be verified by analyzing the treated material for the parameters listed in point (i) above. If the original analyses indicated that levels of salts, metals, or extractable organic halogens were not a problem then those parameters may not have to be repeated. Depending upon the final disposition the treated material may require further testing. It is the responsibility of the licensee and/or approval holder of the site on which the treatment system is located to characterize the material to verify it's suitability for final disposition.

(iii) In the event of any volatile or particulate emissions, the operator shall incorporate adequate controls to mitigate any potential problems.

5. Reporting and Record Keeping

In addition to the record keeping requirements outlined in Section 11.8, *Record Keeping* the following requirements also apply.

Licensee and/or approval holders of sites on which biopiles and/or biocells (permanent or one-time) are constructed shall, for each volume of oilfield waste biodegraded, document the following information and retain it on site for a minimum of two years beyond the date the biodegraded material was removed from the treatment system. The following information must be made available to EUB staff upon request:

(a) the type, volume, origin, generator, and analyses, as per 16.3(4)(c)i), of the waste material,

(b) the types and application rates of any amendments added to enhance the biodegradation process,

(c) the volume of any leachate collected and how it was disposed,

(d) the analyses of the treated material, as per 16.3(4)(c)ii), to verify the material meets the criteria for the next treatment or disposal option,

(e) where the treated material was transferred (name and location of the site or facility) for final disposition or for further treatment,

(f) if applicable, the leak detection results, and

(g) if applicable, the groundwater monitoring results (which must be retained for a minimum of five years).

Note: The EUB Calgary office and AEP must be notified if any of the monitoring results indicate a concern. The notification shall describe:

- the parameters that changed,
- the investigative work conducted, and
- any remedial or corrective work that has occurred or is proposed.

6. Closure

In addition to the closure requirements outlined in Section 11.9, licensees and/or approval holders of sites that have used a biocell or biopile for a one-time, on-site treatment of oilfield waste will be required after biodegradation is complete, to remove the treated material, to dismantle the biocell or biopile, and to return the site of the treatment area to equivalent land capability. Operators will be required to document their closure activities, and to retain this information for a minimum of two years beyond the date equivalent land capacity was achieved. This information must be made available to EUB and AEP staff upon request.

17.0 Thermal Treatment

17.1 Introduction

The **purpose** of this section is to establish the minimum requirements for the design and operation of fixed thermal treatment facilities and to provide general information for non-fixed thermal treatment facilities used to treat oilfield wastes.

Thermal treatment is an effective method for removing organic components in oilfield waste and includes:

- incineration,
- thermal oxidation,
- thermal desorption,
- thermal phase separation, and
- thermal distillation recovery.

In these requirements, thermal treatment refers to:

Any process involving the use of heat to remove contaminants from, or destroy contaminants in, an oilfield waste material.

The treatment may involve destruction, recovery or reduction of the contaminants and/or the waste material in which it is found. Although these requirements were developed based on the above removal and destruction technologies, the requirements will apply, where applicable, to other thermal treatment technologies as they become commercially available in Alberta.

Thermal treatment technologies and facilities addressed in this section include small batch feed incinerators, campsite incinerators, and fixed thermal treatment facilities.

- Small batch feed incinerators, which are not allowed to burn more than ten tonnes of waste per month, and campsite incinerators operating at oil and gas or oil sands facilities do not require approval from the EUB provided they meet the criteria specified in Sections 17.3 and 17.4.

- All other fixed thermal treatment facilities, operating at oil and gas, oil sands, or oilfield waste management facilities must be approved by the EUB; refer to Part E, for information required in the application for approval to construct and operate a thermal treatment facility.

- Non-dangerous oilfield waste may be incinerated at AEP regulated incinerators that are approved to incinerate non-hazardous or hazardous wastes. The incinerator must also be approved to accept third party waste.

- Dangerous oilfield waste may be incinerated at AEP regulated incinerators that are approved to incinerate hazardous wastes. The incinerator must also be approved to accept third party waste.

The use of AEP approved mobile thermal treatment units on oil and gas facilities is discussed in Section 17.5, *Mobile Thermal Treatment Units*.

17.2 Thermal Treatment Facilities Requiring Approval to Operate

This subsection applies to fixed thermal treatment facilities that do not meet the criteria described for small batch feed or campsite incinerators. An application containing information outlined in Part E, must be submitted to the EUB. Successful applicants will receive an "Oilfield Thermal Treatment Facility Approval" from the EUB. No on-site construction work or test burns shall commence prior to receiving the approval.

Thermal treatment facilities shall comply with the requirements (siting, safety, waste characterization, EIA, design and operation, site assessment and groundwater protection, record keeping, and closure) outlined in Section 11.0, *Oilfield Waste Management Facilities*.

1. Siting Issues

Siting of thermal treatment facilities must consider the following issues:

regional geology,
hydrogeology,
topography,
set-back distances,
adjacent land uses,
future land uses,
environmental sensitive areas, and
public impact.

In addition to the general siting requirements in Section 11.2, *Siting Issues* for all oilfield waste management facilities, special consideration should be given to air quality issues and dispersion characteristics in the local area.

2. Waste Feed Restrictions

Certain waste feed restrictions may be identified in an approval depending on the thermal treatment technology and process being used (i.e. a limitation could be placed on the halogenated organics content in the waste feed stream). These restrictions will be individually reviewed for each application.

Waste feed streams must not contain polychlorinated biphenyls (PCBs). The waste stream should be classified in accordance with Part B, Section 5.0, *Procedures for Classifying Waste* and must not contain detectable PCBs using the test method selected from Appendix 3.0, *Recommended Test Methods*.

3. Design Parameters

The application for approval must specify the key parameters which would indicate the successful destruction or removal of contaminants and the success of pollution control equipment. The limiting operating values of these parameters must be identified with a discussion of why the identified limits apply.

For traditional incineration technologies this may include:

primary chamber temperature,
primary chamber pressure,
afterburner temperature,
afterburner residence time,
afterburner excess oxygen,
treated material residence time, and
exit temperatures.

For thermal desorption technologies some or all of the previous may apply, as well as:

- gas exit temperature from the vapour cooler, and
- carbon bed pressure drop.

4. Operating Practices

(a) Waste Handling and Storage

Waste materials must be stored in accordance with the EUB ID 95-03 and Guide G-55 *Storage Requirements for the Upstream Petroleum Industry*. Stored waste volumes must not exceed six months processing volume.

Written operating practices must be maintained at the operating site which identify the receiving, unloading and segregation practices for all potential waste streams.

(b) Operating and Safe Work Procedures

In addition to a corporate emergency response plan, written operating procedures must be maintained on-site which address start-up, shutdown, emergency shutdown, and other safe work procedures as required. These

procedures must be designed to control the emission or discharge of contaminants or untreated material during start-ups and shut downs.

(c) Upsets

All equipment must be equipped with an automatic alarm system to be triggered when preset levels of the key design parameters are not met. Alarms must be designed to provide an indication of impending upset conditions. Written operating practices detailing the appropriate response to each alarm must be maintained on site.

(d) Feed Conditioning

Conditioning of the feed, such as a thorough mixing with processed or uncontaminated materials is acceptable, provided that the mixing is done for operational purposes. To ensure compliance with the operating approval, waste stream characterization must be performed prior to feed conditioning. However, dangerous oilfield wastes must not be mixed with any solid or liquid for the primary purpose of dilution to avoid any Alberta regulatory requirement.

5. Residuals Management

Subject to characterization of both the solid and liquid residual materials produced from thermal treatment operations, reuse, recycle or disposal options may be chosen. Part B, Section 5.0, *Procedures for Classifying Waste* gives guidance on how to conduct this characterization. Licensees and/or approval holders of thermal treatment processes must ensure that they inform the oilfield waste generator of the capabilities of their system so that the generator can assess the liabilities associated with the treated material.

(a) Solid Residuals

Providing the residual material meets AEP Tier I Criteria, suitable options include using it as on-site fill material or as landfill cover material. If treatment did not occur on-site, ash or treated soils may be returned to the oilfield waste generator's site.

The use of treated materials as landfill cover must not contravene any conditions in the AEP or EUB landfill licence or approvals and may require written agreement of AEP or EUB..

Ash or processed soils may be landfilled provided it is tested and meets the requirements of Section 15.0, *Oilfield Landfills*.

(b) Liquid Residuals

Liquid residuals should be collected and reused in the process as much as possible. Collected liquids which will not be reused may be recycled as long as the characteristics of the material meet all receiver specifications for that product stream. Cooling water may be treated and released to surface provided that it is tested and meets the criteria in Section 11.6(2)(b), *Design and Operations* prior to a controlled release.

Alternatively, liquids may be injected into waste disposal wells approved to handle the liquids or they may be disposed in any other manner approved by the EUB.

6. Emissions Criteria

Operations at thermal treatment facilities must not result in environmental damage or risk to public safety. Typically, facilities will be expected to achieve the emission levels identified in the following table.

Table 17.1 - Stack Discharge Limits (at 11 per cent Oxygen)

Parameter	Emission Limit
Hydrogen Chloride	75 mg/Rm^3
Particulates	20 mg/Rm^3
Visible Emissions - Opacity	5 per cent (averaged over 6 consecutive minutes)
Carbon Monoxide	57 mg/Rm^3
Dioxins and Furans	0.5 mg/Rm^3
Sulphur Dioxide	260 mg/Rm^3
Oxides of Nitrogen	400 mg/Rm^3
Destruction and Removal Efficiency	99.99 per cent

mg/Rm^3 - milligrams per dry cubic metre at a reference pressure of 1 atmosphere and reference temperature of 25°C.

Stack emission levels for a facility are dependent on a number of parameters which include:

volume of waste being treated,
type of waste being treated,
technology being used, and
site specific requirements.

Applicants should consult the following guidelines to identify the specific emissions criteria which pertains to their thermal treatment process in developing

their application information. Supporting data must be provided with explanations for the choice of criteria.

- National Guidelines for Hazardous Waste Incineration Facilities, Design and Operating Criteria, Volume 1. Canadian Council of Ministers of the Environment, March 1992.

- Operating and Emissions Guidelines for Municipal Solid Waste Incinerators. Report CCME-TS/WM-TRE003. June, 1989.

7. Test Burns and Compliance Tests

For further details on requirements for test burns or compliance tests, refer to the "National Guidelines for Hazardous Waste Incineration Facilities, Design and Operating Criteria, Volume 1", Canadian Council of Ministers of the Environment, March 1992.

(a) Test Burns

The main objective of a test burn is to acquire quantitative data that will be representative of the actual thermal treatment operations. These tests are conducted to ensure that the facility can properly treat the waste and meet all performance requirements and contaminant emission limits.

Successful completion of a test burn will be a condition of an EUB approval to operate. The application for approval to construct and operate a thermal treatment facility must outline the test burn protocol that will be followed. Information in the application should include:

(i) waste type(s) and source(s),
(ii) waste feed characterization, including the sampling and analysis methods used,
(iii) parameters to be monitored in all effluent streams, including sampling and analysis methods used,
(iv) operating parameters such as temperature, air flow rate, mass flow rate, waste feed rate, residence time, total hydrocarbons and combustion and destruction efficiencies (if applicable), and
(v) the time period over which the test will be conducted.

Further testing may also be required for approved facilities if the operator wishes to:

- change the facility design or operating conditions,
- alter the waste feed stream matrix, or
- if the principle contaminants in the waste feed changes.

(b) Compliance Testing

Compliance testing may be required on certain approved thermal treatment facilities. The need for compliance tests will depend on the thermal treatment technology being used and other factors such as the monitoring procedures at the facility. The purpose of conducting these tests is to ensure that the facility continues to comply with existing standards and the requirements identified in the facility approval.

The need to conduct compliance testing and the procedures and requirements to follow during a test will be determined for each individual facility. The frequency of testing will be identified in the facility approval.

8. Monitoring and Reporting

In addition to the record keeping requirements in Section 11.8 *Record Keeping*, for all oilfield waste management facilities, the following requirements also apply.

(a) Inspections

Daily inspections of the facility must be conducted to detect leakage, spills, corrosion, hot spots, and malfunctions. Equipment shall be examined for wear and signs of leaks. Results of these inspections should be recorded in the daily operations log with operational changes made to correct deficiencies.

(b) Process and Stack Emission Monitoring

The key parameters which indicate the successful destruction or removal of contaminants and successful pollution control operations should be monitored on a continuous basis. Where continuous monitoring is not employed, alternative monitoring or operational methods which would prevent operating upsets must be identified in the application.

Ambient air quality monitoring may also be required by the specific treatment facility approval.

(c) Groundwater Monitoring

A comprehensive groundwater monitoring program must be included in the design, operation, and decommissioning of a thermal treatment facility that requires approval to operate from the EUB.

(d) Monthly Documentation

Licensees and/or approval holders of thermal treatment facilities must document the following information and retain it on-site for a minimum of two years. The following information must be made available to EUB staff upon request:

(i) a balance of opening inventory (waste materials and residuals) for each month,

(ii) for each receipt of waste material, the volume, source, generator, type (characterization), and date received,

(iii) the volume of waste material thermally treated (daily) including the volume of residuals generated (liquids and solids),

(iv) the daily operational information from the continuous process and emission monitors, including identifying and briefly explaining any occurrences lasting more than 60 minutes where operating parameters or emission limits were not met,

(v) a closing inventory balance for the month identifying total volumes of waste materials received, total volume thermally treated, total volume of waste material waiting for treatment, volume of residuals sent for disposal, and the name and location of the disposal facility, and volume of residuals stored on site, and

(vi) copies of all analyses conducted for the purposes of feed characterization.

(e) Annual Report

Licensees and/or approval holders of thermal treatment facilities must summarize the monthly information and prepare an annual report by March 31 of each year. This report which must be retained on site for a minimum of 2 years and made available to EUB staff upon request, shall contain as a minimum:

(i) the amount of material processed, including sub-totals for different waste streams,

(ii) a listing of the types of contaminants processed,

(iii) the amount of residual materials disposed and the disposal method,

(iv) a description of the performance of the air pollution control equipment,

(v) a summary of the process monitoring results,

(vi) a general description of operations, and

(vii) a summary of the results of groundwater monitoring programs (if any).

17.3 Campsite Incinerators

Portable incinerators having a burning capacity of less than 90.7 kg/hr which are used to dispose of kitchen camp wastes from drilling and exploration sites do not require an approval from the EUB. The EUB advises the use of these campsite incinerators in areas where access to an approved disposal site is not available.

The incinerator shall:

1. be capable of burning the waste to an inert ash,

2. incorporate a stack of suitable height and an effective spark arrestor,

3. be maintained in good operating condition such that warped components, leaks, refractory, or other damage is repaired as soon as is practicable,

4. be provided with underfire air, and

5. be provided with overfire air for all incinerator types excepting controlled air units.

Considerations should be given to the requirements of the Air Emissions Regulation (AR 124/93).

17.4 Small Batch Feed Incinerators

Basic principles of good incinerator design have been used to develop the following criteria. No formal approval from the EUB is required for these small incinerators to operate on oil and gas or oil sands sites, provided that all the requirements of this guideline are met. The licensee and/or approval holder of the oil and gas or oil sands site is required to send notification to the main EUB (Calgary) office. The notification should identify the company name, location of the site, the approximate volumes of waste types I, II, and III (refer to Table 17.2), and filter material that will be batch incinerated at the site, and that all of the requirements of this section will be met.

1. Siting

These guidelines apply to small non-mobile incinerators owned and operated by the waste generator. Facilities where oilfield waste incineration is occurring must be located a minimum of 1.5 km from any residents or public facility, unless otherwise approved by the EUB.

The surface terrain of the incinerator site shall allow for the prompt and effective clean up of all materials that may spill or leak during waste storage and disposal operations. The clean-up materials should be disposed of in the incinerator.

Maximum ground level ambient pollutant concentrations shall not encompass any occupied dwelling, watercourse, food processing establishment, farm building with livestock, or feedlot and feed processing or handling establishment.

2. Waste Feed Restrictions

The feedstock for the small oilfield incinerators described in this section is limited to waste types I, II and III (as listed on Table 17.2) and oilfield filter material. Oilfield filter material is defined as all types of disposable filters from oil and gas production operations including vehicle filters, oil pads, and absorbents used in maintenance of such operations. These wastes must be generated on the oil and gas site where the small incinerator is located, or if the incinerator is located on a battery or gas plant, wastes can be accepted from associated well sites, provided these sites have the same licensee as the site on which the incinerator is located.

The incinerators are to be used for batch feed only with a limit of one charge per day. The maximum allowable percentage of filter material (by weight) in any one charge is 50 per cent. Filter material must be burned with waste types I, II or III so as not to exceed the 50 per cent limit. Continuous flow through the incinerator is prohibited. A maximum volume of 10 tonnes of waste per month may be incinerated.

3. Design Parameters

(a) Feed System

Manual feed systems for batch loading the incinerator is the basis of these guidelines. Applicable OH&S regulations must be complied with when handling the wastes. The incinerator should be sized such that not more than one charge per day is required to handle the waste quantities. A safety system to warn of firing or a high temperature in the primary chamber when loading is required. The incinerator should not be loaded if the primary temperature is above the boiling point of any of the waste's liquid residue.

(b) Primary Chamber

(i) The volume of the primary chamber should be designed to allow for a total heat release rate of between 445,000 kJ/h/m^3 (12,000 BTU/h/ft^3) and 670,000 kJ/h/m^3 (18,000 BTU/h/ft^3). A heat release rate of over 670,000 kJ/h/m3 (18,000 BTU/h/ft^3) is not recommended for use in the design as this may lead to uncontrolled conditions, resulting in high particulate emissions and the discharge of incomplete combustion products to the environment.

(ii) The hearth area should be designed to allow a burning rate of 58.5-78.0 kg/h/m^2 (12-16 lb/h/ft^2).

(iii) The floor should have a recessed area or otherwise have the ability to contain liquid drippings from filters thus allowing incineration during the cycle.

(iv) Temperature in the primary chamber should be maintained in the range of 400-760°C. Avoiding temperature peaks above 760°C will minimize excursions in gas velocities, thereby reducing ash carry-over and particulate emissions. Care should be taken to ensure the primary temperature is always above the auto-ignition temperature of the waste, especially low heating value wastes.

(v) The external casing of the chamber should be designed to maintain a maximum temperature of 70-90°C. This can be accomplished with the use of refractory and/or insulation materials. Where appropriate, an expanded metal shield or other suitable means of shielding should be installed for the protection of personnel.

(vi) The temperature in the primary chamber should be controlled by a sensor located at the breaching. When water-wet or low heating value wastes (<6000 kJ/kg) are incinerated, the sensor should be connected to a system to provide automatic temperature control through a modulating or on/off primary chamber burner.

(c) Secondary Chamber

(i) The temperature in the secondary chamber should be designed with an operating temperature of not less than 1000°C during the incineration cycle.

(ii) The incinerator should be designed to provide no less than 6 per cent residual oxygen on a dry basis in the flue gas exhaust from the secondary chamber.

TABLE 17.2

Classification And Design Data Of Wastes To Be Incinerated

Type of Waste	Description	Principal Components	Approximate Composition % by Weight	Moisture Content % (Design Maximum)	(Average) Incombustible Solids %	kJ Value per kg of Refuse as Fired (Design Minimum)	Required Minimum Burner Input (kW per kg Waste)
I*	Rubbish	Combustible waste, paper cartons, rags, wood scraps, floor sweepings; domestic, commercial industrial sources.	Rubbish (80-100) Garbage (20-80)	25	10	15000	0
II*	Refuse	Rubbish and garbage; residential sources.	Rubbish (35-80) Garbage (65-20)	50	7	10000	1.3
III*	Garbage	Animal & vegetable wastes, restaurants, hotels, markets; Institutional, commercial, and club sources.	Garbage (65 - 100) Rubbish (0 - 35)	70	5	5815	1.9
IV**	Animal solids and organic wastes	Carcasses, organs, solid organic wastes; hospital, laboratory abattoir, animal pound, and similar sources.	100 animal and human tissue	62	9	2300	7.5
V	Gaseous liquid or semi-liquid wastes	Industrial process wastes (tars, paints, solvents, fumes).	Variable	Dependent on predominant components.	Must be determined by wastes survey.		Must be determined by wastes survey.
VI	Semi-solid and solid	Combustibles requiring hearth, retort, or grate burning equipment (rubbish, plastics, wood wastes).	Variable	Dependent on premoninant components.	Must be determined by wastes survey.		Must be determined by wastes survey.

* The above figures are recommended for use in computing heat release, burning rate, velocity and other details of incinerator design.

** Type IV wastes require a "heated hearth" type of incinerator.

(iii) The secondary chamber should be designed for a gas residence time of not less than 1 second at 1000°C. This residence time is to be based on the volume of the secondary chamber from the flame from to the location of the temperature sensing device. These calculations or a vendor guarantee must be available on-site for inspection by EUB staff.

(iv) The residence time of gases in the combustion chamber may be calculated using the following formula:

$$V_T = V_p + V_m$$

Where:

V_T = total volumetric flow rate in m^3/sec at 1000°C
V_p = volumetric flow rate of dry combustion products at 1000°C
V_m = volumetric flow rate of moisture at 1000°C

(v) Therefore, the active chamber volume required to achieve one-second retention time is the volume in m^3 from the equation (V_T) in the above formula. ("Dead" areas with little or no flow should not be included in the retention volume). It should be noted that in sizing the secondary chamber to meet the one-second retention time required, the length of the chamber should be calculated from the flame front to the location of the temperature sensing device.

(vi) The temperature in the secondary chamber should be controlled by a sensor located at a point representing one second retention time from the flame front or final air injection points. The sensor should be connected to a system to provide automatic temperature control and it should also regulate the modulating secondary chamber burner.

(vii) The refractory surface of the secondary chamber should be heated over a minimum period of half an hour, prior to feeding waste into the incinerator, to ensure optimum conditions for the destruction of any volatile organic compounds.

(viii) The external casing of the secondary chamber should be designed to maintain maximum temperature of 70-90°C by means of insulation and refractory. For the protection of personnel, an expanded metal shield or other suitable means of protection should also be installed on the casing.

(d) Turbulence

(i) Gas turbulence is an important parameter in the design of incinerators and can be achieved by a high combustion gas velocity, tangential air injection, abrupt changes in flow direction, and the installation of combustion gas restrictions (e.g. orifices, checker work, or baffles).

(ii) Turbulence is difficult to quantify; however, use of the Reynolds number (Re) has been suggested to provide an indication of the gas phase turbulence in the incinerator. An example of the calculation of the Reynold's Number is provided in Part F, Appendix 5.0.

(iii) Preferred designs would have a calculated Reynolds number in the secondary chamber over 10 000 to ensure turbulent flow. Lower numbers plus other turbulence adding features may be adequate. The secondary burner must be designed as per the following combustion air requirements. These calculations or a vendor guarantee must be available on-site for inspection by EUB staff.

(e) Combustion Air Requirements

(i) For starved-air incinerators, air into the primary chamber should be supplied at 30 to 80 per cent of that required for stoichiometric combustion. Primary air supply must be through multi ports to ensure air distribution through the waste.

(ii) The air supply in the secondary chamber of all incinerators should be able to provide excess air at 40 to 150 per cent of that theoretically required during the peak burning rate.

(iii) The combustion air supply should be automatically adjustable with a Temperature Recorder Control System to maintain the set temperatures in the primary and secondary chambers of the incinerator.

(f) Burners

(i) The burners must be able to maintain a stable flame throughout the range of pressures, input rates, and fuel/air ratios experienced in the primary and secondary chambers.

(ii) The primary burner should be designed:

- to supply a minimum of 80 per cent of the total heat input of the incinerator design capacity;

- to modulate to a low "holdfire" setting to protect the burner throughout the incineration cycle.

(iii) The burner(s) in the primary chamber should be:

- located at a downward angle to provide maximum impingement of the flame onto the wastes. The alignment of the burner(s) should not allow the flame to impinge on the refractory walls or on other burner(s);

- set to maintain a temperature of 400-760°C in the primary chamber once the burn cycle is initiated;

- constructed with a sealed casing to eliminate the flow of tramp air into the chamber.

(iv) The burner(s) in the secondary chamber should be:

- mounted to promote thorough mixing plus flame and air penetration throughout the whole chamber. The alignment of the burner(s) should not allow the flame to impinge on the refractory walls or on other burner(s);

- set to maintain a temperature of not less than 1000°C in the secondary chamber at all times;

- fully modulated with a low "holdfire" setting to ensure a flame throughout the incineration cycle.

