FINAL REPORT

UPDATING ALBERTA'S HAZARDOUS WASTE REGULATORY FRAMEWORK

Report Prepared by the Hazardous Waste Technical Committee for the Waste Management Stakeholder Group

November 30, 2006

EXECUTIVE SUMMARY

Alberta Environment is developing a long-term Waste Strategy for the Province emphasizing resource conservation through the recovery and the beneficial use of materials that otherwise would be disposed of as wastes. The strategy encompasses and consolidates issues and initiatives related to municipal solid waste (MSW), industrial waste, agricultural waste, and biomedical waste including a component of all these wastes known as hazardous waste.

A Waste Management