(g) Process Monitoring/Control

(i) One, preferably two, viewports should be installed in the primary chamber immediately behind the burners to facilitate visual inspection of the burn. The location should be selected to reduce particulate impingement, so that the viewport will remain relatively clean.

(ii) A Temperature Controller should be used to control the primary and secondary temperature by:

- turning off or reducing the heat input from the burner; and

- turning off, throttling back, or increasing the air supply.

(iii) All incinerators should be equipped with continuous primary and secondary temperature monitoring equipment on-line for the full cycle of operations. Recording is not required.

(h) Incinerator Stack

(i) For natural draft systems, calculations for stack design should be based on a secondary chamber gas temperature of 1000°C. If substantial heat losses through the stack are expected, such losses should be taken into account in determining the average stack temperature and the available draft. Equivalencies to these procedures will be considered.

(ii) The stack height should be calculated to provide a minimum available draft of 6.3 mm (0.25 in) water gauge (W.G.) at the breaching. The latter is an absolute minimum draft provision for all natural draft incinerators and must result in a draft of at least 2.5 mm (0.1 in) W.G. at the burner air inlets. Perry's Chemical Engineers' Handbook outlines procedures for calculating stack draft. Equivalencies to these procedures will be considered.

(iii) Each incinerator stack height shall be designed to comply with the EPEA Ambient Air Objectives as amended from time to time and the anticipated stack emissions which follow in sub-section 17.4.5. A study using an approved air modeling program shall be required in order to show that the incinerator stack is in compliance. Worst case calculations will be required to determine the necessary stack height incorporating topography, structures, and tree height. Emissions to be studied are SO_2, HCl, NO_x and particulates. The results of this study shall be maintained on-site and available for EUB inspection.

4. Operating Practices

(a) Operator Training

Incinerator operators should be properly trained and be familiar with all the manufacturer's operating procedures for the unit.

(b) Inspections

Incinerators should be visually inspected before each burn. Ensure primary holes are clear of any buildups.

(c) Waste Handling and Record Keeping

Waste should be categorized by weight and logged prior to charging to ensure that the design feed rate is not exceeded and to maintain a record of the quantities of waste processed. Source and description of wastes should be recorded and retained at the incineration site for a minimum of two calendar years. Therefore, all records are maintained as 12-month groups.

(d) Waste Charging

Waste should be charged into the incinerator during operation or until the full cool down cycle has been completed. Filters must not be stored in the primary chamber prior to incineration to avoid excessive liquid draining from them.

(e) Incinerator Preheating

The secondary chamber should be heated to operating temperature prior to the ignition of the primary chamber, to ensure optimum conditions for the destruction of the waste.

(f) Ash, Removal, and Disposal

(i) Ash resulting from the incineration of waste may contain significant levels of heavy metals. Therefore, care should be exercised in disposing of incinerator ash. Metal filter cores may be recovered and sent to scrap metal recyclers.

(ii) The incinerator ash should be evaluated according to the TCLP leachate test specified in Part F, Appendix 3.0. Ash passing the leachate test can be sent to an approved landfill and disposed of with due regard to Section 15.0, *Oilfield Landfills*.

(iii) The incinerator ash should be stored and transported in enclosed containers.

5. Emission Criteria

The anticipated stack emissions are listed in the following table:

TABLE 17.3

Stack Emission Limits For Small Batch Feed Waste Incinerators

Parameter	Emission Limit*
Particulates	230 mg/Rm^3
Hydrogen Chloride	75 mg/Rm^3
Carbon Monoxide	57 mg/Rm^3
Sulphur Dioxide	0.15 kg of SO_2 per kg of waste consumed up to a maximum of 100 kg of SO_2 per day
Opacity	20 per cent

* The emission limits are based on the maximum one-hour average concentrations that are calculated on a dry basis corrected to 11 per cent oxygen at 25°C and 101.375 kPa.

The anticipated incinerator stack emissions are determined within the stack, based on approved sampling and analytical protocol. All stack sampling facilities and survey methods shall comply with the requirements described in the document entitled *Stack Sampling Code (Ref. 89)* as amended from time to time and issued by the Standards and Approvals Divisions of Alberta Environmental Protection.

6. Performance Test

Testing of incinerator emissions are based on the design processing capacity of the incinerator while processing oilfield wastes. The performance test is to be done once only, within 90 days of initial start-up.

Primary and secondary temperature versus time profile must be recorded. Incinerator cycles and testing periods must be superimposed upon the profile.

Additional testing details are outlined in Section 7 of the document entitled *Guidelines for Design and Operation of Refuse Incinerators in Alberta* as amended from time to time and issued by Alberta Environmental Protection.

7. General Information Requirements

The licensee and/or approval holder of the oil and gas site shall for each new installation prepare a report containing the following items, retain it on-site for as long as the incinerator is on the site, and provide it to the EUB upon request:

(a) a copy of such plans, specifications, and technical information as may reasonably be required to determine compliance with the provisions of Section 17.4,

(b) a description of the waste to be incinerated, identified according to a waste survey and the types of waste listed in Table 17.2, and the average and maximum percentage by weight of each type. The description should also include the maximum batch charging rate and the maximum amount of waste to be incinerated daily. Refer to application information and details per the document entitled "Guidelines for Design and Operation of Refuse Incinerators in Alberta" for further guidance with respect to the information that should be contained in this report,

(c) the results of the performance test done within 90 days of initial start-up, as described in the previous section, and

(d) a description of the disposal option used for the ash resulting from the incineration of wastes.

8. Information Documentation

The approval holder or licensee of an oil and gas or oil sands site on which a small batch feed incinerator is located shall document the following information and retain if on site for a minimum of 2 years. Upon request, this information must be made available to EUB staff.

(a) for each batch of waste incinerated, the weight, volume, waste type, source, date incinerated, and volume residuals generated, and

(b) any daily operational, inspection, and maintenance information.

17.5 Mobile Thermal Treatment Units

1. Jurisdiction

The EUB does not currently issue approvals for mobile thermal treatment units. These facilities will continue to be under the jurisdiction of Alberta Environmental Protection (AEP).

2. Operation at Oil and Gas Facilities

Mobile thermal treatment units which either have received approval from or have been registered with AEP may operate at oil and gas facilities provided that:

(a) All thermal treatment operations comply with the operating requirements of the existing oil and gas facility,

(b) All operations are in accordance with the thermal treatment approval or registration conditions from AEP. Dangerous oilfield wastes must only be treated by units approved by AEP to treat hazardous waste,

(c) Only wastes from the site where the unit is located at may be treated or, if the site is a battery or gas plant, wastes from the associated well sites provided these sites have the same licensee as the site on which the incinerator is located, and

(d) If the operation of a mobile unit is expected to exceed a time period of six months, the possible impacts of the operation must be reviewed in consultation with the EUB Calgary office.

It is the responsibility of the licensee and/or approval holder of the oil and gas or oil sands site to ensure that on-site operations involving mobile thermal treatment units do not result in any contravention of the approval issued for the oil and gas production facility. This includes compliance with the above requirements a) through d) and any further restrictions which may be dictated by specific site conditions.

3. Notification of Operations

The licensee and/or approval holder of the oil and gas facility shall, **30 days** prior to commencement of thermal treatment operations, submit to the main EUB Calgary office, written notification containing the following:

(a) the location of the oil and gas site on which the mobile unit will be located,

(b) the company/operator of the mobile unit and the AEP license/approval or registration number,

(c) the volumes, types, and sources of the wastes to be treated by the mobile unit,

(d) the final disposition of the treated material, and

(e) the duration of the activity.

The licensee and/or approval holder of the oil and gas or oil sands facility shall ensure that all landowners and residents within **1.5 kilometers** are notified of the details of the intended activity at least 30 days prior to commencement of thermal treatment operations. Note: If the operating licence for the mobil thermal treatment unit also identifies conditions for public notification, then the most stringent public notification requirements must be met.

The local EUB area office shall be notified by the Licensee and/or Approval Holder of the oil and gas facility of the details of the intended activity at least **48 hours** prior to commencement of thermal treatment operations. In practice, it would be advisable to notify the EUB area office at the same time as the public are notified.

PART E

APPLICATION REQUIREMENTS FOR

OILFIELD WASTE MANAGEMENT FACILITIES

Part E

Application Requirements for Oilfield Waste Management Facilities

18.0 Overview of the Application Requirements

The **purpose** of this section is to outline the information that needs to be addressed in an application for approval to construct and operate an oilfield waste management facility.

An oilfield waste management facility may consist of one or more of the following components:

- waste storage area/facility,
- waste transfer station,
- waste processing facility,
- waste disposal well (class Ia or Ib),
- surface facilities associated with waste disposal wells,
- landfill,
- biodegradation facility (biopiles or biocells),
- thermal treatment facility, and
- other oilfield waste management technology or facility.

Applicants considering any of the waste management components listed above should review the applicable sections of Part D, *Oilfield Waste Management Facilities*, for design and operation requirements.

When the proposed waste management component is to be constructed on an existing EUB approved oil and gas or oil sands facility, the type of component as well as the volume and characteristics of the waste material to be handled, will dictate whether notification or application is required. Applicants should refer to the applicable section in Part D for more details. Applicants who intend to integrate a waste management component with a new oil and gas or oil sands facility shall include the appropriate information for the waste management component with the facility application. When appropriate, the waste management component will be covered in the facility approval.

Unless otherwise approved by the EUB, the wastes treated by the waste management component must be generated on the oil and gas or oil sands site where the component is located. If the component is located on a battery or gas plant, wastes can be accepted from associated well sites provided the well sites have the same licensee as the site on which the waste management component is located. In the situation where the waste management component is located on a wellsite and the wellsite is a satellite of a battery, wastes generated at the battery and its associated wells may be treated at the waste management component provided the licensee of the wellsite and the battery are the same. Closure of the waste management component will be included in the overall

facility closure, with the exception of landfills and fixed thermal treatment facilities other than small batch feed and campsite incinerators, financial assurance will not be required.

When the proposed waste management component is to be constructed on a stand-alone site, the applicant must obtain approval from the EUB to construct and operate an oilfield waste management facility. Oilfield waste management facilities can be first party or third party waste receivers as outlined in their approval to operate.

With the exception of Class Ia waste disposal wells, EUB approved waste management facilities shall only accept wastes generated in the upstream petroleum industry. Receipt of downstream and other industrial wastes is prohibited at EUB approved facilities. Applicants interested in accepting both oilfield wastes and downstream or other industrial wastes must seek direct approval from AEP.

All applicants for any oilfield waste management facilities must address the information requested under Section 21.0, *General Information,* which includes introductory, assessment, site, development, and closure information.

- *Introductory Information* includes the name of the applicant, the name and location of the facility, and the waste handling, treatment, or disposal method(s) described within the application.

- *Assessment Information* pertains to information required to assess the impact and necessity of the proposed facility. Section 19.0, *Environmental Impact Assessments*, addresses the possible requirement for an EIA for a proposed facility.

- *Site Information* pertains to a description of the topography, soil, geology, and hydrogeology of the site as determined by a site assessment. Applicants are required to conduct a site assessment for all waste management facilities. For some facilities, applicants will also be required to design and implement a groundwater monitoring program based on the site assessment information. Refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection.*

- *Development Information* pertains to public consultation which includes obtaining approval from the local authority for the proposed development, as well as informing the public about the proposed facility and giving them the opportunity to communicate any concerns. Companies are encouraged to begin public involvement and communication activities well before submission of any application to the EUB. Refer to EUB Informational Letter, IL 89-4, *Public Involvement in the Development of Energy Resources.*

- *Closure Information* includes an estimate of the expected lifespan of the facility, a plan to close the facility during any point of its operational lifetime, and a financial assurance program to cover the estimated cost of closure activities. Refer to Section 20.0, *Financial Security,* and EUB IL 96-3, *Suspension and*

Reclamation of Upstream Oil and Gas Facilities, and the attached MOU that outlines the agreement reached between AEP and EUB on these activities.

In addition to the general information, the applicant must address the design and operation of waste management and disposal method(s) proposed for the facility, as listed in Sections 22.0 to 28.0.

Other application considerations include:

- Three copies of the application must be submitted to the Applications Groups within the Facilities Division of the EUB.
- All applications will be registered and the applicant will be invoiced for the registration fee. If the application is deficient or incomplete, it will be returned to the applicant.
- The level of detail in any application should reflect the scope and complexity of the proposed development.
- The licensee, approval holder, applicant or owner shall retain, for the life of the facility, copies of the details of their application, and verification that the as-built characteristics of the facility comply with the required design criteria, and make this information available to EUB staff upon request.

19.0 Environmental Impact Assessments

The EUB believes that oilfield wastes must be regulated in a manner that is equivalent to the way industrial wastes are regulated under the Environmental Protection and Enhancement Act (EPEA). Therefore, an applicant proposing to construct and operate an oilfield waste management facility may be required to prepare an Environmental Impact Assessment (EIA) report on the project, especially if dangerous oilfield wastes are to be handled.

Applicants proposing to construct and operate or to utilize the following methods to treat or dispose oilfield waste, are required to contact Alberta Environmental Protection (AEP) and the EUB to determine the need for an EIA:

- a fixed incinerator that accepts dangerous oilfield waste, and
- a landfill that accepts dangerous oilfield waste.

This communication should be done early in the process, before the application for the oilfield waste management facility is filed with the EUB.

As the characteristics that designate a waste regulated under EPEA as hazardous, are the same as those that classify oilfield waste as dangerous, the requirement to consult with AEP and the EUB regarding the need for an EIA is also extended to other proposed facilities that are intended to handle, treat, or dispose dangerous oilfield waste.

Enquiries regarding the EIA process should be directed to AEP, EIA Review Branch Head. The Director of Environmental Assessment will determine if further consideration for a proposed activity is needed under the Environmental Assessment process as outlined in EPEA under Part 2, Division 1, Environmental Assessment (Mandatory and Exempted Activities) Regulation AR 111/93 and Environmental Regulation AR 112/93. The characteristics of the proposed activity and the wastes associated with it will be considered by the Director in deciding if assessment under EPEA is needed.

If AEP decides that an EIA is required, the EIA report should be filed with the application to the EUB for the proposed facility.

20.0 Financial Security

20.1 Introduction

The **purpose** of this section is to provide information regarding financial security requirements for oilfield waste management facilities.

The EUB has identified the need for a financial security system for oilfield waste management facilities regulated by the EUB. Financial security is required to ensure adequate resources will be available for the eventual decommissioning and reclamation of these facilities.

Financial security will be required for each stand-alone oilfield waste management facility as well as for all EUB approved landfills and fixed thermal treatment facilities (excludes small batch feed and campsite incinerators).

The financial security system for oilfield waste management facilities will be administered by the EUB. The amount required will be based on the estimated cost of reclamation and the associated post-closure monitoring of the facility (as described in the closure portion of the initial application). The EUB requires that each oilfield waste management facility have its own financial security in place.

20.2 Facilities Requiring Financial Security

The following oilfield waste management facilities require financial security:

- oilfield waste storage facility,
- oilfield waste transfer station,
- surface facilities associated with disposal wells that require approval as outlined in Part D, Section 13.0, *Surface Facilities Associated with Waste Disposal Wells*,
- oilfield waste processing facilities,
- all EUB approved oilfield landfills,
- permanent biodegradation facilities (treats third party waste or are on a stand-alone site), and
- fixed thermal treatment facilities other than small batch feed and campsite incinerators.

In some cases, oilfield waste management components will be incorporated onto an existing approved oil and gas or oil sands facility site. Costs of closure of these waste management components will be included in the overall closure of the facility, and therefore, with the exception of landfills and fixed thermal treatment facilities other than small batch feed and campsite incinerators, financial assurance will not be required.

Waste treated by the waste management component must be generated on the site where the component is located, or if the component is located in a battery or gas plant, wastes can be accepted from associated well sites provided the well sites have the same licensee as the site on which the component is located.

The following oilfield waste management components/options do **not** require financial security:

- oilfield waste storage area,
- land treatment (on-site, one-time)
- biocells or biopiles (on-site, see biodegradation section),
- campsite incinerators, and
- small batch feed incinerators (burn less than 10 tonnes per month).

In cases where a facility requiring financial security already has posted security through another mechanism (i.e. security posted under EPEA requirements), the licensee and/or approval holder is responsible to identify this duplication to the EUB. If it is determined that the facility in question already has sufficient financial security in place through another mechanism, the EUB will not require additional financial security.

20.3 Determination of Financial Security

Financial security is to be provided by the applicant of the oilfield waste management facility. The amount of financial security required will be established based on the closure information provided to the EUB as part of the initial application for an oilfield waste management facility. In the case of existing facilities, the amount can be established from information provided in the original application. The approval holder may be required to provide further closure and cost information if the original information is out of date or incomplete.

The following is a procedure for determining the amount of financial security required:

1. An estimate of the total cost for reclamation must be provided by the applicant as part of the initial application for approval. This must also include any costs associated with post-closure monitoring and reporting. For existing facilities the closure information provided in the original application may have to be updated and/or expanded.

2. The estimated costs will be reviewed by the EUB and through consultation with the applicant/approval holder, the amount of financial security will be determined.

3. The applicant will be required to post the required amount of security before approval to operate will be given.

4. In the case of existing facilities, once the EUB has determined the amount of security required, the applicant/approval holder will have **60** days to put the financial security in place in order to continue to operate.

20.4 Adjustment of Security

There are several situations which may affect the required amount of security, these include:

- changes in the cost of future reclamation requirements,
- changes in the operations of a facility (see below),
- the land or any portion of it is reclaimed at the facility (see below),
- the closure plan is amended, and
- any other circumstances that may affect the cost of reclamation.

Any of the above circumstances may require the approval holder to reassess the amount of required security. The EUB expects that the operator will undertake this reassessment on an as-needed basis.

Adjustments will also be required on an annual basis to account for inflation as per the current annual Alberta Inflation Rate (Statistics Canada). For interest bearing securities where the interest is enough to cover the inflation rate, this will be considered adequate.

The EUB may also increase or decrease the amount of security required to reflect the current closure and post-closure costs. In the case where the EUB has increased the security amount, the facility approval holder will have **60** days to comply. In the case where the amount is decreased, the facility approval holder can modify the specific facility security.

Additionally, the approval holder may apply to the EUB to have their closure plans and associated costs adjusted based on changing site conditions, operating procedures, etc. The approval holder must make this request in writing.

The financial security process to be followed when facilities are built, purchased, sold, or changed is as follows:

1. New Facilities

Approvals for new facilities will be contingent on the approval holder posting adequate financial security prior to the start-up of the facility. The amount of the security is based on the cost of closure specified in the application and approved by the EUB.

2. Facilities Undergoing Expansion/Changes

Changes to the closure plan must be submitted as part of an application for modification of the facility. The plan must include amendments to the closure and post-closure cost with the expansion/changes in place. Depending on the amount of security that the changes represent, the EUB will decide whether adjustments are required immediately or can be deferred until the next security anniversary date.

3. Facilities Undergoing Closure

Following the confirmation from AEP that the clean-up objectives for the next intended land use have been achieved, the EUB will notify the approval holder that the amount of security required for that facility will be reduced accordingly. It should be noted that the amount required for post-closure monitoring, if required, may be held back to ensure that the monitoring is conducted.

4. Facilities Which are Sold or Transferred

The financial security for the approval holder selling the facility will not be returned until the approval for transfer is given by the EUB. The purchasing company will be required to post security for this facility before the approval will be transferred.

20.5 Acceptable Forms of Security

Security must be in one or more of the following forms payable to the EUB:

- cash,
- irrevocable letters of credit, performance bonds or security bonds in a form acceptable to the EUB, or
- any other form acceptable to the EUB.

20.6 Forfeiture of Security

Security provided for a facility may be forfeited if the operator/approval holder:

1. fails to commence and complete reclamation in a timely fashion at the facility,
2. fails to meet reclamation standards specified in the closure plan,
3. fails to renew an existing security before its expiry date or fails to adjust the security amount for inflation (refer to Section 20.7, *Renewal of Security*),

4. fails to account for changes in the closure plan,

5. has not complied with an order or direction of the EUB or AEP, or

6. becomes insolvent.

The EUB will provide prior notice to the operator of its intention to collect on the security for reasons identified in points 1, 2, 4, and 5 above.

The forfeited security is held by the EUB in an interest bearing trust account. Interest earned less administrative fees will be added to the security. The funds will be used to reclaim and perform post-closure monitoring of the facility(s) in question as well as to pay any administrative fees. If any money remains in the security after the reclamation and post-closure monitoring of the facility(s) has been completed, the EUB will pay the excess amount back to the approval holder of the facility(s). Where the amount of the forfeited security and interest is insufficient to pay for the cost of the reclamation and post-closure care of the facility(s) including administrative fees, the approval holder remains liable for the balance.

20.7 Renewal of Security

For securities with expiry dates, the EUB requires replacement securities to be in place **30 days** prior to the expiry of the previous security (new security must account for inflation).

For securities with no expiry date, adjustments to account for inflation must also be in place **30 days** prior to the anniversary date of the security.

The EUB expects the approval holder to keep track of renewal dates.

The EUB will not notify approval holders when securities are due to be renewed. If the new/adjusted security is not put in place, the EUB will collect the present security and subsequently notify the approval holder of this action (see Section 20.6, *Forefeiture of Security*). If a suitable security is put in place at a later date, the approval holder may apply to the EUB for a return of any money not used for reclamation and post-closure monitoring back to the approval holder, less administrative fees.

21.0 General Information Required in Applications

The **purpose** of this section is to identify the general information that is required in all applications to construct and operate an oilfield waste management facility. In addition, specific application information is required as per Sections 22.0 to 28.0.

21.1 Application Introductory Information

The following introductory information shall be provided:

(a) date of application,

(b) name, address, and phone number of the applicant,

(c) name, address, and phone number of the operator (if different from above),

(d) the name of the facility,

(e) the legal land description of the facility site,

(f) current land use and zoning,

(g) proposed construction commencement and completion date,

(h) proposed date of commencement of operations,

(i) a discussion of the applicant's technical and financial qualifications that are pertinent to the design, construction, and operation of any part of a waste management facility,

(j) a list of the sections that will be included in the application (waste storage, transfer station, surface facility associated with a waste disposal well, waste processing, landfill, biodegradation, thermal treatment, and other), and

(k) an indication of whether an application for a waste disposal well or a cavern that will be associated with the project proposed in this application has been submitted to the EUB.

21.2 Assessment Information

To assess the impact and necessity of the proposed facility the applicant shall, where applicable, provide:

(a) a general description of the proposed facility,

(b) an analysis of the need for the facility including:

(i) the geographical area the facility will service and the streams that will be accepted (include whether the facility is intended to handle wastes generated only by the applicant, (i.e. first party), or wastes generated by various companies; (i.e. third party),
(ii) historical statistics and production forecasts for oilfield wastes in the area, and
(iii) the technical, environmental, and economic benefit of building a new facility,

(c) the criteria used to select the proposed site, as well as any alternative sites considered,

(d) a description of the potential positive and negative environmental, social, economic, and cultural impacts of the proposed facility,

(e) the plans developed to mitigate and monitor the potential negative impacts identified,

(f) the plans developed to minimize the production or release into the environment of substances that may have an adverse effect,

(g) a response indicating whether the Director of Environmental Assessment has determined if an EIA is necessary for the proposed facility, or a response describing the reasoning the applicant used to determine that an EIA was not necessary, and

(h) any other information the EUB may require.

21.3 Site Information

A concise summary outlining the information obtained from the site assessment (refer to Appendix 4.0, *Requirements for Site Assessment and Groundwater Protection*). This concise summary must include:

(a) a facility plot plan at an appropriate scale that clearly identifies:

(i) site topography, surface drainage patterns, local recharge and discharge areas, type of vegetation, and tree cover,
(ii) on-surface or buried pipelines, utility lines, conduits, pits, or tanks,
(iii) buildings, loading facilities, or storage areas,
(iv) disposal or source wells,
(v) existing or abandoned monitoring wells or standpipes,
(vi) any areas containing buried fill material or waste,
(vii) any areas of known extensive or frequent spills, and
(viii) horizontal direction of shallow groundwater flow,

(b) the location of all surface waters and inferred areas of groundwater discharge within a 3 km radius of the site,

(c) a summary of local groundwater and surface water users within a 3 km radius of the site,

(d) a summary of the regional hydrogeology and geology for the area in which the site is located as derived from existing data in the public domain,

(e) the description of the soil including the following:

  (i) the physical characteristics of the soil including thickness, texture, internal drainage characteristics, evidence of fracturing, and an estimate of the moisture content, and
  (ii) the background chemical characteristics of the soil, including pH, electrical conductivity, major extractable ions, cation exchange capacity, total metals, per cent hydrocarbon, and sodium adsorption ratio,

(f) a description of how the quality of the surface and subsurface soil will be monitored,

(g) for those facilities that require groundwater monitoring, site specific information as determined during the drilling and installation of monitoring wells, including the following:

  (i) the description of the surficial geology, including the type and thickness of strata,
  (ii) the depth of the shallowest water bearing strata (depth of the water table) and the hydraulic conductivity of this zone, including raw test data and method of analysis,
  (iii) the horizontal and vertical directions, rates, and approximate velocities of the groundwater flow,
  (iv) a description of the quality of the groundwater including, as a minimum, the initial results obtained for pH, electrical conductivity, major ions, total metals, and mineral oil and grease,
  (v) the depth, location, and type of any contaminant encountered, the probable source of the contaminant, and acknowledgement that AEP has been contacted regarding the contamination,
  (vi) the rationale for the location, depth, and screened interval for each monitoring well,
  (vii) a description of the construction materials and completion details for each well,
  (viii) methods employed to develop the wells,
  (ix) sampling and testing procedures, and
  (x) the ground level elevation, casing top elevation, depth to water, depth of well, and screened interval for each well, presented in a tabular form,

(h) a description of how the surface run-off water will be controlled, accumulated, and discharged including, if applicable, the pond or dike design and sizing calculation for containment of a 1 in 10 year, 24-hour storm, and the path taken by the surface run-off discharge,

(i) a description of how the quality of the ambient air will be monitored, and

(j) any other information the EUB may require.

21.4 Development Information

Information relating to the development of the site shall, where applicable, include:

(a) written confirmation indicating that the landowner has consented to the construction and operation of the facility,

(b) verification that approval (a development permit) from the local authority has been obtained or is in the process of being obtained,

(c) a description of the consultative process undertaken to inform the public of the proposed development in accordance with EUB IL 89-4, *Public Involvement in the Development of Energy Resources* including:

  (i) the names of the landowners/occupants personally contacted within a 0.5 km radius of the proposed facility and any concerns they had regarding the proposed development,
  (ii) a copy of the information package delivered to all landowners/occupants within a 1.5 km radius of a proposed sweet facility and a 2.0 km radius of a proposed sour facility, or to any interested party, as well as any resulting concerns about the proposed development, and
  (iii) a map showing the landowner/occupant of all lands within a 1.5 km (sweet) or 2.0 km (sour) radius of the facility, and

(d) any other information the EUB may require.

21.5 Closure

A discussion regarding closure of the facility shall, where applicable, include:

(a) a description of the plan developed to perform any planned or unplanned closure of the facility, or any part of it, at any point during its active life including:

  (i) an estimate of the maximum inventory (wastes and products) expected on-site and how these inventories will be eliminated,
  (ii) an estimate of the time required to eliminate inventories, and

(iii) a schedule of closure activities including the elimination of inventories, the dismantling of surface equipment, the abandonment of wells or pipelines, and the reclamation of the facility site,

(b) a description of the proposal developed for post-closure monitoring if required,

(c) an estimate, in current dollars, of the cost of planned or unplanned closure and of post-closure monitoring or site maintenance,

(d) the financial assurance the applicant can demonstrate to cover the cost of facility closure and post-closure care (refer to Section 20.0, *Financial Security*),

(e) an estimate of the expected year of final closure of the facility,

(f) the expected land use and zoning of the site after effective closure, and

(g) any other information the EUB may require.

22.0 Waste Storage Facilities and Transfer Stations - Specific Application Information

The **purpose** of this section is to identify the specific information which is required in an application to construct and operate a waste storage facility or transfer station.

General information, which is also required with the application, is contained in Section 21.0.

For operational information, reference should also be made to Part D, Section 12.0, *Waste Storage Areas/Facilities and Waste Transfer Stations*.

22.1 Design and Operational Procedures

Details on the design features and operational procedures shall, where applicable, include:

(a) a description of the oilfield waste streams that will be accepted for storage including their source and anticipated annual volumes,

(b) a description and scale diagram of the facility design in accordance with EUB ID 95-3 and Guide G-55, *Storage Requirements for the Upstream Petroleum Industry*, including:

- (i) the location, size, and construction material of all storage containment devices, including the materials to be stored within,
- (ii) the secondary containment system and its capacity,
- (iii) the leak detection system and the sampling program established for it, including the sampling frequency and the parameters the samples will be tested for,
- (iv) if applicable, the corrosion monitoring system,
- (v) the management or control of inventory to minimize spills or overflows, and
- (vi) the location, size, and equipment spacing of all heating, pumping, and compressing equipment.

(c) a description of the operational procedures including:

- (i) the method of receiving, appropriately segregating, storing, and handling the various oilfield wastes,
- (ii) the estimated retention time of the various oilfield wastes in the facility, and
- (iii) the method of removing and transporting oilfield wastes to an approved facility for treatment and/or disposal, and the name of the treatment/disposal facility,

(d) a description and example of the method in which material balances will be kept, identifying receipt to disposition of all waste materials,

(e) a description of the security measures with respect to unauthorized dumping or entry by unauthorized persons, livestock, or wildlife,

(f) a description of the operational safety procedures in place, as well as the contingency plan developed to respond to emergencies such as fires or the accidental release of fluids or fugitive air emissions,

(g) the qualifications with respect to training and certification required by employees, and

(h) any other information the EUB may require.

23.0 Surface Facilities Associated with Waste Disposal Wells - Specific Application Information

The **purpose** of this section is to identify the specific information which is required in an application to construct and operate a surface facility associated with a waste disposal well.

General information, which is also required with the application, is contained in Section 21.0.

For operational information, reference should also be made to Part D, Section 13.0, *Surface Facilities Associated with Waste Disposal Wells.*

Operators seeking approval for a waste disposal well should first refer to EUB IL 94-2 and EUB Guide G-51 for completion, logging, testing, monitoring, and application requirements. These references identify the types of wastes that can be injected down the various classes of disposal wells. Guide G-51 does not, however, outline the requirements for any surface facilities associated with the well. Therefore, operators applying for approval of a Class Ia or Ib waste disposal well that will not be located on an existing EUB approved site, but will have surface facilities (i.e. receiving tanks) associated with the well, will be required to include the information outlined in this section on surface facilities, in the application for the disposal well. Whenever possible, a joint approval will be given for both the disposal well and the surface facilities.

23.1 Design and Operational Procedures

Details on the design features and operational procedures shall, where applicable, include:

(a) a description of the oilfield waste streams that will be accepted for deep well disposal, including their source and anticipated annual volumes,

(b) a description and scale diagram of the surface facilities associated with the disposal well in accordance with EUB ID 95-3 and Guide G-55, *Storage Requirements for the Upstream Petroleum Industry*, including:

- (i) the location, size, and construction material of all storage containment devices,
- (ii) the secondary containment system and its capacity,
- (iii) the leak detection system and the sampling program established for it, including frequency and the parameters the samples will be tested for,
- (iv) if applicable, the corrosion monitoring system,
- (v) the tank inventory control systems to minimize spills or overflows, and
- (vi) the location, size, and equipment spacing of all, heating, pumping, and compressing equipment,

(c) a description of the operational procedures including:

(i) the method of receiving the wastes, and for those Class Ia wells approved to accept industrial as well as oilfield wastes, the method used to segregate the wastes, and acknowledgement that AEP has approved the industrial waste streams, the surface facilities used to receive them, and the plan developed to manage any residuals (solids or organics) that separate from the fluids, and

(ii) the method of removing residuals, such as oil or solids that separate from the upstream waste fluids and the method used to treat or dispose the residuals including the name of the treatment/disposal facility,

(d) a description and example of the accounting procedures from the receipt to disposition of all materials. This description shall include, but not be limited to:

(i) the methods used to verify the composition and volume of incoming materials,

(ii) the procedure used to measure and account for all fluids injected into the well, and

(iii) the procedure used to measure and account for all fluids injected into the well and any crude oil recovered from the upstream side,

(e) a description of the security measures with respect to unauthorized dumping or entry by unauthorized persons, livestock, or wildlife,

(f) a description of the operational safety procedures in place, as well as the contingency plan developed to respond to emergencies such as fires or the accidental release of fluids or fugitive air emissions,

(g) the qualifications with respect to training and certification required by employees, and

(h) any other information the EUB may require.

24.0 Waste Processing Facilities - Specific Application Information

The **purpose** of this section is to identify the specific application information which is required in an application to construct and operate a waste processing facility.

General information, which is also required with the application, is contained in Section 21.0.

For operational information, reference should also be made to Part D, Section 14.0, *Waste Processing Facilities.*

24.1 Design and Operational Procedures

Details on the design features and operational procedures shall, where applicable, include:

(a) a description of the oilfield wastes that will be accepted for processing or treatment and their anticipated annual volumes,

(b) a description of the treatment and process technologies to be used including the specifications of the receiving, inlet measuring, treating, separating, and recycling equipment, and their minimum and maximum flow capacities, retention times, and operating pressures and temperatures. For those facilities that have an integrated custom treating facility, identify any common and unique equipment,

(c) an estimate of the annual volume of freshwater to be used in the operation of the facility and the fresh water source, including where applicable, a copy of the groundwater diversion permit or water withdrawal permit,

(d) a process flow schematic showing:

  (i) all the separation vessels, measurement points, vessel relief valves and piping, vessel drains, and fuel lines, etc.,
  (ii) the minimum and maximum operating pressures and temperatures for each vessel, and
  (iii) the common and separate equipment for those facilities that will include a custom treating facility,

(e) a scale diagram showing:

  (i) the location, size, and equipment spacing of all separating, heating, pumping, and compressing equipment, including those common or unique to an integrated custom treating facility, and
  (ii) the location, size, and construction material of all storage facilities and dikes, including those common or unique to an integrated custom treating facility,

(f) a description of the plans developed to monitor any leakage from tanks and other containment devices including, where applicable:

  (i) the leakage monitoring system, including sampling frequency and test parameters,
  (ii) the corrosion monitoring system, and
  (iii) the management or control of tank inventory to minimize spills or overflows,

(g) a discussion of the method proposed for the disposal of solid waste and sludge material (for off-site disposal identify the operator, name, and location of the facility that will be used),

(h) a discussion of the method proposed for the disposal of liquid waste (for off-site disposal identify the operator, name, and location of the facility that will be used),

(i) a description and example of the accounting procedure from the receipt to disposition of all products. This description shall include, but not be limited to:

  (i) the methods used to verify the composition and volume of the incoming streams, and
  (ii) the procedure used to measure and account for any recovered oil, water, and solids. (Note: Oil recovered from an integrated custom treating facility must be accounted separately from the oil reclaimed from the wastes.), and

(j) any other information the EUB may require.

25.0 Oilfield Landfills - Specific Application Information

The **purpose** of this section is to identify the specific information which is required in an application to construct and operate an oilfield landfill.

General information, which is also required with the application, is contained in Section 21.0.

An application to construct or expand an oilfield landfill must address each of the requirements listed in Part D, Section 15.0, *Oilfield Landfills*, with regard to:

- Landfill Siting Criteria,
- Design Requirements,
- Operating Procedures,
- Required Engineer Features of Class Ia, Ib, II or III Oilfield Landfills,
- Waste Criteria,
- Monitoring and Analyses,
- Reporting Requirements, and
- Closure, Post-Closure and Reclamation Requirements.

25.1 Design and Operational Procedures

In addition to the above information, an application to construct or expand an oilfield landfill must also clearly state the following information based on the class of oilfield landfill being applied for:

(a) the Class of the proposed oilfield landfill, and whether third party wastes will be received by the landfill,

(b) a description of the oilfield waste streams to be placed in the landfill, including their source, and anticipated annual volumes,

(c) a description of the on-site waste handling methods,

(d) the method for measuring and accounting for the volumes of waste received,

(e) a description and discussion of the type of landfill design being proposed (above ground, shallow entombed or conventional),

(f) a description and discussion of the landfill development method being proposed cell, trench or area,

(g) the method for placing the waste into the landfill,

(h) a plot and schematic cross-section of the proposed landfill, including the location of the trench or cell in relation to the seasonal high water table,

(i) a description of the physical and chemical properties of any engineering containment systems (liners), and all other material underlying the landfill, including surficial deposits and bedrock, as well as a discussion of the ability of these materials (natural or installed) to retard the movement of contaminants and their compatibility with the oilfield wastes being landfilled,

(j) a description of the above-liner leachate control and handling system, including the monitoring protocol, testing frequency, and disposal destination of the leachate,

(k) a description of any below-liner leak detection system, including the monitoring protocol, and testing frequency,

(l) a description of the surface run-off and run-on control systems,

(m) an outline of any proposed gas interception, venting or recovery systems, and a description of how odours and fugitive emissions will be monitored, handled, and mitigated,

(n) a description of all proposed cover material including physical, and chemical properties,

(o) a description of the quality assurance and quality control methods to be employed to ensure proper site engineering and installation practices are followed, including a description of how the hydraulic conductivity and integrity of all liners will be verified during construction,

(p) a description of the security measures with respect to entry by unauthorized persons, livestock or wildlife, or with respect to unauthorized dumping,

(q) a description of the operational safety procedures in place, as well as the contingency plan developed to respond to emergencies such as fires or fugitive air emissions,

(r) the qualifications with respect to training and certification required by employees, and

(s) any other information the EUB may require.

25.2 Reclamation Plan

A reclamation plan, laid out during the initial design of the landfill and incorporated throughout the operational life of the landfill, shall include:

(a) a description of the reclamation design and proposed post-reclamation use of the landfill site,

(b) a description of how this design was incorporated into the initial site assessment, and how it will be incorporated into the overall operation of the landfill,

(c) a description of how the leachate collection, leak detection, groundwater monitoring, and gas interception, venting or recovery systems will continue to be maintained and operated, and

(d) any other information the EUB or AEP may require.

26.0 Biodegradation Facilities- Specific Application Information

The **purpose** of this section is to identify the specific application information which is required in an application to construct and operate a biodegradation facility.

General information, which is also required with the application, is contained in Section 21.0.

For operational information, reference should also be made to Part D, Section 16.0, *Biodegradation.*

26.1 Design and Operational Procedures

Details on the design features and operational procedures shall, where applicable, include:

(a) a description of the oilfield wastes to be accepted for biodegradation including their source, anticipated annual volumes, and typical chemical and physical characteristics,

(b) a description of the proposed biodegradation technique including the volume that will be treated at one time, any amendments that will added, and the anticipated degradation period for a volume of waste,

(c) a description and example of the accounting procedure from receipt to disposition of all products.

(d) a description of the intended uses or disposition of the treated material,

(e) a description of how any generated leachate will be handled and/or disposed,

(f) a description and scale diagram of the design of the biodegradation system including:

- (i) the primary containment device,
- (ii) the secondary containment device,
- (iii) the leachate collection system,
- (iv) the leak detection system, and
- (v) the groundwater monitoring system, if applicable,

(g) a scale diagram of the facility site showing the following in relationship to the biodegradation system:

- (i) location, size, and equipment spacing of any separating, heating, pumping, and compressing equipment, and
- (ii) location, size, and construction of any storage facilities,

(h) a description of how fugitive air emissions will be monitored,

(i) a description of the operational safety procedures in place at the facility, as well as the contingency plan developed to respond to emergencies such as fires, the accidental release of fluids, or fugitive air emissions,

(j) the qualifications with respect to training and certification required by employees,

(k) a description of the security measures with respect to unauthorized dumping or entry by unauthorized persons, livestock, or wildlife, and

(l) any other information the EUB may require.

27.0 Thermal Treatment Facilities - Specific Application Information

The **purpose** of this section is to identify the specific application information which is required in an application to construct and operate a thermal treatment facility.

General information, which is also required with the application, is contained in Section 21.0.

For operational information, reference should also be made to Part D, Section 17.0, *Thermal Treatment.*

27.1 Design and Operational Procedures

Based on the thermal treatment technology (incineration or thermal desorption) being applied for, details on the design features and operational procedures shall, where applicable, include:

(a) a description of the oilfield waste streams that will be accepted for thermal treatment including their source, characterization, composition, and anticipated annual volumes,

(b) a description of the design and manufacturer's specifications of the incinerator including the make, model, number, chamber type, rated capacity, and charging method,

(c) the limiting design and operating values of the parameters, if applicable, listed below and a discussion of why the identified limits apply:

(i) primary chamber temperature, pressure, design volume, and hearth area,
(ii) secondary chamber temperature, pressure, and retention time,
(iii) primary air injection,
(iv) secondary air injection,
(v) auxiliary burner(s) type, primary ignition, secondary afterburner, timer cycle, supply fuel, and type of flame failure control,
(vi) minimum destruction and removal efficiency,
(vii) combustion performance parameters including minimum oxygen level, maximum carbon monoxide levels, and minimum incinerator operating temperature, and
(viii) stack emission levels for opacity, hydrogen chloride, particulate, dioxin and furan, carbon monoxide, carbon dioxide, nitrogen oxides, and sulphur dioxide,

(d) a description of the incinerator stack including its diameter, height above grade, height above roof, distance from the nearest building and the building's height, height of other obstructions, spark arrester, sampling ports provided, and pollution control equipment,

(e) a description of process monitoring system for the incinerator and of the continuous emissions monitoring system for the stack,

(f) a scale drawing of the incinerator showing its internal dimensions, burner locations, charging doors, size and location of test openings, temperature control, and temperature recording device,

(g) a description of the testing to be conducted to ensure the required destruction and removal efficiencies and emission limits will be met,

(h) a description of the operational procedures including:

(i) the method of receiving, storing, and preparing waste for incineration,
(ii) a list of the gaseous and particulate substances and their volumes that will be released into the environment as a result of the incinerator's operation, as well as the methods by which the substances will be released and the operational steps taken to reduce the volumes released, and
(iii) a discussion of the method proposed for the disposal or treatment of the liquid and solid residue or ash generated by the incinerator,

(i) a scale diagram of the facility showing the location, size, and material specification of all equipment and surface improvements,

(j) a description and example of the accounting procedure from receipt to disposition of all products,

(k) a description of the operational safety procedures in place at the facility, as well as the contingency plan developed to respond to emergencies such as fires or fugitive air emissions,

(l) the qualifications with respect to training and certification required by employees,

(m) a description of the security measures with respect to unauthorized dumping or entry by unauthorized persons, livestock, or wildlife, and

(n) any other information the EUB may require.

28.0 Other Waste Management Technologies

Applicants wishing to apply for an oilfield waste management technology not described in the previous sections shall provide information on the design features, operational procedures and monitoring systems applicable to the waste management technology. The details provided should reflect the scope and complexity of the proposed development.

PART F

OTHER WASTE MANAGEMENT

AND

DISPOSAL OPTIONS

Part F

OTHER WASTE MANAGEMENT AND DISPOSAL OPTIONS

29.0 Spreading of Oily By-Products to Roads

29.1 Introduction

The **purpose** of this section is to establish the minimum requirements and criteria for applying oily by-products materials to road surfaces.

The **intent** of these requirements is to ensure that environmental considerations surrounding the safe and responsible application of oily by-products to road surfaces are addressed.

Approval holders or licensees of oil and gas facilities must maximize the recovery and conservation of resources and minimize the amount of oily by-product material generated. Licensees and approval holders producing this material are strongly encouraged to review their respective handling and disposal techniques in consideration of alternate oil reclamation programs. Good operating practices used in the management of storage facilities for oily by-products such as minimizing the volumes of produced water and other oilfield wastes entering these facilities. The removal of free water will greatly assist in meeting the criteria set out in this section.

The EUB considers the application of oily by-product materials to public or private roads as an acceptable management option available to the oil and gas industry. The oily by-product materials, which are typical of that recovered or generated during in-situ oil sands and heavy oil production operations in northeast Alberta, is a resource valued by local communities when applied to permanent roads in accordance with criteria set out in these requirements. A joint industry, government, and scientific task force has been investigating and researching this matter for many years. Their research has shown that if applied appropriately, this material poses minimal environmental impact and safety risks.

The use of oily by-products in agricultural product storage areas, feed lots, or temporary lease roads is prohibited.

29.2 Oily By-Product Materials

Oily by-product material is considered materials containing oil or bitumen generated during heavy oil production and typically consists of mainly sand and slop oil.

29.3 Characterization

Oily by-product material may be applied to road surfaces if the following characterization criteria are met:

1. No free water. Every effort should be made to ensure water on the surface or lying within the storage facilities is recovered prior to removing the oily by-product material for application to roads.

2. Oil shall be of a density greater than 920 kg/m^3. Material with less than 5 per cent residual hydrocarbon is unacceptable as road mix.

3. pH $\geq$ 6.

4. Total salts (calculated as a loading limit):

   - Na $\leq$ 5 500 kg/ha, and
   - Cl $\leq$ 7 000 kg/ha.

5. Total metals (concentration in sample):

   - Cd $\leq$ 3 mg/kg,
   - Hg $\leq$ 0.8 mg/kg,
   - Pb $\leq$ 375 mg/kg,
   - Ni $\leq$ 150 mg/kg,
   - Cu $\leq$ 150 mg/kg, and
   - Zn $\leq$ 600 mg/kg.

   Note: The above metal concentrations have been derived from the CCME Criteria for metals in agricultural applications. They are intended to be used as a **screening tool or flag**. The limits will be used to assess whether the metal concentrations as derived from the analytical methodologies are within the expected limits for those metals. If metal concentrations are noted in excess of the above limits, the licensee and/or approval holder of the oil and gas facility may be asked to provide an explanation prior to approval being granted. Licensee and/or approval holders who repeatedly exceed the limits will be required to carry out a detailed investigation as to the cause.

6. The material must not contain halogenated hydrocarbons, hazardous chemicals, refined or lube oils, drilling waste, flare pit sludges, or deleterious substances such as filters, rags, vegetation, or other debris including significant volumes of contaminated agricultural soils.

29.4 Application Depth

The maximum depth of application of material is limited to the smallest of the "Calculated Application Depths" determined for Na and Cl using the following formula:

$$d\ (cm) = \frac{L \times 10^4}{D \times C}$$

where:
- d = depth (cm) - calculated.
- L = loading rate (kg/ha) - specified in Section 29.3(4) for Na and Cl,
- D = density of sample (kg/m^3) - determined by laboratory, and
- C = concentration Na and/or Cl (mg/kg) - determined by laboratory.

Note: Application method for oily by-product materials are set out in the Saskatchwan/Alberta Waste Disposal Cooperative report, *Alberta Recommended Practices for Road Surfacing and Dust Suppression Techniques* (revised July 1994). This report is available through EUB Field Offices. The amount of material that can be applied to roads, as calculated above, must also be consistent with that report. Industry must adopt these as minimum acceptable oily by-product application methods.

29.5 Mixing Of By-Product Materials

If the material to be used for road surfacing or dust suppression is a combination of two or more oily by-product streams (i.e. from a number of different storage facilities), each must be sampled and analyzed in accordance with the methods prescribed. The limiting factor for application of the aggregate material will be dependent on loading limits of Na and Cl noted in Section 29.4, *Application Depth,* assuming metals are within the established limits. Therefore, the limiting application depth of the oily by-product materials used in the final mix will be calculated as follows:

$$d\ (cm) = \frac{L \times 10^4}{(D1 \times C1 \times P1) + (D2 \times C2 \times P2)}$$

where:
- d = maximum application depth (cm) - calculated,
- L = loading rate (kg/ha) - specified in Section 29.3(4) for Na and Cl,
- D1 = density of first substance (kg/m^3) - determined by laboratory,
- C1 = concentration Na or Cl (mg/kg) - in first substance determined by laboratory,
- P1 = proportion of first substance in the final mixture,
- D2 = density of second substance (kg/m^3) - determined by laboratory,
- C2 = concentration Na or Cl (mg/kg) - in second substance determined by laboratory, and
- P2 = proportion of second substance in the final mixture.

Example calculation from data sheet:

Notes	Sample #	Density (kg/m^3)	Concentration (mg/kg)	Calculated Depth of Application
Sand	1	1792	Na = 3300	9.30cm
	1		Cl = 5640	5.97 cm
Slop Oil	2	1052	Na = 3350	15.6 cm
	2		Cl = 6900	9.64 cm

Assume the mix will contain 70 per cent sand and 30 per cent slop oil by volume.

In this example, Cl is the limiting factor in both samples (5.97 cm in #1 and 9.64 cm in #2). If Na was the limiting factor in one sample and Cl in the other, the mixing depth calculation would have to be repeated for both Na and Cl. The smaller of the two calculated application depths would be the limiting factor for the composite mix.

Using the equation above :

$$d\ (cm) = 7000\ kg/ha \times 10^4 / \{(1792\ kg/m^3 \times 5640\ mg/kg \times 0.70) + (1052\ kg/m^3 \times 6900\ mg/kg \times 0.30)\} = 7.56\ cm$$

The mix of 70 per cent sand and 30 per cent slop oil can be applied 7.6 cm deep.

29.6 Sampling

Appropriate sampling methods must be used to obtain a representative sample from each storage facility or container whose contents are to be used in the disposal project in question. Sub-samples from the field containers (usually 20L polyethylene pails) should be prepared following the protocol below:

- visually examine the sample, record ratio of free water to solids,

- decant and discard any free water in the sample container,
- remove all large rocks, twigs, or vegetation,
- homogenize the remaining oily by-product material, and
- collect a 2 kg aliquot of the homogenized sample and place in a clean glass jar (1 L) with a teflon-lined lid. Store the sample at 4°C. Collect sub-samples from the 1 L glass jar for the required analyses.

29.7 Analyses

The following analyses are required for the characterization of the oily by-product material:

METHOD	PARAMETERS
*1.9 (sample: water) Water Soluble Extract	pH, Specific Conductance, Chloride, Sodium
* Composition Analysis (Dean Stark)	% water, % solids, % hydrocarbon
* Total Metals (US EPA 3050 (SW 846))	cadmium, mercury, lead, nickel, copper, zinc
Specific Gravity (Standard Methods for the Examination of Water and Waste water, APHA, AWWA, WPCF, 16th Ed. Washington, 1985. Method 213 E.)	Density of oily by-products resembling sludges.
Specific Gravity (American Society for Testing and Materials, Washington. "Standard Method for Specific Gravity of Soils", Designation D 854 - 83).	Density of granular oily by-products such as oil sands and silts.

* A description of the unique analytical methods is included in this section. The remaining methods can be found in the cited sources.

A standardized reporting format has also been developed to ensure consistency in chemical analyses and units of measurement (see attached *Oily By-Product Characterization for Road Disposal Data Sheet*). Use this form to report all data.

1. 1:9 Water Soluble Extract Analyses Oily By-Product Material for Application to Roads (tentative)

This method as described specifically relates to water soluble extracts on oily by-product material which are being considered for application to roads, and is intended for the determination of pH, specific conductance, chloride, and sodium.

The sample is shaken with demineralized water at a 1:9 (sample: water) ratio for

several hours and then allowed to stand overnight. Analyses are carried out on the clarified aqueous portion. Data are expressed as milligrams of constituent per kilogram of original material as received.

(a) Procedure

(i) Prepare a 1:9 (sample: water) mixture by weighing 100 grams, ± 0.1g (to an accuracy of ± 0.1g) of homogenized oily by-product material into a 2 litre glass jar with a teflon lined lid. Add 900 ml demineralized water.

(ii) Shake on a mechanical shaker for 2 hours.

(iii) Allow to stand overnight at 4°C.

(iv) Decant supernate - if supernate portion of sample is extremely turbid with suspended solids, clarification may be carried out by filtering supernate through a coarse (5 u) pure cellulose filter paper. Carry out pH and specific conductivity measurements on the supernate. Follow instrument manufacturers recommended procedures.

(v) Filter a portion of the supernate through 0.45 u cellulose accetate filter paper. Carry out chloride and sodium analyses on the supernate by Ion Chromatography and Atomic Absorption Spectrophotometry respectively, following manufacturers recommended procedures.

Note: Other approved analytical methodology may be used, such as titrimetric or colorimetric procedures for chloride determinations, and flame emission or Inductively Coupled Plasma Emmission for sodium determinations.

(b) Data Generation and Calculations

(i) Report pH values in pH units and Specific Conductance in dS/m on the liquid supernate.

(ii) Report chloride and sodium values in mg/L obtained from the liquid supernate and then calculate the concentration of these elements in mg/kg appearing in the original sample "as received" (i.e. mg/L (from supernate) x 9 = mg/kg).

(iii) Use the standard report form as supplied (see attached, *Oily By-product Characterization for Road Disposal Data Sheet*) to report all data.

(iv) Calculate the loading value for sodium and chloride in kg/ha by following the calculation as outlined on the data sheet. This provides a loading value in kg of constituent per hectare of road surface.

2. Dean Stark Analysis for Oily By-Products

Dean Stark analysis is used to determine the hydrocarbon, water, and solids contents of oily by-product samples by using a toluene reflux to separate these components. Condensed solvent and water are continuously separated in a distillation trap, with the water being retained in the trap. The solvent is recycled through the extraction thimble of the extraction apparatus to dissolve the hydrocarbon. The solids remaining in the thimble after extraction are measured gravimetrically, the water content is measured by volume in the trap, and the hydrocarbon content is calculated from this data.

(a) Apparatus

(i) Condenser - approximately 400 mm long with a 24/40 standard taper joint.

(ii) Distillation trap - with 24/40 standard taper joints, constructed so that the water is separated from the solvent, and the solvent is recycled back into the distillation apparatus.

(iii) Distillation flask - a 1 Litre 45/50 standard taper single necked flash.

(iv) Extraction Thimble - Whatman 85 x 200 mm cellulose thimble, single thickness.

(b) Procedure

(i) Dry the thimbles in the drying oven for a minimum of 8 hours. Cool the thimbles in the desiccator for a minimum of 20 minutes, weigh to the nearest 0.001 g. Record this weight as the initial dry weight of the thimble.

(ii) Ensuring that the sample is homogeneous, add approximately 30 to 40 g of sample to the thimble, weigh to the nearest 0.001 g. Record this as the weight of the thimble plus sample.

(iii) Assemble the distillation apparatus, ensure that all joints are vapour tight.

(iv) With water flowing through the reflux condensers, turn the hot plate or heating mantle to a medium heat setting, this will start the reflux.

(v) The toluene will boil and immerse the thimble in hot vapour. As the material in the thimble is heated, the water in the sample will be vaporized and be carried along with the hot solvent vapours to the condenser where they will be cooled and fall back into the distillation trap. The water will fall to the bottom of the trap, and the solvent will be recycled back into the distillation apparatus. The hydrocarbon portion of the sample will be dissolved in the hot solvent vapour, and drip from the bottom of the thimble.

(vi) The extraction is complete when the water level in the trap remains constant, and the solvent dripping from the thimble is clear. Depending on the nature of the sample, this may take from 1 to 8 or more hours.

(vii) Terminate the extraction and allow the solvent and apparatus to cool.

(viii) Measure the volume of water that is retained in the distillation trap to the nearest 0.1 ml. Record this volume as the volume of water.

(ix) Dismantle the distillation apparatus and remove the thimble.

(x) Dry the thimbles in the drying oven for a minimum of 8 hours. Cool the thimbles in the desiccator for a minimum of 20 minutes, weigh to the nearest 0.001 g. Record this weight as the final weight of the thimble.

(c) Data Generation and Calculations

$$\% \ Solids = \frac{S}{W} \times 100$$

$$\% \ Water = \frac{V}{W} \times 100$$

% Hydrocarbon = 100 - (% Solids + % Water)

Where: S = the final weight of the solids after the reflux is completed,
V = the volume of water retained in the trap, ml, the density of water is assumed to be 1.0 kg/L, and
W = the sample weight = (initial weight of thimble + sample) - (initial weight of the thimble).

- Use the standard report form as supplied (see attached *Oily By-product Characterization for Road Disposal Data Sheet*) to report all data.

3. Acid Digestion of Sediments, Sludges, and Soils - US EPA 3050 (SW846)

A representative 1-2 g (wet weight) sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid or hydrochloric acid. Dilute hydrochloric acid is used as the final reflux acid for the ICP or flame analysis of Cd, Pb, Ni, and V. Dilute nitric acid is employed as the final dilution acid for furnace AA analysis of Cd and Pb. A separate sample shall be dried for a solids determination.

(a) Procedure

Follow the EPA method with the exception of drying or grinding the sample prior to digestion.

(b) Data Collection and Calculations

(i) Calculate the concentrations for Cd, Hg, Ni, Cu, Zn, and Pb in mg/kg in the original sample "as received".

(ii) Use the standard report form as supplied (see attached *Oily By-product Characterization for Road Disposal Data Sheet*) to report all data.

29.8 Approval Process

1. Industry will sample and analyze the material to be spread on the roads or driveways.

2. If material is acceptable for road applications, the operator will provide the following information to the recipient (local authority or landowner) and the EUB:

(a) completed copy of the oily by-product characterization for road disposal data sheet signed by a representative from the laboratory and the operator, and

(b) a letter which identifies the source of the material and that it was sampled and analyzed properly and that it meets EUB requirements.

3. The operator shall have written consent that the recipient (local authority or landowner) agrees to have oily by-product spread on the road or driveway.

4. At the end of the season the EUB will enter the information onto the database and will provide a summary to the Counties and MDs. A copy of the program for the new database will be made available to the companies for their use. The company can maintain their own database and submit the information to the EUB on disk.

5. Each County and MD will submit a list of operators that have applied oily by-product to roads to the EUB.

6. The EUB will compare the database to the County and MD records and will follow-up any discrepancies.

Oily By-Product Characterization For Road Disposal Data Sheet

Laboratory Name: _____

Lab Sample Number: _____ Date Received: _____
Field Sample Number: _____ Date Analysed: _____

Sample Information	
Company:	Source: (i.e. ecology pit, desand tank etc.)
Location: Lsd __ __ __ __ W M	Description: (i.e. oily sand, slop oil etc.)

Composition (Dean Stark)		Extractable Salts (1:9 Dilution)		
Oil	%	pH	SC	dS/M
Solids	%		Concentration	Calculated Depth of Application[2]
H_2O	%	Na mg/L	mg/kg	cm
Density of Sample	kg/m^3	Cl mg/L	mg/kg	cm

Total Metals (US EPA 3050 (SW 846))					
	Concentration		Concentration		Concentration
Cadmium/Cd	mg/kg	Nickel/Ni	mg/kg	Lead/Pb	mg/kg
Mercury/Hg	mg/kg	Zinc/Zn	mg/kg	Copper/Cu	mg/kg

Maximum application depth _____ cm (least "Calculated Depth of Application" from above).

The undersigned hereby certifies that the information is accurate and in accordance with the requirements of Section 29.0.

Signed: _____ (Laboratory) _____ (Operator)

[1] Sample must not contain halogenated hydrocarbons, hazardous chemicals, refined or lube oil, flare pit sludges, or deleterious substances such as filters, rags, vegetation, and other debris including significant volumes of contaminated agricultural soils.

[2] The calculated depth of application for each constituent is determined as follows:

$$d\ (cm) = \frac{L \times 10^4}{D \times C}$$

Where: d = depth (cm) - calculated
L = loading rate (kg/ha) - specified in Section 29.3 for Na and Cl
D = density of sample (kg/m^3) - determined by laboratory
C = concentration (mg/kg) determined by laboratory

This represents the calculated maximum depth of oil sludge (prior to mixing with aggregate) allowed, without exceeding each parameter limit specified in Section 29.3. Your maximum allowed application depth is the smallest of the two calculated values and total metals concentration must not exceed these values specified in Section 29.3. You must also follow the Recommended Standards of Practice.

30.0 Drilling Waste Management

For regulatory purposes, there are two categories of wastes produced from drilling operations:

- drilling sump wastes, and
- other solid, liquid material wastes associated with the wellbore and the surface equipment.

30.1 Drilling Sump Wastes

Drilling sump wastes are addressed in a separate EUB waste management document entitled *Drilling Waste Management Requirements* (Guide 50). The disposal and treatment protocols in this document are only applicable to drilling sump wastes and must not be applied to other oilfield wastes.

The *Drilling Waste Management Requirements* (Guide 50) were developed with comprehensive input and review from industry, government and the public sector under the direction of the Drilling Waste Review Steering Committee (DWRSC).

This included collective workshops and public participation.

30.2 Other Drilling Wastes

The management of the other drilling wastes is ultimately the responsibility of the well licensee.

31.0 Waste Transport by Pipelines

31.1 Introduction

The **purpose** of this section is to promote effective and operationally sound waste management practices that concern the disposal of waste into pipelines. Specifically, the use of pipelines as a conduit for waste dilution is discouraged. Although this concern primarily relates to crude oil pipelines, the information equally applies to natural gas pipelines.

Historically, crude oil pipelines have routinely been used for the disposal of a number of types of upstream petroleum industry wastes. These waste types include tank bottom sludges, lubricating oils, well servicing fracturing fluids, solvents, and other chemicals.

Although these wastes are often thought to be compatible with hydrocarbon liquids, operational problems have occurred in pipeline systems and downstream refineries from the cumulative effect of solids, metals, and other materials contained in the waste streams. It is now apparent that the current pipeline specification of less than 0.5 per cent BS & W (basic sediment and water) is singularly insufficient to control the quality of materials injected into pipelines, thereby potentially creating significant downstream waste management, process, and safety related issues.

As the authority to manage this subject does not fall under the jurisdiction of any one party, a committee was formed in 1994 representing refiners, producers, pipeline licensees, regulators, petroleum product suppliers, and waste facility operators.

31.2 Appropriate Wastes for Disposal via Injection into Pipeline Systems

It is recognized that the introduction of inappropriate wastes into crude oil pipelines is a waste management issue, as well as a crude quality issue which must be addressed between the producers, pipeline licensees, and refinery companies. It is expected that such issues will be routinely handled through contractual obligations between the parties involved.

Hydrocarbons in waste liquid (i.e. fracturing fluids) may be of value to refinery operations and under controlled conditions, may be safely handled by the pipeline and refinery system. The following oilfield wastes may be injected into a pipeline system if both of the following control conditions are met:

- the waste has a usable hydrocarbon content and does not pose a downstream handling problem, and
- specific agreements have been arranged between the waste producer, the pipeline licensee, and the refinery for which the specific waste volume is destined (refer to Section 31.3, *Communication*).

Appropriate Waste Types
(if the above two conditions are met:)

- Liquid pigging wastes.
- Certain hydrocarbon based drilling fluids.
- Certain hydrocarbon based surface and downhole treating chemicals.
- Waste refined fuels including diesel and gasoline.
- Well servicing fracturing fluids that are produced from the wellbore and are a part of regular production. Fluids transferred as part of a production stream will not require a specific agreement as identified above. Note: well servicing fracturing fluids, whether residual, spent or unused, which have purposely been isolated from the process production system (i.e. cannot be handled by surface separation or treatment usually due to solids content) must not be disposed directly into a pipeline system.
- Non-halogenated organic solvents. Note: if a solvent is contaminated then the control mechanism must address the contaminant, which may, in consultation with the pipelines and refineries, determine whether it is a contaminant to the pipeline and refinery system.
- Crude oil emulsions.
- The liquid component of all hydrocarbon based sludges provided it is not contaminated by any of the banned waste types, identified in Section 6.1.
- Certain other liquid hydrocarbon wastes that have a BS & W content greater than 0.5 per cent, but still have a sufficient hydrocarbon content to be acceptable, with agreement, by the pipeline licensee and refinery companies.

31.3 Communication

It is imperative that a cooperative communication process be established between producers, pipeline licensees, and refiners to successfully manage oilfield wastes and to help maintain the quality of Alberta's marketable crude oil.

Crude oil recovered from an oilfield waste treatment facility is not considered a waste as per these requirements. Other oilfield waste management facility products which are identified in the appropriate waste types list, are expected to be included in this communication process.

32.0 Radioactive Contaminated Oilfield Wastes

The **purpose** of this section is to establish the minimum requirements for the handling and disposal of radioactive contaminated oilfield wastes.

32.1 Control and Disposal of Recirculated Radioactive Contaminated Frac Sand

These materials are regulated by the Atomic Energy Control Board (AECB). Specific details on how radioactive contaminated frac sands are handled and disposed should be discussed with the AECB.

Licences issued by the AECB to all frac sand licensees normally contain the following condition:

For disposal, sand labelled with a radioactive prescribed substance shall be:

1. sent to Atomic Energy of Canada Limited, after making prior arrangement,
2. sent, after making prior arrangements, to a facility possessing an appropriate waste facility operating licence (WFOL) issued by the AECB, or
3. buried at the worksite under at least 30 cm of soil, provided that the specific activity is less than one scheduled quantity per kilogram of sand.

In all cases where the licensee uses the burial option, the contaminated material must be buried in accordance with the AECB licence condition.

If the licensee does not agree to burial in accordance with the disposal conditions of their licence, the AECB must be notified immediately of the following information:

1. the details of the job including:

    (a) site,
    (b) amount and type of tracer,
    (c) # of tonnes of sand used,
    (d) # of tonnes of sand recirculated,
    (e) where the sand is to be stored,
    (f) intended fate of the material,
    (g) soil conditions on the site, and
    (h) whether it was an oil or water based frac, and

2. the names of the people responsible for:

    (a) the well,
    (b) the contaminated sand,
    (c) the decision not to bury,
    (d) the transportation of the contaminated sand, and
    (e) the ultimate treatment or handling of the sand.

In certain cases, the AECB may, upon request, issue written approval for the transfer of oily, contaminated frac sand to a nearby site for burial where soil conditions are more suitable. The AECB views the transport of radioactive contaminated frac sand as an unnecessary hazard, subject to motor vehicle accident, containment leakage, and wind spreading, all of which could potentially result in contamination of public thoroughfares, private property, or equipment.

The following procedures are required by the EUB to handle and dispose radioactive contaminated frac sands:

1. If the material is to be buried on site, in accordance with the AECB licence, the material must be buried in clay.

2. If the material cannot be buried on site, the material must be disposed into an approved Class Ia or Ib landfill.

3. Oily by-product materials that contain radioactive materials may not be applied to road surfaces.

32.2 Naturally Occurring Radioactive Materials

Naturally Occurring Radioactive Materials (NORMs) are not within the scope of the Atomic Energy Control Act administered by the AECB. Jurisdiction for the control of NORM rests with the individual provinces.

The Western Canadian NORM Committee produced a document entitled *Guidelines for the Handling of Naturally Occurring Radioactive Material (NORM) in Western Canada.* These guidelines provide some general assistance on NORM management options. Not all these options are available in Alberta.

The options are very general in nature and do not give specific criteria for the handling treatment or disposal methods for the NORM material.

The EUB, together with stakeholders, will be developing specific NORM requirements. Until such time as these requirements are developed, the EUB recommends that any handling, treating, or disposing of NORM material generally follow the guidelines established by the NORM Committee document.

Copies of the NORM guidelines may be obtained from:

Alberta Labour, Professional and Technical Services
Occupational Health and Safety
9th Floor, 10808 - 99 Avenue
Edmonton, Alberta T5K 0G5

PART G

APPENDICES

PART G

APPENDICES

Appendix 1.0

References

A number of publications by the Alberta Energy and Utilities Board (EUB) were published prior to 1 January 1996 under the Board's former name of the Energy Resources Conservation Board (ERCB). Those publications are referred to in this reference list as having an ERCB publication designation.

Enforcement

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3. Energy Resources Conservation Board, Informational Letter IL 94-23, 1994. "Interim Policy on the Importation of Non-Dangerous Oilfield Waste".

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7. Alberta Environment, EPS, 1983. "Guidelines for the Disposal of Sulphur Containing Solid Wastes".

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Waste Storage and Transfer Facilities

10. Energy Resources Conservation Board, Interim Directive, ID 95-03. "Storage Requirements for the Upstream Petroleum Industry".

11. Energy Resources Conservation Board, 1995, Guide G-55, "Storage Requirements for the Upstream Petroleum Industry".

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12. Energy Resources Conservation Board, Informational Letter, IL 94-2, "Injection and Disposal Wells; Well Classifications, Completion, Logging and Testing Requirements".

13. Energy Resources Conservation Board, Guide G-51, 1994. "Injection and Disposal Wells; Well Classifications, Completion, Logging and Testing Requirements".

Biodegradation

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Appendix 2.0

Definitions

Aboveground Storage Tank:	A tank that sits on or above the ground surface and whose top and complete external sides can be visually inspected.
Agent:	An agent is a person or corporation that assumes the same responsibilities and obligations as the applicant. An agent must be designated when the company seeking an approval does not have a corporate office in Alberta. An agent assumes all legal responsibilities for the applicant.
BS & W:	An acronym meaning "basic sediments and water" which commonly refers to settled solid and semi-solid components of liquids in tanks and other containment vessels. BS & W is also commonly referenced as S & W (sediments and water). BS & W or S & W are determined using the ASTM Standard D4007 or the API document *Sediment and Water*, Chapter 10, Section 3, Determination of Water and Sediment in Crude oil by the Centrifuge Method (Laboratory Procedure).
Biodegradation Facility:	Oilfield waste management facility utilizing biodegradation to degrade oilfield waste. Examples include permanent biopiles and biocells. On-site land treatment if a single application of oilfield waste is not considered to be a biodegradation facility.
Closure:	Occurs when there is no further disposal and/or treatment of waste at a waste management facility. Reclamation activities may still be ongoing after closure.
Closure (Landfill):	Occurs when there is no further disposal of waste at the landfill, and placement of a final cover is completed.
Compliance Test:	Evaluation of a thermal treatment process for the purposes of obtaining operational data to determine if a process meets the terms and conditions of regulatory approvals previously issued for that treatment process and the approved waste(s) tested. Requirements for compliance tests will be specified in the operating approval for the thermal treatment process.
Container:	Any portable above ground containment device (i.e. drums, pails, bags, boxes, totes, etc.) which has a capacity that does not exceed 1 m^3.
Containment Device:	See "Primary Containment Device" and "Secondary Containment Device".

Dilution:	Mixing of a liquid or solid (waste) with another liquid or solid for the primary purpose of reducing the concentration of the original liquid or solid (waste).
Environment:	All components of the earth including air, land, and water; all layers of the atmosphere, all organic and inorganic matter and living organisms, and interacting natural systems.
Filter Material:	All types of disposable filters from oil and gas production operations, including vehicle filters, oil pads, and absorbants used in maintenance of such operations.
Fixed Thermal Treatment Unit:	A thermal treatment unit which has been approved for operation at one geographical location only and which cannot be moved without a near complete dismantling.
Generator:	See Waste Generator.
Halogenated:	The production of incorporating a halgen (i.e. fluorine, chlorine, bromine, or iodine) into a chemical compound.
Incineration:	A thermal treatment process which destroys contaminants by oxidation in a controlled environment, at temperatures which are effective to reduce contaminants to ashes, inert gases, or vapours.
Inert Waste:	Any solid waste that, upon disposal to land, is not reasonably expected to undergo physical, chemical and/or biological changes to such as extent as to produce substances that may cause an adverse effect. Examples include demolition debris, concrete, asphalt, glass, cement returns, scrap metal, and dry timber or wood that has not been chemically treated. Also known as Non-reportable Waste.
Landfill:	A waste management facility at which waste is disposed by placing it on or in land in a manner that minimizes adverse human health and environmental effects, but does not include a land treatment facility, a surface impoundment, a salt cavern, or a disposal well. Oilfield landfills are a type of Oilfield Waste Management facility, and are approved by the EUB to accept only oilfield waste.
Land Treatment:	A planned and controlled mixing of the waste and surface soil in which the inherent soil processes are used to biodegrade, transform, and assimilate the waste constituents.
Leak Detection System:	A system designed for the early detection and collection of any leakage from a primary containment device.

Liquid:	A substance that contains free liquids as determined by the US EPA Method 9095 Paint Filter Liquids Test, *Test Methods for Evaulating Solid Wastes Physical/Chemical Methods* (EPA Publication No. SW 846).
Manifesting:	The use of documentation which must accompany shipments of dangerous oilfield waste on public roads to assist first responders in the event of an accident, and to confirm the proper shipment of wastes.
Mobile Thermal Treatment Unit:	A thermal treatment unit which can be moved in single or multiple units between geographical locations and which has received an approval to operate from Alberta Environmental Protection which does not pertain to a fixed geographical location.
Monitoring Well:	A well used to monitor the detection of liquid leakage from an underground primary or secondary containment device, or a well placed into a specific zone to enable the sampling of groundwater and to detect the presence of any leachate in the groundwater aquifer or the unsaturated zone.
Oilfield Waste:	An unwanted substance (by the generator) or mixture of substances that results from the construction, operation or reclamation of a well site, oil and gas battery, gas plant, compressor station, crude oil terminal, pipeline, gas gathering system, heavy oil site, oil sands site, or related facility.
Oily Waste:	A specific type of oilfield waste that contains oil or bitumen generated primarily during heavy oil production and typically consists of mainly sands and slop oil.
Operator Code:	The code assigned by the EUB to individual companies used to identify the licensee of wells or pipelines or the holder of approvals for batteries or other facilities.
Post-Closure Period:	The period of 25 years from final closure of a landfill, or so long as leachate that does not meet the performance standards for landfills (listed in Table 15.1) is generated at a landfill after final closure.
Primary Containment Device:	A device used to physically contain materials produced, generated, and used by the upstream petroleum industry.
Receiver:	See Waste Receiver.

Reclamation:	The removal of equipment or buildings or other structures or appurtenances, and/or the conducting of investigations to determine the presence of substances, and/or the decontamination of buildings, other structures, other appurtenances, land, or water, and/or the stabilization, contouring, maintenance, conditioning or reconstruction of the surface of land, and/or any other procedure, operation or requirement specified in the regulations.
Residuals:	The material left after a treatment process and may include ash, solids, water, and recovered contaminants.
Secondary Containment Device:	An impervious barrier placed between the primary containment device and the ground beneath and surround it, for the purpose of containing and preventing any leakage from the primary containment device from impacting the environment.
Sludge:	An accumulated free settling wet solid typically consisting of hydrocarbon, water, and inorganic sediments (i.e. sands, silts, etc.) where the BS & W exceeds 0.5 per cent
Small Quantity Exemption:	Oilfield wastes (other than those substances listed in Part B of Table 4 of the Schedule to the *Alberta Users Guide for Waste Managers* published by Alberta Environmental Protection), are not considered dangerous and are exempt from the storage requirements if they are produced at any single site in an amount less than 5 Kg per month, if a solid, or 5 L per month, if a liquid, and the total quantity accumulated does not exceed 5 Kg or 5 L at any time.
Solid:	A substance that does not contain free liquids and is not gaseous at standard conditions.
Stand-alone Facility:	A facility constructed and operated on its own site.
Storage:	The holding of materials produced, generated, and used by the upstream petroleum industry for a period of time until the products or wastes are used, transported, treated, or disposed.
Storage Area:	See Waste Storage Area.
Storage Facility:	See Waste Storage Facility.
Tank:	A device designed to contain materials produced, generated, and used by the upstream petroleum industry, which is constructed of impervious materials that provide structural support and may include such materials as concrete, plastic, fibreglass reinforced plastic, or steel.

Test Burn:	Operation of a thermal treatment process for the purpose of obtaining operational data, to determine if a process meets regulatory requirements. Test burns are required if the process has not previously received regulatory approvals for the waste tested.
Thermal Desorption:	A thermal treatment process which applies a heat source to a waste material to evaporate or volatilize contaminants from the waste material. Contaminant vapours are then incinerated in an oxidizing unit.
Thermal Distillation Recovery:	A thermal treatment process which applies a heat source to a waste material to evaporate or volatilize the contaminants. Contaminant vapours are then cooled, condensed, and collected. Collected liquids may then be separated into oil and water phases.
Thermal Oxidation:	See Incineration.
Thermal Phase Separation:	See Thermal Distillation Recovery.
Transfer Station:	See Waste Transfer Station.
Treatment:	Any method, technique, or process that is applied to change the physical, chemical, or biological character or composition of a substance.
Underground Storage Tank:	A tank that is partially or completely buried and does not allow for the visual inspection of the top, complete sides, and bottom of the tank without excavation.
Uppermost Formation:	A continuous water saturated geological stratum or strata including, but not limited to sand leases and acquifers, that is projected to be the most probable pathway or pathways for lateral transport of leachate.
Vaulted Storage Tank:	A tank that is contained in a concrete or other type of solid walled space (i.e. vault) either below or above ground level. The vault can be accessed through a manway or a top which is open to atmosphere. It may or may not be possible to visually inspect the tank on all sides.
Waste:	See Oilfield Waste.
Waste Generator:	The licensee and/or approval holder, or agent, as defined by the records of the Board, of a well or other facility, over which the Board has jurisdiction, which generates oilfield waste. Refer to Section 2.1, *Responsibilities*.

Waste Management Facility: (Oilfield)	A facility whose operation is approved by the EUB and consists of any or all of the following: waste processing facility, waste storage facility/waste transfer station, surface facility associated with disposal wells, biodegradation facility, oilfield landfill, thermal treatment facility, or any other oilfield waste management technology or facility.
Waste Receiver:	A person or party who accepts or receives oilfield waste for the purpose of storage, consolidation, transfer, treatment, or disposal. Refer to Section 2.1, *Responsibilities*.
Waste Storage Area: (Oilfield)	A storage area is part of an operating EUB approved oil and gas or oil sands facility. This is a designated area used to store oilfield waste in containers, tanks, bulk pads, or lined earthen excavations.
Waste Storage Facility: (Oilfield)	A stand-alone storage facility dedicated to the collection of one company's waste materials, until volumes are sufficient for an economic transfer of the wastes to treatment/disposal facilities.
Waste Tracking:	A system for monitoring and recording the generation, handling, treatement, and disposal of waste.
Waste Transfer Station:	A stand-alone storage facility that is used for the purpose of collecting upstream oilfield wastes, generated by various companies, until volumes are sufficient for an economic transfer of the wastes to treatement/disposal facilities.
Waste Transporter:	A person or party who receives or takes control of oilfield waste for the purpose of transportation.
Waste Treatment:	Any method, technique or process, including, without limitation, neutralization and stabilization, that is designed to change the physical, chemical, or biological character or composition of a substance.
Watercourse:	The bed and shore of a river, stream, lake, creek, lagoon, swamp, marsh, or other natural body of water, or a canal, ditch, reservoir, or other man-made surface feature whether it contains or conveys water continuously or intermittently.
Weather Protection:	A structure, protective coating or cover which ensures that the physical integrity of primary containment devices are not compromised by the elements of nature.
Wellhead Protection Zone:	The surface and subsurface area through which groundwater moves to reach a municipal or communal water supply well. The horizontal extent of the wellhead protection zone corresponds to the distance from the well to the boundary defined by a minimum draw-down, based on the normal pumping rate of 0.1 m from the equilibrium groundwater level.

Appendix 3.0

Recommended Test Methods

This section provides a listing of the recommended test methods for the analysis of water, soil, sludges, hydrocarbons and waste for characterization purposes.

Test methods not listed in this section may also be considered, providing they can be validated through collaborative studies, comparison to SRM (Standard Reference Materials), and statistical analyses (precision, standard deviation data).

The *Guidelines for Collaborative Study Procedure to Validate Characteristics of a Method of Analysis*, in the appendix of AOAC (1990), or *Method Development and Evaluation*, Method 1040 in APHA (1992), outlines steps that must be considered when preparing a collaborative study.

Analytical Methods; Reference Code Descriptions

1. AOAC, "Official Method of Analysis, of the Association of Official Analytical Chemists", current edition.

2. APHA-AWWA-WEF, "Standard Methods for the Examination of Water and Wastewater", current edition.

3. ASTM, "American Society for Testing and Materials", current edition.

4. Alberta Environmental Protection, "Methods Manual for Chemical Analysis of Water and Wastes", Alberta Environmental Centre, Vegreville, Alberta; October 1987, AECV87-M1, or latest edition.

5. Alberta Environmental Protection, "Methods Manual for Chemical Analysis of Pesticides and PCB Residues in Water and Wastes", Pollution Control Laboratory, Edmonton, Alberta, 1979.

6. Carter, M. R., "Soil Sampling and Methods of Analysis", Canadian Society of Soil Science, 1993.

7. Dionex Corporation Methods Manual.

8. ENVIRODAT, Dictionary of Codes, Environment Canada.

9. EPA, see US EPA.

10. FSPA, "Method Manual for Forest Soil and Plant Analysis", Kalra, Y. P. and Maynard, D. G., IR NOR-X-319, Forestry Canada.

11. McGill and Rowell, "Extraction of Oil from Soils", The Reclamation of Agricultural Soils after Oil Spills, Department of Soil Science, University of Alberta.

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13. NAQUADAT, Dictionary of Codes, Water Quality Branch, Environment Canada.

14. SM (Standard Methods), see APHA.

15. Syncrude, "Syncrude Analytical Methods for Oil Sand and Bitumen Processing", Syncrude Canada Ltd., Edmonton, Alberta, 1979.

16. TCLP, "Toxicity Characteristic Leaching Procedure".

17. TDGR, "Transportation of Dangerous Goods Regulation".

18. US EPA, "Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846", 1986 or latest edition.

19. US EPA, "Environmental Protection Agency Regulations on Test Procedures for the Analysis of Pollutants", 40 CFR 136, 1984.

APPENDIX 3: RECOMMENDED TEST METHODS[1]			
ANALYTICAL PARAMETER/TEST	**SECTION WCR**	**CLASS**	**METHOD**
WASTE CHARACTERIZATION			
Liquids/Solids	-	-	US EPA method 9095 Paint Filter Liquids
Dispersible Form	Waste Control Regulation 1(f)	-	As described in the Regulation and Part 1 of Alberta Users Guide for Waste Managers
Flammable Liquids	Waste Control Regulation Schedule 1 Section 1(a)	3.1 3.2 3.3	ASTM D56-79, or ASTM D93-80, or ASTM D3828-81, or ASTM D3278-82
Flammable	Waste Control Solids Regulation Schedule 1 Section 1(a)	4	ASTM D93-80 US EPA METHOD 1010
Flammable Solids	Waste Control Regulation Schedule 1 Section 1(b)	4.1	Readily Combustible Burn Test or Burning Rate Test - Interim Compilation of Test Methods Under TDGR
Flammable Solids	Waste Control Regulation Schedule 1 Section 1(b) see also 14(2)(d)	4.2	Test for Pyrophoric Substances or Test for Self Heating Substances - Interim Compilation of Test Methods Under TDGR
Oxidizing Substances	Waste Control Regulation Schedule 1 Section 1(c)	5	Test for Solid Oxidizing Substances - Interim Compilation of Test Methods Under TDGR
Poisonous Solids or Liquids	Waste Control Regulation Schedule 1 Section 1(d)(i) and (ii)	6.1	By review of specified references or previous knowledge

[1]Refer to Alberta Users Guide for Waste Managers, March 1995, Alberta Environmental Protection

ANALYTICAL PARAMETER/TEST	SECTION WCR	CLASS	METHOD
Toxic Gases	Waste Control Regulation Schedule 1 Section 1(d)(iii)	2.3	By review of specified references or previous knowledge
Corrosive Solids or Liquids	Waste Control Regulation Schedule 1 Section 1(e)	8	Method 9040, 9041, 9045 SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods - US EPA
Polychlorinated Biphenyls or, Articles containing PCB	Waste Control Regulation Schedule 1 Section 1(f)	9.1	US EPA Method 8080A or ASTM D 3304 or A Method for the Analysis of Polychlorinated Dibenzo-para-dioxins (PCDDs), and Polychlorinated Biphenyls (PCBs), etc. 1/RM/3, May 1990 Environment Canada
Toxic Leachate Waste - containing... Table 1	Waste Control Regulation Schedule 1 Section 1(g)(i)	9.2	Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) US EPA Reg 40CFR261 App II
Toxic Leachate Waste - containing... Table 2	Waste Control Regulation Schedule 1 Section 1(g)(ii)	9.3	Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) US EPA Reg 40CFR261 App II
Toxic Leachate Waste - containing Dioxin or Furan	Waste Control Regulation Schedule 1 Section 1(g)(iii)	9.3	A Method for the Analysis of Polychlorinated Dibenzo-para-dioxins (PCDDs), and Polychlorinated Biphenyls (PCBs), etc. 1/RM/3, May 1990 Environment Canada or Reference Method for the Analysis of Polychlorinated Dibenzo-para-dioxins (PCDDs), and Polychlorinated Dibenzo fruans (PCDFs) in Pulp and Paper Mill Effluents EPS 1/RM/19 Feb 1992 Environment Canada
Waste Type 200 Spent Filters produced in the fabric cleaning industry where an organic solvent is used as the cleaning agent	Table 3 of the Schedule to the Alberta User Guide for Waste Managers BUT see Section 3(h) of the WCR	9.3	Determine if the filters have been steam stripped in a steam cabinet with sparger for a period of 8 hours or more.
Waste Type 201 Spent Lubricating Oil and Undrained Lube Oil Filters Removed from Internal Combustion Engines	Table 3 of the Schedule to the Alberta User Guide for Waste Managers BUT see Section 3(h) of the WCR	9.3	Calculated DE for filters

ANALYTICAL PARAMETER/TEST	SECTION WCR	CLASS	METHOD
Landfillable halogenated solids	Waste Control Regulation Section 14(2)(a) Landfillable Hazardous Wastes	-	TCLP, General: - extract the sample in n-hexane using EPA 3550: - run the extract as per EPA 9076; or - ethyl acetate or n-hexane extraction followed by combustion and microcolormetric titration - Specific compounds - EPA 8240 and 8270 (SW-846)
Landfillable halogenated liquids	Waste Control Regulation Section 14(2)(b) Landfillable Hazardous Wastes	-	TCLP Petroleum Liquids: EPA 9076 for total halogenated organics, Alberta Environmental Protection M106.0 for PCBs Water: EPA 9020 for total halogenated organics, Alberta Environmental Protection A106.0 for PCBs PCB: analytical method involves the use of a gas chormatograph with an electron capture detector. The use of US EPA Method 8080A or ASTM D 3304 are recommended.
Landfillable nonhalogenated organic compounds	Waste Control Regulation Section 14(2)(c) Landfillable Hazardous Wastes	-	TCLP for cresols and cresylic acid: EPA 8270 following the acid extractables portions only, use EPA 3510 or 3550 for sample extraction as appropriate. For remainder of parameters (liquids and solids): EPA 8240 purge and trap GC/MS (3 additional purge parameters) or GC/FID.
Landfillable spontaneously combustible hazardous waste	Waste Control Regulation Section 14(2)(d) Landfillable Hazardous Wastes	4.2	Test for Pyrophoric Substances or Test for Self-Heating Substances - Interim Compilation of Test Methods Under TDGR
Landfillable liquid hazardous waste containing metals	Waste Control Regulation Section 14(2)(e) Landfillable Hazardous Wastes	-	arsenic SM* 3114B, beryllium SM* 3120B, cadmium Naquadat No. 48011, chromium hexavalent SM* 3500-CrD, lead Naquadat No. 8201, mercury SM* 3500 HgB, nickel Naquadat No. 28011, selenium SM* 3114B, silver SM*3500-AgC, thallium SM* 3500-TlC, uranium Dionex Method 48 Note SM*=Standard Method
Landfillable solid hazardous waste containing metals	Waste Control Regulation Section 14(2)(f) Landfillable Hazardous Wastes	9.3	Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) US EPA Reg 4CFR261 App II (for hazardous waste buried with garbage) or (modified for hazardous waste buried alone, monofills)
Landfillable liquid hazardous waste containing cyanide	Waste Control Regulation Section 14(2)(g) Landfillable Hazardous Wastes (Liquid Cyanide)	-	Naquadat No. 06608L with auto colorimetric instrumentation

ANALYTICAL PARAMETER/TEST	SECTION WCR	CLASS	METHOD
Landfillable hazardous corrosive wastes	Waste Control Regulation Section 14(2)(h) Landfillable Hazardous Wastes	8	Method 9040, 9041, 9045 SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

APPENDIX 3: RECOMMENDED TEST METHODS						
ANALYTICAL PARAMETER/TEST	**METHOD PREPARATION**	**ENVIRODAT CODE**	**INSTRUMENTATION METHOD**	**UNITS**	**DETECT. LIMIT**	**METHOD REFERENCE**
WATERS						
pH		10301	Combination Electrode/ pH meter			APHA 4500 H^+ (B); AOAC 973.41; EPA 9040
Specific Conductance		2041	Conductivity Meter	dS/m		APHA 2510 (B), AOAC 973.40; EPA 9050
Major Ions						
Calcium (Ca)	0.45 μm Filtration	20111 (D)	ICP -AES	mg/L	0.006	APHA 3500 Ca (C); APHA 3120 (B); EPA 6010
		20103 (D)	Atomic Absorption	mg/L	0.05	APHA 3500 Ca (B); EPA 7140
		02010 (D)	EDTA Titrimetric	mg/L	0.5	APHA 3500 Ca (D)
Magnesium (Mg)	0.45 μm Filtration	12111 (D)	ICP - AES	mg/L	0.002	APHA 3500 Mg (C) ; APHA 3120 (B); EPA 6010
		12102 (D)	Atomic Absorption	mg/L	0.01	APHA 3500 Mg (B); EPA 7450; AOAC 974.27
Potassium (K)	0.45 μm Filtration	19111 (D)	ICP - AES	mg/L	0.3	APHA 3500 K (C) ; APHA 3120 (B); EPA 6010
		19102 (D)	Atomic Absorption	mg/L	0.1	APHA 3500 K (B); EPA 7610; AOAC 973.53;
		19103 (D)	Flame Photometer	mg/L	0.02	APHA 3500 K (D)
Sodium (Na)	0.45 μm Filtration	11111 (D)	ICP - AES	mg/L	0.03	APHA 3500 Na (C) ; APHA 3120 (B); EPA 6010
		11102 (D)	Atomic Absorption	mg/L	0.1	APHA 3500 Na (B); EPA 7770; AOAC 973.54
		11103 (D)	Flame Photometer	mg/L	0.02	APHA 3500 Na (D)
Chloride (Cl)	0.45 μm Filtration	17203 (D)	Automated Ferricyanide Method (Colorimetric)	mg/L	0.1	APHA 4500 Cl (E); EPA 9250, 9251;
		17209 (D)	Ion Chromatography	mg/L	0.01	APHA 4500 Cl (F); APHA 4110 (B)
			Titrimetric	mg/L		APHA 4500 Cl (B)

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Nitrate (NO_3) (Nitrate + Nitrite - N) (Dissolved)	0.45 μm Filtration	7111/7112 (NO_3+NO_2)	Cadmium Reduction/ Automated	mg/L	0.002/	APHA 4500 NO_3 (E, F)
		7315 (NO_3)	Ion Chromatography	mg/L	0.01	APHA 4500 NO_3 (C); APHA 4110 (B)
		7120 (NO_3+NO_2)	Automated Colorimetric: Hydrazine Reduction	mg/L		APHA 4500 NO_3 (H)
Sulfate (SO_4) (Dissolved)	0.45 μm Filtration	16309	Ion Chromatography	mg/L	0.01	APHA 4500 SO_4 (B); APHA 4110 (B)
		16306	Automated Methylthymol Blue Method	mg/L	0.2	APHA 4500 SO_4 (F); EPA 9036
Metals, Total	Digestion: Nitric/hydrochloric EPA 3010, APHA 3030		ICP - AES	mg/L		APHA 3500 (C); APHA 3120 (B); EPA 6010
			Atomic Absorption	mg/L		APHA 3500 (B); APHA 3111 (B, C, D)
Mercury (Hg)	Digestion: Nitric/Sulphuric Acid and Persulfate/Permanganate:	1594	Cold-Vapour Atomic Absorption	mg/L	0.00005	APHA 3500 Hg (B); APHA 3112 (B); EPA 7470
Free Cyanides (CN)	Undigested, Distillation		Colorimetric			APHA 4500 CN (E)
Oil and Grease[2]	Separatory funnel extraction with freon (APHA 5520 (D))	6524	Infrared Analysis	mg/L		APHA 5520 (C)
	Separatory funnel extraction with n-hexane or MTBE or Freon	6521	Gravimetric Analysis	mg/L	1	APHA 5520 (B)
Total Petroleum Hydrocarbon **(Mineral Oil and Grease)**	Separatory funnel extraction with freon: Silica gel clean up (APHA 5520 (F))	6579	Infrared Analysis	mg/L	0.2	APHA 5520 (C)
			Gravimetric Analysis	mg/L		APHA 5520 (B)

[2]Due to restrictions on the use and manufacture of freon, new methods are currently being developed for the analysis of Oil and Grease.

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Total Organic Carbon (TOC)		6001	Combustion-Infrared Carbon Analyzer	mg/L	0.5	APHA 5310 (B); AOAC 973.47
		6005			0.1	
Phenols	Steam distillation		Direct Photometric Method: with 4-AAP	mg/L		APHA 5530 (D)
		6537	Automated Photometric Method: with 4-AAP	mg/L	0.001	EPA 420.2
Total Dissolved Solids (TDS)	Filter thru glass fibre filter (Watman 934 A/H) or equiv.		Total Dissolved Solids Dried at 180 °C	mg/L		APHA 2540 (C)
		8, 10	Calculated ($Ca+Mg+Na+K+Cl+SO_4+NO_3+(0.6 \times Alkalinity)$)	mg/L		APHA 1030 (F)
Chemical Oxygen Demand (COD)	$K_2Cr_2O_7/H_2SO_4$ Digestion	8304	Closed Reflux/Colorimetric	mg/L	5	APHA 5220 (D)
		8301	Closed Reflux/Titrimetric	mg/L	1	APHA 5220 (C);

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
			SOILS AND SLUDGES			
Saturated Paste and Paste Extract						McKeague 3.21
Water Saturation (%)	Saturated Paste		Gravimetric: (Water content/Weight basis)	%		McKeague 3.21; McKeague 2.411; Carter 18.2.2
Texture			Hand Method			McKeague 4.8
Hydraulic Conductivity	Saturated Soil Sample		Constant-Head Core Method			McKeague 2.51; Carter 55.2; EPA 9100
			Falling-Head Core Method			Carter 55.3, EPA 9100
pH	Saturated Paste Extract 1:2 Soil in 0.01 M $CaCl_2$	10317	pH Meter			McKeague 3.11, Carter 16.3; EPA 9045;
	Saturated Paste Extract 1:2 Soil : Water	10316	pH Meter			McKeague 3.14, Carter 16.2; EPA 9045;
Electrical Conductivity (EC)	Saturated Paste Extract	2041	Conductivity Meter	dS/m		APHA 2510 (B); EPA 9050; Carter 18.3.1; McKeague 4.1
Major Ions:						
Calcium (Ca)	Saturated Paste Extract 0.45 μm Filtration	20111	ICP - AES	mg/L		APHA 3500 Ca (C); APHA 3120 (B); EPA 6010
		20103	Atomic Absorbtion	mg/L		APHA 3500 Ca (B); EPA 7140
			EDTA Titrimetric	mg/L		APHA 3500 Ca (D)
Magnesium (Mg)	Saturated Paste Extract 0.45 μm Filtration	12111	ICP - AES	mg/L		APHA 3500 Mg (C); APHA 3120 (B); EPA 6010
		12102	Atomic Absorbtion	mg/L		APHA 3500 Mg (B); AOAC 974.27; EPA 7450
Potassium (K)	Saturated Paste Extract 0.45 μm Filtration	19111	ICP - AES	mg/L		APHA 3500 K (C); APHA 3120 (B); EPA 6010
		19102	Atomic Absorbtion	mg/L		APHA 3500 K (B); AOAC 973 53; EPA 7610
		19103	Flame Photometer	mg/L		APHA 3500 K (D)

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Sodium (Na)	Saturated Paste Extract 0.45 μm Filtration	11111	ICP - AES	mg/L		APHA 3500 Na (C); APHA 3120 (B); EPA 6010
		11102	Atomic Absorbtion	mg/L		APHA 3500 Na (B); AOAC 973.54; EPA 7770
		11103	Flame Photometer	mg/L		APHA 3500 Na (D)
Chloride (Cl)	Saturated Paste Extract 0.45 μm Filtration	17203	Automated Ferricyanide Method (Colorimetric)	mg/L		APHA 4500 Cl (E); EPA 9250, 9251
		17209	Ion Chromatography	mg/L		APHA 4500 Cl (F); APHA 4110 (B)
			Titrimetric	mg/L		APHA 4500 Cl (B)
Nitrate (NO_3) (NO_3+NO_2)	Saturated Paste Extract 0.45 μm Filtration	7111 /7112 (NO_3+NO_2)	Cadmium Reduction/ Automated Cd Reduction	mg/L		APHA 4500 NO_3 (E, F)
		7315 (NO_3)	Ion Chromatography	mg/L		APHA 4500 NO_3 (C); APHA 4110 (B)
		7120 (NO_3+NO_2)	Automated Colorimetric: Hydrazine Reduction	mg/L		APHA 4500 NO_3 (H)
Sulfate (SO_4)	Saturated Paste Extract 0.45 μm Filtration	16309	Ion Chromatography	mg/L		APHA 4500 SO_4 (B); APHA 4110 (B)
		16306	Automated Methylthymol Blue Method	mg/L		APHA 4500 SO_4 (F); EPA 9036
Water and Solids Content			Gravimetric Analysis: Oven Dry			McKeague 2.411; Carter 51.2
Available Nutrients:						
Ammonia Nitrogen (NH_3-N)	Extraction 2 N KCl (Carter 4.4)	07505 (D)	Phenate Method; Automated Phenate Method	mg/L		APHA 4500 NH_3 (D, H); Carter 4.4
		310	Ammonia Selective Electrode	mg/L		APHA 4500 NH_3 (F, G);
Nitrate Nitrogen (NO_3-N + NO_2-N)	Extraction 2 N KCl (Carter 4.3)	7111 /7112 (NO_3+NO_2)	Colorimetric Method (Cadmium Reduction)	mg/kg		APHA 4500 NO_3 (E, F), McKeague 4.311; Carter 4.3
		7315 (D)	Ion Chromatography	mg/L		APHA 4500 NO_3 (C)

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Phosphorous, extractable (Ortho phosphate)	Medium Strength "Bray" Extract	15255 (D)	Automated Ascorbic Acid; Photometric	mg/L		APHA 4500 P (F); AOAC 973.55, 973.56
		15317 (E)	Colorimetric/Autoanalyzer			McKeague 4.43, McKeague 4.44, FSPA 13.1
Nitrogen, Total (sum of ammonia, nitrate and nitrite nitrogen.)	Micro-Kjeldahl Digestion APHA 4500 N_{ORG}	7015	Phenate Method/Automated	mg/L		APHA 4500 NH_3 (D,H); Carter 22.2
		7012	Ion Selective Electrode	mg/L		APHA 4500 NH_3 (F, G)
Phosphorous, Total	Sodium Carbonate Fusion (Carter 23.2.2)	15255	Automated Ascorbic Acid; Photometric	mg/L		APHA 4500 P (F); AOAC 973.55, 973.56
Cation Exchange Capacity (CEC)			Ammonium Acetate Saturation			McKeague 3.321; Carter 19.4
			Sodium Acetate Saturation			McKeague 3.34
Sodium Adsorption Ratio (SAR)	Saturated Paste Extract		Calculated From Soluble Ions (Ca, Mg, and Na)			McKeague 3.26; Carter 18.4.3
Metals, Total	Digestion: Nitric Acid/H_2O_2 (open beaker) EPA 3050) or, Nitric Acid (closed vessel Microwave) EPA 3051		ICP - AES	mg/kg		APHA 3500 (C); APHA 3120 (B); EPA 6010
			Atomic Absorption	mg/kg		APHA 3500 (B); APHA 3111 (B, C, D)
Boron (B)	Hot Water Extraction	382 (E)	ICP - AES	mg/kg		APHA 4500 B (D); APHA 3120 (B); EPA 6010; Carter 12.2.4
		5106 (D)	Azomethine-H Method	mg/kg		McKeague 4.61; Carter 12.2.2
		5102 (D)	Curcumin Method	mg/kg		APHA 4500 B (B); McKeague 4.62;
Mercury (Hg)	Digestion: Nitric Acid (closed vessel microwave) EPA 3051	80051 (T)	Cold Vapour Atomic Absorption	mg/kg		APHA 3500 Hg (B); APHA 3112 (B); EPA 7471;
	Digestion: Acid/$KMnO_4$					

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Arsenic (As)	Digestion: Nitric/Sulphuric Acid	33011 (T)	Continuous Hydride Generation - Atomic Absorption	mg/L		APHA 3500 As (B); APHA 3114 (C), EPA 7061
	Digestion: Nitric Acid/H_2O_2 (EPA 3050) or, Nitric Acid (EPA 3051)	33009	Atomic Absorption Furnace Technique	mg/L		APHA 3500 As (B); APHA 3113 (B); EPA 7060
			ICP-AES			APHA 3500 As (D); APHA 3120 (B); EPA 6010
Selenium (Se)	Digestion: Nitric/Sulphuric Acid	34011	Continuous Hydride Generation - Atomic Absorption	mg/L		APHA 3500 Se (C); APHA 3114 (C), EPA 7741
	Digestion: Nitric Acid/H_2O_2 (EPA 3050) or, Nitric Acid (EPA 3051)	34009	Atomic Absorption Furnace Technique	mg/kg		APHA 3500 Se (H); APHA 3113 (B); EPA 7740
			ICP-AES			APHA 3500 Se (I); APHA 3120; EPA 6010
Oil and Grease[3]	Separatory funnel extraction with freon (APHA 5520 (D))		Infrared Analysis	mg/kg		APHA 5520 (C)
	Separatory funnel Extraction with n-hexane or MTBE or Freon		Gravimetric Analysis	mg/kg		APHA 5520 (B)
Total Petroleum Hydrocarbon (Mineral Oil and Grease)[2]	Separatory funnel extraction with freon: Silica Gel Clean up (APHA 5520 (F))		Infrared Analysis	mg/kg		APHA 5520 (C)
			Gravimetric Analysis	mg/kg		APHA 5520 (B)
% Oil	Soxhlet Extraction with Methylene Chloride		Gravimetric Analysis	%	0.01	EPA 3540; McGill and Rowell
Total Organic Carbon /Organic Matter	Wet Oxidation		Titration	mg/L		McKeague 3.613; Carter 21.2
	Wet Combustion		Titration	%		McKeague 4.22

[3]Due to restrictions on the use and manufacture of freon, new methods are currently being developed for the analysis of Oil and Grease.

ANALYTICAL PARAMETER/TEST	METHOD PREPARATION	ENVIRODAT CODE	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Phenols	Extraction: NaOH		Direct Photometric Method: with 4-AAP	mg/L		APHA 5530 (D)
		6537	Automated Photometric Method: with 4-AAP	mg/L	0.001	EPA 420.2
Bulk Density			Core Method: Mineral Soils	g/L		McKeague 2.2

ANALYTICAL PARAMETER/TEST	MATRIX	METHOD PREPARATION	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
HYDROCARBON FRACTIONATION						
Flash Point	Liquid/Soil and Sludge		Closed Cup Pensky-Martens	°C		ASTM D-93-77, EPA 1010
Spontaneous Combustion	Liquid/Soil and Sludge		Hot Circulating Oven @ 140°C (initial temp)			Transportation of Dangerous Goods Regulation 3.4.3.5 Division 4.2
Screening Tests:						
Light Aliphatic Compounds: (Total Purgeable Hydrocarbons) (C_3 - C_{14})	Liquid	Purge and Trap (EPA 5030)	GC/MS, GC/FID, GC/PID			EPA 8015; EPA 8240
		Headspace (EPA 3810)				
	Soil/Sludge	Extraction: Methylene Chloride (EPA 5030)				
Total Extractable Hydrocarbons (TEH) (C_8 - C_{30}) (C_8 - C_{60}) Also referred to as Total Petroleum Hydrocarbons (TPH) if cleanup is employed	Liquid	Extraction: Methylene Chloride, Carbon disulphide, or acetone (EPA 3510, 3520), Cleanup: (EPA 3610)	GC/MS, GC/FID, GC/PID			EPA 8000, EPA 8270
	Soil/Sludge	Soxhlet Extraction: Methylene Chloride (EPA 3540)				
Oil and Grease[4] (C_{10} +)	Liquid	Extraction: n-hexane, MTBE or Freon (APHA 5520 (D)).	Infrared Analysis	mg/L, mg/Kg		APHA 5520 (C)
	Soil and Sludge	Soxhlet Extraction: Methylene Chloride (EPA 3540)	Gravimetric Analysis	mg/L, mg/Kg		APHA 5520 (B)

[4]Due to restrictions on the use and manufacture of freon, new methods are currently being developed for the analysis of Oil and Grease.

ANALYTICAL PARAMETER/TEST	MATRIX	METHOD PREPARATION	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Mineral Oil and Grease[5] (C_{10}+)	Liquid/Soil and Sludge	Extraction: Freon: Silica Gel Cleanup (APHA 5520 (F))	Infrared Analysis	mg/L, mg/Kg		APHA 5520 (C)
Also referred to as Total Petroleum Hydrocarbons (TPH) if analyzed by I.R..			Gravimetric Analysis	mg/L, mg/Kg		APHA 5520 (B)
Specific Tests:						
Volatile Organic Compounds (VOC)	Liquid	Purge and Trap (EPA 5030)	GC/MS			EPA 8015; EPA 8240
		Headspace (EPA 3810)				
	Soil/Sludge	Extraction: Methanol (EPA 5030)				
Monocyclic Aromatics (BTEX: C_6 - C_9)	Liquid	Purge and Trap (EPA 5030)	GC/PID			EPA 8020
		Headspace (EPA 3810)				
	Soil/Sludge	Extraction: Methanol (EPA 5030)				
Poly and Hetro-cyclic Aromatics (PAH)	Liquid	Extraction: Methylene Chloride (EPA 3510) Cleanup: EPA 3611, 3630, 3640	GC/FID			EPA 8100
	Soil/Sludge	Soxhlet Extraction: Methylene Chloride (EPA 3540) Cleanup: EPA 3611, 3630, 3640	GC/MS: Capillary Column Technique			EPA 8270
			HPLC			EPA 8310
Asphaltenes	Liquid/Soil and Sludge	Extraction: Benzene/n-pentane	Gravimetric (Weight Basis)			Syncrude Method 5.1

[5]Due to restrictions on the use and manufacture of freon, new methods are currently being developed for the analysis of Oil and Grease.

ANALYTICAL PARAMETER/TEST	MATRIX	METHOD PREPARATION	INSTRUMENTATION METHOD	UNITS	DETECT. LIMIT	METHOD REFERENCE
Polychlorinated Biphenols (PCB)	Liquid	Extraction: Methylene Chloride (EPA 3510, 3520) Cleanup (3620, 3650, 3660)	GC/Electron Capture Detection			EPA 8000; EPA 8080
	Soil/Sludge	Extraction: Acetone/Hexane (EPA 3540, 3550) Cleanup (3620, 3640, 3660)				
Halogenated Organics						
Adsorbable Organic Halides (AOX)	Liquid	Acidified (Nitric acid); Passed through column of GAC, Washed, Combusted	Neutron Activation			EPA 9022, Helmke 1982
Extractable Organic Halides (EOX)	Soil/Sludge	Extraction: Ethyl Acetate, Combusted	Microcoulometric-Titration Detector			EPA 9020
Total Organic Halides (TOX)	Liquid	Extraction: Cyclohexane-MTBE, Washed, Combusted (Liquids can also be passed through GAC and then combusted)				
	Soil/Sludge					
Solvent Scan (including): Acetone, benzene, n-butyl alcohol, carbon disulphide, cresols and cresylic acid, cyclohexanone, ethyl acetate, ethyl benzene, ethyl ether, isobutanol, methanol, methyl ethyl ketone, nitrobenzene, 2-nitropropane, pyridine, toluene, xylene	Liquid	Direct Headspace (EPA 3810)	GC/MS			EPA 8240
	Soil/Sludge	Extraction: Methanol/Water Followed by Direct Headspace (EPA 3810)				

Appendix 4.0

Requirements for Site Assessment and Groundwater Protection

4.1 Introduction

The **purpose** of this appendix is to identify the minimum requirements for a site assessment and a groundwater monitoring program.

It is the operator's responsibility to:

- determine if additional work beyond the minimum is required, and
- to justify why the actions taken at a specific site are sufficient. Site assessments and groundwater monitoring systems will be audited by EUB staff.

In the interest of protecting the environment, the EUB requires certain facilities under its jurisdiction (i.e. oilfield waste management facilities) to have a monitoring system that will provide an early indication of potential groundwater impact.

To properly design and implement an appropriate monitoring system, operators will be required to first conduct a site assessment. However, if upon completion of the site assessment it is concluded that groundwater monitoring will not provide sufficiently early detection of contamination, alternative monitoring systems shall be implemented such as soil vapour surveys, soil sampling surveys, or shallow geophysical techniques (i.e. electrical conductivity, electromagnetic, or ground penetrating radar surveys).

Qualified expertise must be employed to:

- evaluate hydrogeological and geological information,
- conduct a site investigation and establish the hydrogeologic conditions for the site,
- implement an appropriate monitoring system, and
- interpret analytical results.

The design of a monitoring program should be based upon the information obtained from the site assessment, and it should take into account the type of activity that has occurred or could occur on that site.

4.2 Site Assessment

Site assessments must be conducted at a sufficient level of detail to allow for the implementation of an appropriate monitoring program.

Published reports, maps, aerial photographs, existing water well data, research papers, or any other information available in the public domain should be used to establish the regional hydrogeologic setting within a 3 km radius of the facility site. The site geology and hydrogeology should then be determined from on-site investigations.

The following outlines the minimum information that should be compiled and evaluated as part of a site assessment. The information that must be submitted to the EUB is outlined in the monitoring and reporting section.

1. Regional Assessment

A. Setting

A description of the regional setting including the following:

(a) a detailed scale topography map that includes all local surface water bodies,

(b) soil types and distribution, and

(c) any nearby industrial facilities, waste transfer stations, landfills, etc. that may affect quality or flow of groundwater.

B. Geology and Hydrogeology

A description of the geology (surficial deposits and underlying bedrock) and hydrogeology of the area based on the following, if available:

(a) surficial geology maps,

(b) bedrock topography/geology maps,

(c) hydrogeologic maps and cross sections,

(d) published reports, and

(e) air photos.

C. Groundwater Use in the Area

Based on available information from government records (i.e. Groundwater Information Centre of the Hydrogeology Branch of Alberta Environmental Protection):

(a) identify all surface and groundwater users within a 3 km radius of the facility, and

(b) identify depths, specific yields, and water quality of aquifers.

2. Site Investigation

The objective of the site investigation is to reconcile the information gathered during the regional assessment with the true site specific conditions.

Based on the regional assessment, the operator should have a preliminary understanding of the soil characteristics, geology, and groundwater chemistry and flow directions. These conditions along with knowledge of the type of activity that either has taken place or will take place on the site, should be used to determine the placement of the groundwater monitoring wells.

As the site assessment will be used to establish a baseline for further monitoring and reporting, it is important that the initial site investigation includes a wide spectrum of parameters and constituents. This assessment then becomes the baseline for all future monitoring and reporting. From this broad list of parameters, the operator can then choose a smaller list of "critical" parameters to monitor over the longer term. As a minimum, the groundwater must be tested for the following parameters:

- pH,
- major ions,
- electrical conductivity,
- total metals, and
- mineral oil and grease.

Refer to Section 4.3, *System Design,* for information on well placement and the construction and installation of monitoring wells.

3. Site Specific Data

On-site investigations during the drilling and installation stages of the monitoring wells should provide the following site specific information:

(a) surface and near surface features, such as natural slope of the site, existing or potential sources of contamination and any manmade or natural features that may act as conduits for contaminant migration, including:

(i) site topography, locations of all surface water, and surface drainage patterns,

(ii) on-surface or buried pipelines, utility lines, conduits, pits, or tanks,

(iii) buildings, loading facilities, or storage areas,

(iv) disposal or source wells,

(v) existing or abandoned monitoring wells or standpipes,

(vi) areas containing buried fill material or waste, and

(vii) areas of known extensive or frequent spills,

(b) a description of the soil characteristics including:

(i) the geological parent materials, thickness, and type and depth of genetic horizons,

(ii) physical characteristics including texture, evidence of fracturing, internal drainage characteristics, and an estimate of moisture content, and

(iii) background chemical characteristics including pH, electrical conductivity, major extractable ions, cation exchange capacity, total metals, percent oil, and sodium adsorption ratio,

(c) a description of the hydrogeology including:

(i) type, thickness, and distribution of each stratigraphic unit,

(ii) depth of water table,

(iii) estimate of the moisture content and its variation in the unsaturated zone,

(iv) measured hydraulic conductivity of the first saturated strata,

(v) horizontal and vertical direction, rate, and approximate velocity of groundwater movement, and

(vi) local groundwater discharge and recharge areas, and

(d) a description of the groundwater quality from the initial sampling of the monitoring wells including, as a minimum, the following:

(i) pH,

(ii) major ions,

(iii) conductivity,

(iv) total metals, and

(v) mineral oil and grease.

4. Site Assessment Results

After the completion of the site assessment, the operator should be able to:

(a) determine potential pathways of contaminant migration,

(b) identify the depth, location, and type of any contaminant encountered, the probable source, and the appropriate remedial actions to be undertaken,

(c) assess whether monitoring the unsaturated zone alone or in concert with the groundwater, or whether any other monitoring techniques, are warranted, and

(d) assess whether additional groundwater monitoring wells are required.

4.3 System Design

1. Strategy of Well Placement

Prior to the installation of monitoring wells, the site topography and local drainage features can often provide an indication of the groundwater flow directions. Techniques such as electromagnetic surveys, ground penetrating radar, and drive-point wells, may be utilized to assist in the placement of the permanent monitoring system. The following identifies the minimum requirements for a groundwater monitoring system.

(a) A minimum of four permanent monitoring wells must be installed during the initial stage of a groundwater monitoring program.

(b) Three shallow wells shall be installed to determine the depth and horizontal direction of groundwater flow in the shallowest water bearing zone, typically the permanent water table.

(c) If a perched water table exists, additional wells will be required to monitor this situation.

(d) Of the three shallow wells monitoring the permanent water table, one must be placed hydraulically upgradient of the site and two downgradient. This upgradient well should be situated to provide the best indication of background (unimpacted) groundwater chemistry at the site.

(e) A fourth monitoring well shall be installed beside the downgradient well most likely to be impacted, and completed to allow the measurement of the vertical hydraulic gradient.

If groundwater contamination is detected, subsequent monitoring wells may be required to delineate the vertical and horizontal extent of contamination. Care must be taken during the drilling and completion of all wells to ensure that they do not serve as conduits for migration of contaminants.

2. Monitoring Well Construction and Installation

A variety of drilling methods are available for the installation of monitoring wells. The choice of method will often be dictated by the site conditions.

Recognized industry practices must be followed to ensure that:

- contaminants are not introduced into the well during construction,
- a minimum disturbance of subsurface materials occurs,
- a representative sample can be collected, and that
- no contaminants from zones other than the interval at which the well is screened will be able to enter the well.

Information on appropriate monitoring well design, installation, completion, development, and sampling procedures can be found in the references relating to site assessment and groundwater protection, listed in Appendix 1.0, *References*. The EUB expects operators, or their consultants, to implement monitoring systems in accordance with industry standards.

Monitoring wells that are no longer used as part of the monitoring program (i.e. as a result of damage or inappropriate placement) must be properly abandoned. Operators must document their abandonment procedures and make them available to EUB staff upon request.

4.4 Monitoring and Reporting

1. Initial Information Submission

A concise summary outlining the information obtained from the site assessment and the monitoring program implemented at the site must be submitted to the EUB. This summary must include:

(a) a facility plot plan at an appropriate scale that clearly identifies any features listed in item 2.2.1a), as well as the locations of the groundwater monitoring wells and the horizontal direction of the shallow groundwater flow,

(b) the location of all surface waters and inferred areas of groundwater discharge within a 3 km radius of the facility,

(c) a summary of local groundwater and surface water users within a 3 km radius of the facility,

(d) a summary of the regional hydrogeology and geology for the area in which the site is located, as derived from existing data in the public domain,

(e) monitoring well construction, completion, and monitoring details including:

  (i) the rationale for the location, depth, and screened interval,

  (ii) a description of the construction materials and completion details,

  (iii) methods employed to develop the wells,

  (iv) sampling and testing procedures, and

  (v) the ground level elevation, casing top elevation, depth to water, total depth of well, and screened interval for each well, presented in tabular form,

(f) site specific information, determined during the drilling and installation of the monitoring wells, including the following:

  (i) the physical characteristics of the soil including thickness, texture, internal drainage characteristics, evidence of fracturing, and an estimate of the moisture content,

(ii) background chemical characteristics of the soil including pH, electrical conductivity, major extractable ions, cation exchange capacity, total metals, per cent oil, and sodium adsorption ratio,

(iii) the description of the surficial geology, including the type and thickness of the strata,

(iv) the depth of the shallowest water bearing strata (depth of the water table) and the hydraulic conductivity of this zone, including raw test data and method of analysis,

(v) the horizontal and vertical directions, rates and approximate velocities of the groundwater flow,

(vi) a description of the quality of the groundwater including, as a minimum, the initial results obtained for pH, electrical conductivity, major ions, total metals, and mineral oil and grease, and

(vii) the depth, location, and type of any contaminant encountered, the probable source of the contaminant, and a discussion of the remedial actions to be undertaken, and.

(g) a discussion of whether any other monitoring techniques are warranted and whether any other monitoring wells are required.

2. Routine (Annual) Monitoring and Reporting

Each groundwater monitoring system, once established, shall be sampled twice per year, spring and fall. More extensive monitoring may be required in some instances depending on the specific site and facility. The monitoring results must then be compiled into an annual report. It is the responsibility of the operator of the facility to ensure that the sampling is undertaken and the annual report is prepared.

Annual reports must be prepared for each facility with a groundwater monitoring system and must be:

- prepared by 31 March of each year,
- retained on-site for a period of 5 years, and
- made available to EUB personnel upon request.

The annual report must concisely detail the present monitoring results as well as those from the previous 5 years.

The annual report shall contain the following:

(a) a site map showing the locations of facility features and monitoring wells, as well as the horizontal direction of the shallow groundwater flow,

(b) a tabular compilation of the present and previous 5 years monitoring results including groundwater elevation and analyses for each monitoring well,

(c) a tabular compilation of the present and previous 5 years results from any other monitoring technique employed (the map in item (a) above must be modified to reflect this monitoring technique),

(d) a summary of any work undertaken to augment the monitoring system,

(e) an assessment of whether the monitoring results indicate potential groundwater impact,

(f) a discussion of any work undertaken to alleviate potential impacts identified in item (e) above or of the status of any on-going work undertaken to alleviate previously identified impacts, and

(g) a trend analysis of the monitoring data to predict the potential for future groundwater impairment.

If it is determined that the groundwater at the site has been impacted, the EUB must be notified of this within 60 days of the sampling date.

Groundwater impact determination should utilize the trending analysis described above along with other statistical methods. For naturally occurring constituents, any significant deviations above normally expected seasonal fluctuations would be considered important. The basis for this assessment would be the background levels established from the initial site assessment. The presence of constituents not normally found in groundwater, such as BTEX or phenols, must be reported. This discussion must include a description of the impact, including the source of the impact, any potential for off-site contamination, and a preliminary proposal to address the problem.

It is expected that good practice will be applied in sampling and analysis. For examples of methods of analysis, refer to Appendix 3.0, *Recommended Test Methods,* and the references relating to site assessment and groundwater protection listed in Appendix 1.0 *References*.

Appendix 5.0

Calculation of the Reynold's Number

The Reynolds Number (Re) can be determined as follows:

$$Re = \frac{VD}{Ki}$$

where V = average velocity in the secondary chamber used to calculate residence time, m/s

D = diameter (or equivalent diameter) or flow stream in the secondary chamber used to calculate residence time, m

Ki = kinematic viscosity, m^2/s

As an example of this calculation, assume a secondary chamber has a wet gas flowrate of 0.2 Nm^3/s; a square internal duct size of 0.61 x 0.61 m; and an equivalent diameter of 0.67 m and is 1 m long. The gas flow is at a temperature of 1 000°C, and is at a velocity of 2.3 m/s. From Figure 1; K=140 x 10^{-6} at 1 000°C.

Therefore:

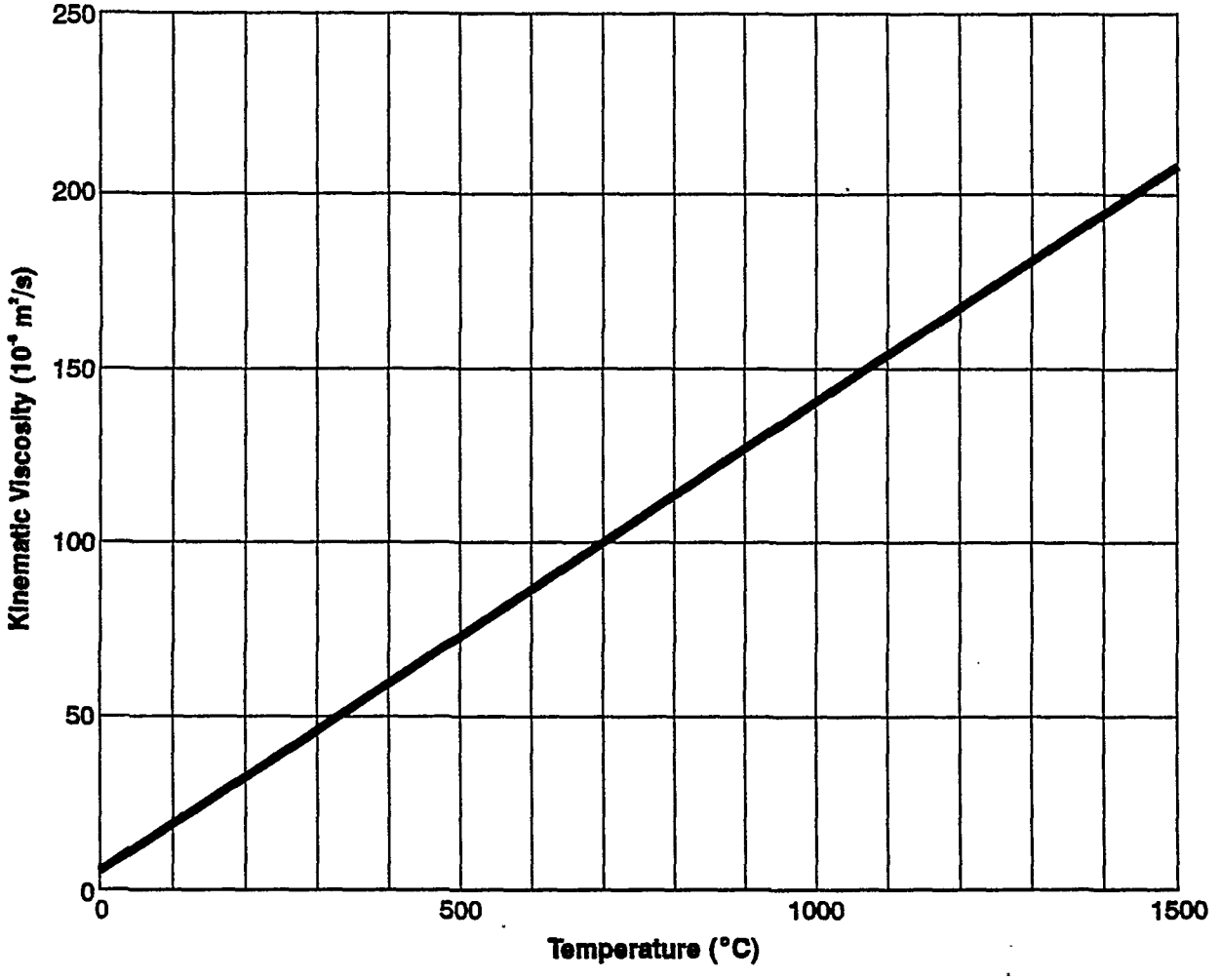
$$Re = \frac{VD}{Ki}$$

$$Re = \frac{2.3\ m/s \times 0.67 m}{140 \times 10^{-6} m^2/S}$$

$$= 11\ 000$$

This is greater than the minimum Re of 10 000 and turbulence can be assumed to be adequate.

Figure 1 Air Viscosity Versus Temperature



Appendix 6.0

Waste Minimization

6.1 Introduction

The **purpose** of this section is to describe waste minimzation philosophies and to promote an active participation in waste minimization by all licensees and/or approval holders.

Waste minimization is a continuous improvement practice. It is an ongoing process involving the 4Rs (Reduce, Reuse, Recycle, and Recover), and includes the full-cycle assessment of environmental effects and the associated economic and technical feasibility of the various management options.

The oil and gas industry is encouraged to promote waste minimization within their operations. Because of the potentially significant volumes of waste which require handling and disposal, the industry should ensure effective management strategies are employed to minimize and effectively handle wastes in a diligent manner.

The 4Rs represent the minimization strategies that may be employed to reduce wastes requiring disposal.

Reduction offers petroleum companies the greatest options for waste minimization and can usually be applied on-site. The ultimate way to manage waste is to not produce it in the first place, or to only produce environmentally non-reportable wastes which are easier and less costly to dispose. Reuse can also be applied on-site. The on-site application of Recycle and Recover are limited and usually require the use of an off-site waste contractor for waste treatment.

The most effective waste management practice is to avoid the production of waste in the first place.

Waste minimization provides:

- savings in raw material and production costs,
- a reduction in environmental implications (risk),
- savings in time and energy,
- lower waste treatment and disposal costs,
- reduced liabilities,
- improved corporate image, and
- less employee exposure to hazardous materials.

6.2 Waste Minimization Strategies

1. Reduce

Waste reduction is the preferable option. It is best to produce as little waste as possible by reducing the waste at source. In some cases, the production of the waste can be totally eliminated. For example:

- Purchase chemicals in bulk to reduce container waste and the frequency of possible spillage when handling.
- Segregate process streams to minimize sludge or liquid production, and to optimize reduction/recycle options.
- Prevent leaks and spills to eliminate contaminated soils.
- Dry sludges prior to treatment and disposal, thereby reducing the waste volume and allowing easier dry waste disposal.
- Train and motivate employees to practice waste reduction.
- Improve material receiving, storage, and handling practices to reduce losses.
- Install more efficient processing equipment or improve the operating efficiency of existing equipment.
- Analyze compressor and engine lubricating oils by a laboratory to determine if an oil change is actually required.
- Reduce the use of filters in water injection streams, if possible.
- Discontinue the use of treater hay from treater vessels.
- Review the need for certain products in operations.
- Use less hazardous substitutes for toxic products (i.e. the use of fresh water gel drilling systems as opposed to invert muds, when possible).

2. Reuse

If a waste is produced, every effort should be made to reuse it, for example:

- clean oil rags,
- use reusable filters,
- reuse filtered lube oil for chemical injection pumps, and

- filter gear lubricating oil to extend period of use.

3. Recycle

This option usually requires off-site contract services.

Although recylcing does help to conserve resources and reduce wastes, there are economic and environmental costs associated with waste collection and recycling processes. Recycling should only be used for wastes which cannot be reduced or reused. Segregate all wastes that are to be recycled. Recycling examples include:

- Use waste acids for the neutralization of caustic wastes.
- Recycling lube oil, glycol, solvents, unspent chemicals, batteries, paper, metal, plastic containers, and glass.

4. Recover

This option usually requies off-site contract services.

Some wastes may contain recoverable substances that can be reused, for example:

- Separating and recovering high levels of hydrocarbons in wash water.
- Recover oil from oily sludges.

Appendix 7.0

Waste Listings

7.1 Listed Wastes

In all cases, it is the generator's responsibility to ensure that all wastes are characterized and classified as well as treated and disposed of correctly. Wastes listed in Section 7.4 of Appendix 7.0, *Waste Management Table,* have been characterized and classified based on historical knowledge, previous testing, and a known origin of waste streams. The purpose of this waste management table is to provide waste generators with some common acceptable practices and criteria. It provides a starting point for characterization, classification, and the treatment/disposal of common oilfield waste streams.

In applying these classifications, it is imperative that generators examine their own wastes to determine if standard industry practices have resulted in the production of the waste and that their wastes fit the listed type. Any unusual operations, process, or site-specific conditions may result in a change in a waste's characteristics. Where classification of a waste is unclear, refer to AEP's *Alberta Users Guide for Waste Managers* for further information.

Waste generators are reminded to confirm with individual waste management facility operators the specific waste streams their facilities are approved to accept.

7.2 Unlisted Wastes

Waste types not listed in Section 7.4 of Appendix 7.0, *Waste Management Table*, must be classified according to Section 5.0, *Procedures for Classifying Waste.* Based on the characteristics of the waste, refer to the miscellaneous waste section in Section 7.4 of Appendix 7.0 for the EUB waste code, and refer to Appendix 3.0, *Recommended Test Methods*, for test methods.

7.3 Changes to Oilfield Waste Management Table

The *Waste Management Table*, Section 7.4 of Appendix 7.0, will be reviewed through a government/industry committee from time to time to consider requests for changes to the table.

Information required for this review will include:

- scientifically or operationally documented information on why the change should be made,
- historical analysis of the typical waste stream and its variability,

- consideration of the safety and environmental consequences of the proposed handling, treatment, and disposal of the waste, and

- consideration of any concerns of the public, the regulatory agencies, and the petroleum industry.

7.4 Waste Management Table

- It is the generators' responsibility to ensure wastes are treated and disposed of correctly. This table is based on wastes produced through the use of standard industry practices. If unusual properties are suspected to exist or the characteristics are uncertain, the general characterization method outlined in Section 6.2, *Procedures for Classifying Waste*, must be used.
- This table contains treatment and disposal information. Other issues such as worker safety, material handling, and storage should also be considered. References for these areas include CAPP's *Production Waste Management Handbook*, WHMIS and TDG. All requirements of TDG must be complied with.
- The use of the "Acceptable Practices" column does not result in the reclassification of a Dangerous Oilfield Waste or a waste indicated as "Testing Required" to a Non-Dangerous Oilfield Waste.
- Where classification of a waste is unclear, refer to AEP's *Alberta Users Guide for Waste Managers*, for further information.

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Absorbents [OILABS]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Reuse via laundering/dry-cleaning - Remove entrained liquids and landfill at an approved Class Ia, Ib or II landfill depending on specific characteristics - Thermal treatment	- Normally not a DOW (depending on flash point or ignitability or leachate). If BTEX > 1000 mg/kg, it cannot be landfilled
Acid Solutions (unneutralized) [ACID]	Dangerous Oilfield Waste	- Use classification according to parent product	corrosivity, heavy metals, flash point (if hydrocarbon present)	- Adjust pH prior to disposal (if possible) - Recover any hydrocarbons prior to disposal - Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (pH 6.0 - 9.0) (if heavy metal content meets criteria outlined in EUB Guide G-51) - Physical/chemical treatment	- See EUB Guide G-51 for injection well requirements

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Activated Carbon [ACTCRB]	Testing Required	- Class 4.2 UN1362 N-DOW Not TDG regulated	flash point, leachate	DOW - Reuse/regenerate - Thermal treatment N-DOW - Reuse/regenerate - Co-dispose (amendment) with soil sterilant contaminated materials - Landfill at an approved Class Ia, Ib or II landfill depending on specific characteristics	- This waste may be DOW depending on leachate characteristics. If BTEX > 1000 mg/kg, it cannot be landfilled
Asbestos [ASBEST]	See comments	- Waste White Asbestos, Class 9.1, UN2590 - Waste Blue or Brown Asbestos, Class 9.1, UN2212	toxic airborne fibres	- Wet to reduce airborne dispersal and double bag - Landfill at an approved Class Ia, Ib, or II landfill (must be covered immediately upon disposal)	- See AEP's *Guidelines for the Disposal of Asbestos Waste*, August 1989
Batteries (Wet and Dry Cell) [BATT]	Wet Cell - Dangerous Oilfield Waste Dry Cell - Non-Dangerous Oilfield Waste (Unless containing KOH)	- Wet cell - Class 8(9.2), UN2794 - acid UN2795 - alkali - Dry cell - not TDG regulated (unless KOH) (NI-Cd)	- corrosivity, leachate (heavy metals)	- Recycle via battery recycler - Remove liquids (wet batteries) and neutralize - Landfill containers at an approved Class Ia, Ib, or II landfill (depending on battery type)	- Alkaline batteries may be disposed of as per "Garbage - Domestic Waste"

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Boiler Blowdown Water [BLBDWT]	See comments	- Not TDG regulated (unless contaminated with a DOW)		DOW - Reuse - Inject down EUB Class Ia or Ib disposal well (depending on heavy metals) N-DOW - Reuse - Inject down EUB Class Ia or Ib disposal well - Surface discharge (must conform with discharge criteria outlined in Section 5.2.2 of EUB Guide G-55 and be cooled to below 50°C prior to discharge)	- Normally not a DOW (unless containing Cr, V, or other additives) - See EUB Guide G-51 for injection well requirements
Catalyst (Non-Sulphur) [CATNS]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate, pyrophoric characteristics	DOW - Reuse/regenerate - Containerize and landfill at an approved Class Ia or Ib landfill N-DOW - Reuse/regenerate - Containerize and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- This waste may be DOW depending on leachate characteristics. If BTEX > 1000 mg/kg, it cannot be landfilled

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Catalyst (Sulphur) [CATSU]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate, corrosivity, pyrophoric characteristics	- Reuse/regenerate - Containerize and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics (add lime as per AEP guidelines)	- This waste may be DOW depending on leachate characteristics. If BTEX > 1000 mg/kg, it cannot be landfilled - See AEP's *Guidelines for the Disposal of Sulphur Containing Solid Wastes*, March 1983
Caustic Solutions (unneutralized, spent) [CAUS]	Dangerous Oilfield Waste	- Use classification according to parent product	corrosivity	- Adjust pH prior to disposal (if possible) - Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (ph 6.0 - 9.0) - Physical/chemical treatment	- May be Waste Type 203 (if used to clean heat exchangers that possess lead-containing materials [i.e. solder, adhesives]) - See EUB Guide G-51 for injection well requirements
Cement (Returns Dry) [Cement]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Crush material and bury on lease with at least 1 meter of cover - Landfill at an approved Class Ia, Ib, I,I or III landfill - Incorporate material into gravel on site or on entrance road	
Chemicals (Inorganic) [INOCHM]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	Dangerous when wet, oxidizer, toxicity, corrosivity, leachate	- Disposal practice will vary with specific chemical (consideration of compatability and solubility) - Reuse/recycle when possible - Contact chemical waste exchange - Physical/chemical treatment	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Chemicals (Organic) [ORGCHM]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	Flash point, oxidizer, toxicity, corrosivity, leachate	- Disposal practice will vary with specific chemical - Reuse/recycle when possible - Contact chemical waste exchange - Physical/chemical treatment - Thermal treatment	
Construction and Demolition Material [CONMAT]	See comments	- Not TDG Regulated (unless contaminated with a DOW)		DOW - Decontaminate and reuse - Landfill at an approved Class Ia or Ib landfill N-DOW - Reuse - Landfill at an approved Class Ia, Ib, II, or III landfill	- Normally not a DOW (unless contaminated with a DOW)
Contaminated Debris and Soil (Chemical/ Solvent) [SOILCH]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate, toxicity	- Disposal/treatment based on specific parameters of waste - Thermal treatment - Physical/chemical treatment - Biodegradation - Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Contaminated Debris and Soil (Crude Oil/ Condensate) [SOILCO]	See comments	- Class 4.1. UN 3175	flash point, leachate	- Biodegradation on-site (or off-site at an approved facility) - Send to an approved oilfield waste processing facility for hydrocarbon recovery - Thermal treatment	- Normally not a DOW (depending on flash point and BTEX content)
Contaminated Debris and Soil (Mercury/Metals) [SOILHM]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate (heavy metals), toxicity	- Physical/chemical treatment - Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics (Hg < 20 mg/kg - waste extract)	
Contaminated Debris and Soil (Pesticide/ Herbicide) [SOILPT]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	toxicity, leachate	- On-site treatment (with activated carbon) - Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Consult the Industrial Vegetation Management Association of Alberta's *Field Manual for Rehabilitating Soils Affected by Residual Herbicides*, April 1987
Contaminated Debris and Soil (Produced/Salt Water) [SOILPW]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- On-site treatment - Send to an approved oilfield waste processing facility for soil washing - Landfill at an approved Class Ia, Ib, or II landfill	
Contaminated Debris and Soil (Refined Fuels/Oils) [SOILRO]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Biodegradation on-site (or off-site at an approved facility) - Send to an approved oilfield waste processing facility - Thermal treatment	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Contaminated Debris and Soil (Sulphur) [SOILSU]	Non-Dangerous Oilfield Waste	- Not TDG Regulated (unless contaminated with a DOW)		- On-site treatment - Landfill at an approved Class Ia, Ib, or II landfill (add lime to neutralize at time of burial)	- See AEP's *Guidelines for the Disposal of Sulphur Containing Solid Wastes*, March 1983
Corrosion Inhibitor/Oxygen Scavenger Solutions [CORINH]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	heavy metals	- Inject down EUB Class Ib disposal well (if heavy metal limits are not exceeded) - Inject down EUB Class Ia disposal well (if heavy metal limits exceeded)	- See EUB Guide G-51 for injection well requirements
Crude Oil/Condensate Emulsions (residuals after treatment) [COEMUL]	See comments	- Class 3, UN1267	flash point, leachate	- Send to an approved oilfield waste processing facility - Inject down EUB Class Ia or Ib disposal well - Cavern disposal - Thermal treatment - Biodegradation facility	- Normally not a DOW (depending on flash point and BTEX content) - All reasonable efforts must be made to recover hydrocarbon prior to disposal - See EUB Guide G-51 for injection well requirements
Dessicant [DESICT]	Testing required	DOW - Class 9.3 NA 9500 N-DOW - Not TDG regulated	corrosivity, flash point, leachate	DOW - Reuse/regenerate - Containerize and landfill at an approved Class Ia or Ib landfill N-DOW - Reuse/regenerate - Recycle (construction fill) - Containerize and landfill at an approved Class Ia, Ib or II landfill	- This waste may be DOW depending on leachate characteristics (BTEX). If BTEX > 1000 mg/kg, it cannot be landfilled

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Dimethyl Disulphide Solutions [DMDS]	Dangerous Oilfield Waste	- Class 3, UN 2331	flash point, toxicity	- Reuse if possible - Return to supplier - Inject down EUB Class Ia disposal well	
Drilling Sump Materials (Gel Chem) [SUMPGL]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Disposal in accordance with EUB Guide G- 50 (Revised)	- See EUB Guide G-50 (Revised) for specific disposal requirements
Drilling Sump Materials (Hydrocarbon) [SUMPIN]	See comments	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Disposal in accordance with EUB Guide G-50 (Revised)	- Normally not a DOW (depending on flash point and BTEX) - Obtain EUB approval prior to disposal - See EUB Guide G-50 (Revised) for specific disposal requirements
Drilling Sump Materials (KCL) [SUMPKC]	Non-Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations		- Disposal in accordance with EUB Guide G-50 (Revised)	- See EUB Guide G-50 (Revised) for specific disposal requirements - Obtain EUB approval prior to disposal
Filter Backwash Liquids (Gas Sweetening) [FLBWSW]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	leachate	- Inject down EUB Class Ia or Ib disposal well	- See EUB Guide G-51 for injection well requirements

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Filter Backwash Liquids (Water Treatment) [FLBWWT]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Reuse - Recycle (Land irrigation) - Return to source - Inject down EUB Class Ia or Ib disposal well	- See EUB Guide G-51 for injection well requirements - High sediment and organic content would require downhole injection
Filters Glycol [FILGLY]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, containerize to prevent contact with air and landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Recovered entrained liquids are DOW and should be recycled or injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements
Filters (Media) - Water Treatment [FILWTT]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	DOW - Reuse/regenerate - Containerize and landfill at an approved Class Ia or Ib landfill N-DOW - Reuse/regenerate - Recycle (construction fill) - Containerize and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- This waste may be DOW depending on leachate characteristics. If BTEX > 1000 mg/kg, it cannot be landfilled

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Filters - Air Pollution Control [FILAPC]	Testing required	- Dependent on specific waste characteristics, consult TDG Regulations		- Biodegradation - Thermal treatment - Landfill to an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (depending on leachate characteristics)
Filters - Gas Sweetening (MEA, DEA, MDEA, Sulphinol) [FILSWT]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, containerize to prevent contact with air and landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Recovered entrained liquids are DOW and should be recycled or injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements
Filters - Lube Oil (Waste Type 201) [FILLUB]	Undrained - Dangerous Oilfield Waste Drained - Non-Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Internal combustion engine lube oil filters are N-DOW if they are fully drained and have a drainage efficiency (DE) > 0.5 DE = $\frac{\text{Undrained weight - drained weight}}{\text{Undrained weight - new filter weight}}$ - Recovered entrained liquids are DOW and should be recycled or injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Filters - Methanol [FILMTH]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Recovered entrained liquids are DOW and should be recycled or injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements
Filters - Other (Raw/Fuel Gas, NGL's) [FILOTH]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, containerize to prevent contact with air and landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Recovered entrained liquids are DOW and should be recycled or injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements
Filters - Produced/ Process Water [FILPWT]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics, leachate	- Recycle (metal recovery) - Thermal treatment - Drain liquids, containerize to prevent contact with air and landfill at an approved Class Ia or Ib landfill	- CAPP has developed a sampling and testing protocol for waste filters - Recovered entrained liquids may be DOW and should be injected down an EUB Class Ia or Ib disposal well - See EUB Guide G-51 for injection well requirements
Filters -Raw/ Fresh Water [FILFWT]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Landfill at an approved Class Ia, Ib, II, or III landfill	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Frac Sand - Non-Radioactive [FRCSND]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Recycle (return to supplier) - Send to an approved oilfield waste processing facility for hydrocarbon recovery - Containerize and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (depending on flash point or leachate characteristics). If BTEX > 1000 mg/kg, the waste cannot be landfilled
Frac Sand-Radioactive (Plus other Radioactive Diagnostic Materials) [FRSDR]	See Comments	- Class 7	leachate	- Recycle (return to supplier) - Bury on-site in accordance with Atomic Energy Control Board Guidelines	- See Part F, Section 31.0 for specific disposal procedures - Radioactive materials must **not** be handled at a waste processing facility and cannot be road disposed - Radioactive frac sand is regulated by the Atomic Energy Control Board (AECB). AECB approval is required for any transportation or disposal of the waste - Waste may be DOW after radioactive decay (heavy metal and radioactive tracer leachate characteristics)
Garbage/Domestic Waste [DOMWST]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Implement the 4R's to reduce volumes (see Appendix 6) - Landfill at an approved Class Ia, Ib, II, or III landfill	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Glycol Solutions (Containing Lead or other Heavy Metals) (Waste Type 202) [GLYCHM]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity (heavy metals)	- Recycle - Inject down EUB Class Ia disposal well (glycol < 40 per cent by mass)	- Glycol solutions from vessels containing lead solder - Identified as Waste Type #202 in AEP's *Alberta Users Guide for Waste Managers*, May 1995 - See EUB Guide G-51 for injection well requirements
Glycol Solutions (No Heavy Metals) [GLYC]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity	- Recycle - Inject down EUB Class Ia or Ib disposal well (glycol < 40 per cent by mass)	- May be a DOW depending on flash point and toxicity - See EUB Guide G-51 for injection well requirements
Hydraulic and Transmission Oil [HYDOIL]	See Comments	- Not TDG Regulated (unless contaminated with a DOW)	heavy metals	- Direct to a licensed lube oil recycling firm - Thermal treatment	- Normally not a DOW (depending on heavy metal content; i.e. Va, V)
Hydrotest Fluids - Methanol [METHNL]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity	- Reuse - Recycle - Inject down EUB Class Ia or Ib disposal well (organics < 10 per cent by mass)	- See EUB Guide G-51 for injection well requirements

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Incinerator Ash [INCASH]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate (heavy metals)	DOW - Landfill at an approved Class Ia or Ib landfill N-DOW - Recycle (construction fill) - Landfill at an approved Class Ia, Ib, or II landfill - Physical/chemical treatment	
Ion Exchange Resin [IEXRES]	Non-Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations		- Containerize and landfill at an approved Class Ia, Ib, or II landfill	
Ion Exchange Resin Regenerant Liquids [IEXLIQ]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations		- Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (pH 6.0 - 9.0)	- Normally not a DOW (depending on pH) - See EUB Guide G-51 for injection well requirements
Iron Sponge [IRNSPG]	Dangerous Oilfield Waste	- Class 4.2, UN1376	pyrophoric characteristics, leachate	- Keep wet to avoid spontaneous combustion; isolate from acidic solutions - Reuse/regenerate - Landfill at an approved Class Ia or Ib landfill (add lime or equivalent at time of burial to neutralize)	- Waste may be susceptible to spontaneous combustion - this material should be kept wet at all times - See AEP's *Guidelines for the Disposal of Sulphur Containing Solid Wastes*

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Lead Based Products (H_2S Sensing Tape) [LDTAPE]	Dangerous Oilfield Waste	- Class 6.1 (9.2), UN1616	heavy metals (Pb)	- Landfill at an approved Class Ia or Ib landfill	
Lead Based Products (Pipe Dope/Greases) [LDDOPE]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	heavy metals (Pb)	- Recycle (if possible) - Thermal treatment - Landfill at an approved Class Ia or Ib landfill	
Lubricating Oil (Hydrocarbon and Synthetic) [LUBOIL]	See Comments	- Not TDG Regulated (unless contaminated with a DOW)	heavy metals, flash point	- Direct to a licensed lube oil recycling facility - Thermal treatment	- Normally not a DOW (depending on heavy metal content; i.e. Va, V)
Metal (Scrap) [SMETAL]	See Comments	- Not TDG Regulated (unless contaminated with a DOW)		DOW - Decontaminate and recycle via a scrap metal dealer - Landfill at an approved Class Ia or Ib landfill N-DOW - Recycle via a scrap metal dealer - Landfill at an approved Class Ia, Ib, II, or III landfill	- Normally not a DOW (unless contaminated with sulphur, chemicals, oil, or other DOW wastes)

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Naturally Occurring Radioactive Materials - NORMs [NORM]	Dangerous Oilfield Waste	- Class 7	toxicity	- General disposal guidelines as given in the Alberta Labour Guidelines *Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada*	- See Part F, Section 31.0 for specific disposal procedures - General guidelines for the handling and disposal of NORM waste have been developed by the Western Canada NORM Committee. *Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada* are available from Alberta Labour
Paints [WPAINT]	Dangerous Oilfield Waste	- Class 3, UN1263 (if flammable) - Class 8, UN3066 (if corrosive)	toxicity, flash point, heavy metals	- Physical/chemical treatment - Thermal treatment - Recycle (if possible) - Approved toxic roundup (if small volumes)	
Pesticides/ Herbicides [PSTHRB]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	toxicity	- Avoid excessive volumes - Waste material exchange programs - Thermal treatment - Approved toxic roundup (if small volumes)	- Utilize third party certified applicators for the application and disposal of pesticides when possible
Pigging Waste (Liquid and Wax) [PIGWST]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics	- Send to an approved oilfield waste processing facility for hydrocarbon recovery - Thermal treatment - Cavern disposal - Landfill at an approved Class Ia or Ib landfill (must be solid)	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Polychlorinated Biphenyls (PCBs) Askarel Liquids [PCBLIQ]	Dangerous Oilfield Waste	- Class 9.1, 9.2, UN2315	toxicity	- Direct to an approved hazardous waste disposal facility	
Polychlorinated Biphenyls (PCBs) - Contaminated Solids < 50 ppm [PCBSLF]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Landfill at an approved Class Ia or Ib landfill	
Polychlorinated Biphenyls (PCBs) - Contaminated Solids > 1000 ppm [PCBSGI]	Dangerous Oilfield Waste	- Class 9.1, 9.2, UN2315	toxicity	- Direct to an approved hazardous waste disposal facility	
Polychlorinated Biphenyls (PCBs) - Contaminated Solids > 50 ppm and < 1000 ppm [PCBSLI]	Dangerous Oilfield Waste	- Class 9.1, 9.2, UN2315	toxicity	- Direct to an approved hazardous waste disposal facility - Landfill at an approved Class Ia or Ib landfill	
Polychlorinated Biphenyls (PCBs) - Fluorescent Light Ballasts [PCBBAL]	Dangerous Oilfield Waste	- Class 9.1, 9.2 UN2315	toxicity	- Direct to an approved hazardous waste disposal facility - Recycle metal component if possible	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Rags [OILRAG]	See Comments	- Not TDG regulated (unless contaminated with a DOW		- Reuse via laundering/dry-cleaning - Remove entrained liquids and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (depending on flash point or leachate). If BTEX > 1000 mg/kg, it cannot be landfilled
Salt Heat Medium [SALT]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations		- Solubilize using an existing aqueous waste stream and inject down an EUB Class Ia or Ib disposal well - Physical/chemical treatment	- Normally not a DOW (unless a strong oxidizer such as potassium or sodium salts) - See EUB Guide G-51 for injection well requirements
Sand - Produced [SAND]	See Comments	- Class 4.1, UN3175		- Send to an approved oilfield waste processing facility for hydrocarbon recovery - Recycle (other industrial uses) - Use in road construction in accordance with EUB IL 95-04 - Cavern disposal - Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (depending on flash point or leachate characteristics). If BTEX > 1000 mg/kg, it cannot be landfilled
Sludge - Cooling Tower [SLGCTW]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	leachate (heavy metals)	- Physical/chemical treatment - Cavern disposal	- May be Waste Type 204 if hexavalent chromium used as a biocide in cooling waters

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Sludge - Flare Pit [SLGPIT]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate, toxicity	- Disposal is based on specific waste characteristics determined from analytical or historical data - Disposal options include: - physical/chemical treatment - approved Class Ia, Ib, or II landfill depending on specific characteristics - biodegradation (on-site or off-site at an approved facility) - thermal treatment - approved oilfield waste processing facility	
Sludge - Gas Sweetening Systems [SLGSWT]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Disposal is based on specific waste characteristics determined from analytical or historical data - Disposal options include: - physical/chemical treatment - approved Class Ia or Ib landfill - biodegradation - thermal treatment	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments

Sludge - Glycol/Gas Drying [SLGGLY]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate, toxicity	- Disposal is based on specific waste characteristics determined from analytical or historical data
				- Disposal options include:
				  - physical/chemical treatment
				  - biodegradation
				  - thermal treatment
				  - inject down EUB Class Ia or Ib disposal well (glycol < 40 per cent by mass)	

Sludge - Hydrocarbon [SLGHYD]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, leachate	- Disposal is based on specific waste characteristics determined from analytical or historical data
				- Disposal options include:
				  - approved oilfield waste processing facility
				  - physical/chemical treatment
				  - biodegradation
				  - thermal treatment
				  - Approved Class Ia, Ib, or II landfill depending on specific characteristics	

Sludge - Lime [SLGLIM]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	corrosivity	- Co-dispose with sulphur containing wastes or soil at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- DOW if pH > 12.5

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments

Sludge - Process [SLGPRO]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate	- Disposal is based on specific waste characteristics determined from analytical or historical data
				- Disposal options include:
				  - physical/chemical treatment
				  - approved Class Ia, Ib, or II landfill depending on specific characteristics
				  - biodegradation
				  - thermal treatment	

Sludge - Sulphur [SLGSUL]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	leachate, corrosivity	- Co-dispose with slightly basic wastes or soil at an approved Class Ia, Ib, or II landfill depending on specific characteristics - Physical/chemical treatment	- See AEP's *Guidelines for the Disposal of Sulphur Containing Solid Waste*, March 1983
Solvents/Residues (Halogenated) [SOLHAL]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity, leachate	- Recycle (regenerate, alternate uses) - Thermal treatment	
Solvent/Residues (Non-Halogenated Aliphatic) [SOLALP]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity, leachate	- Recycle (regenerate, alternate uses) - Thermal treatment	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Solvents/Residues (Non-Halogenated Aromatic) [SOLARO]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, toxicity, leachate	- Recycle (regencrate, alternate uses) - Thermal treatment	
Sweetening Agents (Liquids) [SWTLIQ]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations		- Inject down an EUB Class Ia, or Ib disposal well	- Normally not a DOW (depending on leachate characteristics and flash point) - See EUB Guide G-51 for injection well requirements
Sweetening Agents (Solids) [SWTSOL]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations		- Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (depending on leachate characteristics)
Thread Protectors - Casing/Tubing [THPROT]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Reuse (return to pipe supplier) - Recycle - Landfill at an approved Class Ia, Ib, II, or III landfill	
Treater Hay [TRTHAY]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, pyrophoric characteristics	- Direct to an approved oilfield waste processing facility for hydrocarbon recovery - Thermal treatment	- May be a DOW depending on flash point, or leachate characteristics

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Wash Fluids - Organic [WSHORG]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, halogenated organics content, toxicity	- Recycle (regenerate, alternate uses) - Recover hydrocarbons and inject down EUB Class Ia or Ib disposal well - Thermal treatment	- See EUB Guide G-51 for injection well requirements
Wash Fluids - Water [WSHWTR]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations		- Recover hydrocarbons and inject down EUB Class Ia or Ib disposal well	- Normally not a DOW (depending on organic content, flash point, pH) - See EUB Guide G-51 for injection well requirements
Water Process (with Organic Chemicals) [PWTROR]	Testing Required	- Dependent on specific waste characteristics, consult TDG Regulations	flash point, halogenated organics content, toxicity	- Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (pH 6.0 - 9.0)	- See EUB Guide G-51 for injection well requirements
Water - Process (with Heavy Metals) [PWTRHM]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations	heavy metals, pH	- Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (pH 6.0 - 9.0) (if heavy metal content meets criteria outlined in EUB Guide G-51)	- See EUB Guide G-51 for injection well requirements
Water - Produced (Including Brine Solutions) [WATER]	Non-Dangerous Oilfield Waste	- Not TDG Regulated (unless contaminated with a DOW)		- Recycle (waterflood) - Recover hydrocarbons and inject down EUB Class Ia, Ib, or II disposal well	- See EUB Guide G-51 for injection well requirements

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Well Workover Fluids [WWOFLD]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations	corrosivity, flash point	- Inject down EUB Class Ia disposal well (pH 4.5 - 12.5) - Inject down EUB Class Ib disposal well (pH 6.0 - 9.0) - Recover any hydrocarbons prior to disposal	- See EUB Guide G-51 for injection well requirements - Heavy metals are not normally a concern for well servicing fluids
Wood (Chemically Treated/Cooling Tower) [WOODCT]	See comments	- Dependent on specific waste characteristics, consult TDG Regulations	heavy metals, leachate	- Landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Normally not a DOW (unless in dispersed form and due to leachate characteristics and/or pentachlorophenol content)

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Empty Containers					
Aerosol Cans [EMTCON]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Recycle (if possible) - Ensure containers are empty and landfill at an approved Class Ia, Ib, or II landfill	
Barrels, Pails [EMTCON]	See Comments	- Dependent on previous contents, consult TDG regulations		- Reuse/return to supplier - Recycle (barrel/container reconditioning) - Rinse (see Section 5.3), crush and landfill at an approved Class Ia, Ib, or II landfill	- Normally not a DOW (see Section 5.3) - Containers must be completely empty (see Section 5.3)
Crude Oil Sample Bottles [EMTCON]	Non-Dangerous Oilfield Waste	- Class 3, UN1267		- Reuse - Recycle (commercial bottle washing facility or a plastic/glass recycling facility) - Rinse and landfill at an approved Class Ia, Ib, or II landfill	
Cutting Oil Tubes [EMTCON]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Landfill at an approved Class Ia, Ib, or II landfill	
Grease Cartridges [EMTCON]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Landfill at an approved Class Ia, Ib, or II landfill	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Mud Sacks - Drilling [EMTCON]	Non-Dangerous Oilfield Waste	- Not TDG Regulated		- Reuse (return to mud supplier) - Landfill at an approved Class Ia, Ib, II, or III landfill - Approved thermal treatment	
Paint Cans/Brushes [EMTCON]	See Comments	- Not TDG Regulated (if dry)	toxicity	- Allow residue to dry and landfill at an approved Class Ia, Ib, or II landfill	- Not a DOW if empty and dry
Pesticide/ Herbicide Containers [PSTCON]	Dangerous Oilfield Waste	- Dependent on specific waste characteristics, consult TDG Regulations or supplier of pesticide	toxicity	- Recycle (Pesticide container collection site) - Rinse (see Section 5.3), crush, puncture and landfill at an approved Class Ia, Ib, or II landfill with a designated pesticide container collection site	- Containers must be completely empty and rinsed (see Section 5.3)
Pipe Dope Containers/ Brushes [EMTCON]	See Comments	- Dependent on specific waste characteristics, consult TDG Regulations	heavy metals	- Reuse (if possible) - Rinse (see Section 5.3) and landfill at an approved Class Ia, Ib, or II landfill depending on specific characteristics	- Not a DOW if empty and dry
Miscellaneous Wastes					
Waste Compressed or Liquified Gases [WSTCGS]	Dependent on specific waste	- Dependent on specific waste - Class 2	dependent on specific waste	- Dependent on specific waste	
Waste Flammable Liquid [WSTFLQ]	Dependent on specific waste	- Dependent on specific waste - Class 3	flammability	- Dependent on specific waste	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Waste Flammable Solid [WSTFSD]	Dependent on specific waste	- Dependent on specific waste - Class 4	flammability	- Dependent on specific waste	
Waste Oxidizing Liquid [WSTOLQ]	Dependent on specific waste	- Dependent on specific waste - Class 5	oxidizes	- Dependent on specific waste	
Waste Oxidizing Solid [WSTOSD]	Dependent on specific waste	- Dependent on specific waste - Class 5	oxidizes	- Dependent on specific waste	
Waste Poisonous Liquid [WSTPLQ]	Dependent on specific waste	- Dependent on specific waste - Class 6	toxicity	- Dependent on specific waste	
Waste Poisonous Solid [WSTPSD]	Dependent on specific waste	- Dependent on specific waste - Class 6	toxicity	- Dependent on specific waste	
Waste Radioactive Material [WSTRDM]	Dependent on specific waste	- Dependent on specific waste - Class 7	toxicity	- Dependent on specific waste	
Waste Corrosive Liquid [WSTCLQ]	Dependent on specific waste	- Dependent on specific waste - Class 8	toxicity, corrosivity	- Dependent on specific waste	
Waste Corrosive Solid [WSTCSO]	Dependent on specific waste	- Dependent on specific waste - Class 8	corrosivity	- Dependent on specific waste	

Waste Management Table (cont'd)

EUB Waste Name [Waste Code]	Oilfield Class	Common Transport Class	Common Criteria	Common/Acceptable Practices	Comments
Waste - Miscellaneous [WSTMIS]	Dependent on specific waste	- Dependent on specific waste - Class 9		- Dependent on specific waste	

- It is the generators' responsibility to ensure wastes are treated and disposed of correctly. This table is based on wastes produced through the use of standard industry practices. If unusual properties are suspected to exist or the characteristics are uncertain, the general characterization method outlined in Section 6.2, *Procedures for Classifying Waste*, must be used.
- This table contains treatment and disposal information. Other issues such as worker safety, material handling, and storage should also be considered. References for these areas include CAPP's *Production Waste Management Handbook*, WHMIS and TDG. All requirements of TDG must be complied with.
- The use of the "Acceptable Practices" column does not result in the reclassification of a Dangerous Oilfield Waste or a waste indicated as "Testing Required" to a Non-Dangerous Oilfield Waste.
- Where classification of a waste is unclear, refer to AEP's *Alberta Users Guide for Waste Managers*, for further information.

Appendix 8.0

Oilfield Waste Disposition Annual Report

Oilfield Waste Disposition Annual Report

Operator Code:	Operator Name:	Operator Address:
Reporting Year:	Filling Date:	Amendment (X if yes):
Operator Contact Person:	Operator Contact Phone No.	
No Waste Disposed (X if yes):	Operator Contact Fax No.	

Waste Details					Disposal Methods																		
						Disposal Wells				Landfills													
Source	Waste Code	Total Quantity Disposed	Adjustments	Units (m³) (tonne)	Waste Processing Facility	Ia Well	Ib Well	II Well	Cavern	Ia	Ib	II	III	Biodeg. Facility	Thermal Treatment	Used Oil Recycler	Recycling Facility	Swan Hills	Small Oilfield Waste Incinerators	Biodeg. (On-site)	Road Spread	Burial (On-site)	Others

This information from Directive 030 replaces Appendix 8.1 and 8.2 in Directive 058 (February 1, 2006)

4 Annual Oilfield Waste Disposition Reporting Instructions and Computer Data Format Changes

4.1 Instructions to Complete the Oilfield Waste Disposition Report

Overview

All licensees/approval holders (oilfield waste generators) are required to implement and maintain a waste tracking system that is capable of providing the information required for the Annual Oilfield Waste Disposition Report. The oilfield wastes are required to be tracked from the initial point of generation through to the final disposition location (cradle to grave). This report provides the EUB with annual summaries regarding the types and quantities of oilfield wastes generated, the source of the oilfield waste, and the specific disposal or treatment methods used. Licensees/approval holders that are selected to submit their annual oilfield waste disposition report are required to prepare this report in accordance with Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry (formerly Guide 58).

The following detailed information describes the changes to the table "computer data format."

Header Record Layout General Information

This section of the report is to identify the header record for the file. The following information must be entered:

- **Record Type Code:** Identifies the record type (submission by file or form) for the report header.
- **BA Code:** The code assigned by the EUB to individual companies to identify approval holders or the licensee of wells, facilities, or pipelines.
- **Waste Generation Year:** The year for which this oilfield waste disposition report applies.
- **Report ID:** Sequence associated to the waste generation year for the report.

Oilfield Waste Details

This section of the report is to identify all oilfield waste generation locations (e.g., facilities, wells, batteries, pipelines) of each oilfield waste type generated and the total quantity that was treated or disposed.

- **Licence Type:** The licence type must be identified as well (W), pipeline (P), or facility (F) to describe the licence type for the location where the oilfield waste was generated.
- **Licence Number:** The licence number for the location where the oilfield waste was generated.
- **Surface Location:** The surface location of the well or facility. (For file uploads only, either the surface location of the well or facility licence **or** the licence type and licence number may be provided.)
- **Waste Code:** EUB-assigned waste code for each specific type of oilfield waste reported.

- **Waste Volume:** Total quantity (up to 3 decimal places) of each specific oilfield waste type that was transported off site for management **or** the volume treated on site during the reporting period.
- **Waste Volume Adjustment:** The adjustment quantity, positive or negative, is required to balance the differences between the total quantities of each specific oilfield waste type sent for management and quantities received at the management location, should the quantities be different (up to 3 decimal places, e.g.,123456789.000). Negative numbers are indicated with a negative sign (-).
- **Waste Volume Units:** Units the oilfield waste type is reported in. Oilfield waste is to be reported in either cubic metres or tonnes at 101.325 kPa and 15°C. *(Note that if there are quantities of a waste stream in both tonnes and cubic metres, two separate entries must be made for that specific waste type*.)

Disposal/Treatment Details

This section of the report is to identify the disposal or treatment methods used for each specific oilfield waste type and the corresponding quantities managed.

- **Disposal/Treatment Method:** Oilfield waste disposal or treatment method used for each oilfield waste type reported.
- **Disposal/Treatment Volume:** Total quantity (up to 3 decimal places) of oilfield waste disposed or treated for the reported management method.

Disposal Methods

The purpose of this section of the report is to identify the disposal methods utilized for each specific waste type and the corresponding quantities disposed.
Note: For each waste type, the total of the quantities identified for all the disposal methods utilized must equal the total quantity disposed (reported under "Waste Details") plus or minus the reported adjustments. For waste delivered to transfer stations prior to disposal, it is the responsibility of the waste generator to obtain disposal details from the transfer station operator. Those disposal details are to be indicated in this report.

- **Waste Processing Facility:** Include all waste delivered to oilfield waste processing facilities for treatment prior to disposal.
- **Disposal Wells:** Include all waste delivered directly to disposal wells. Note: Do not include waste delivered to an oilfield waste processing facility for treatment prior to well disposal.

  Class Ia Disposal Well: Directly disposed in a Class Ia disposal well.

  Class Ib Disposal Well: Directly disposed in a Class Ib disposal well.

  Class II Disposal Well: Directly disposed in a Class II disposal well.

  Cavern: Directly disposed in a cavern.
- **Landfills:** Include all waste delivered directly to landfills. Note: Do not include waste delivered to an oilfield waste processing facility for treatment prior to landfill disposal.

  Class Ia Landfill: Directly disposed in a Class Ia landfill.

Class Ib Landfill: Directly disposed in a Class Ib landfill.

Class II Landfill: Directly disposed in a Class II landfill.

Class III Landfill: Directly disposed in a Class III landfill.

- **Biodegradation Facility:** Include all waste delivered directly to biodegradation facilities. Note: Do not include waste delivered to an oilfield waste processing facility for treatment prior to disposal at a biodegradation facility or waste treated on-site by bioremediation processes.
- **Thermal Treatment:** Include all waste delivered to or treated by fixed or mobile incinerators except waste disposed of by small batch feed and campsite incinerators.
- **Used Oil Recycler:** Include all waste delivered to facilities which collect used lubricating oils for reprocessing or fuel blending.
- **Recycling Facility:** Include all waste delivered to recycling facilities (excluding Used Oil Recyclers).
- **Swan Hills:** Include all waste delivered to the Swan Hills Hazardous Waste Treatment Centre.
- **Small Oilfield Waste Incinerators:** Include all waste disposed of by small batch feed and campsite incinerators.
- **Biodegradation (On-site):** Include all on-site waste treatment through bioremediation including biocells/biopiles and land treatment (exclude in situ).
- **Road Spread:** Include all waste disposed by road spreading.
- **Burial (On-site):** Include all waste disposed by on-site burial.
- **Transborder:** Include all waste shipped out of Alberta for disposal.
- **Others:** Include waste treated/disposed utilizing disposal methods not listed above.

4.2 Computer Data Format

Field	Start	Length	Format	Definition/Format/Usage
Header Record Layout–first row of upload file				
Record Type Code	1	3	9(3)	The code identifies the record type for the report header record. The information appears only once for the entire upload file (e.g., 001).
BA Code	4	4	X(4)	EUB-assigned company code (e.g., 0338).
Waste Generation Year	8	4	9(4)	Year for which the report applies (01 Jan – 31 Dec) (e.g., 1996).
Report ID	12	8	9(8)	Sequence associated to the reporting year for the specific report (leading zero fill) (e.g., 00000001).

(continued)

Field	Start	Length	Format	Definition/Format/Usage
Detailed Record Layout–second and each subsequent row of upload file				
Record Type Code	1	3	9(3)	The code identifies the record type for the report header record. The information appears on the second and each subsequent row of the entire upload file (e.g., 002).
BA Code	4	4	X(4)	EUB-assigned company code (e.g., 0338).
Waste Generation Year	8	4	9(4)	Year for which the report applies (01 Jan - 31 Dec) (e.g., 1996).
Report ID	12	8	9(8)	Sequence associated to the reporting year for the specific report (leading zero fill) (e.g., 00000001).
Oilfield Waste Details–an additional row for each unique waste code for a licence				
Licence Type	20	1	X(1)	This is the licence type as indicated as well (W), pipeline (P), or facility (F) to describe the licence type for where the oilfield waste was generated. Must enter W, P, or F.
Licence Number	21	9	X(9)	This is the licence number for the location where the oilfield waste was generated (e.g., 0000001).
Surface Location	30	17	X(17)	This is the complete surface location for the licence (includes Location Exception, LSD, Section, Township, Range, Meridian) (e.g., 00-11-26-045-06W4).
Waste Code	47	6	X(6)	EUB-assigned waste code (see the on-line help to download a list of waste codes).
Waste Volume	53	13	9(9)V3	Total quantity of each specific type of oilfield waste shipped or treated (up to 3 decimal places) (e.g., 123456789.000).
Waste Volume Adjustment	66	14	9(9)V3	The adjustment quantity, positive or negative, is required to balance the differences between the total quantities of each specific oilfield waste type sent for management and quantities received at the management location, should the quantities be different (up to 3 decimal places, e.g., 123456789.000). Negative numbers are indicated with a negative sign.
Waste Volume Units	80	1	X(1)	Units the oilfield waste type is reported in (cubic metres or tonnes). Must enter M or T**.**
Disposal/Treatment Details–an additional row for each unique disposal/treatment method for each oilfield waste code for each licence				
Disposal or Treatment Method	81	2	X(2)	Disposal or treatment method used for each oilfield waste type (see the on-line help to download a list of disposal or treatment methods).
Disposal or Treatment Volume	83	13	9(9)V3	Quantity of oilfield waste disposed or treated for the disposal or treatment method used (up to 3 decimal places, e.g., 123456789.000).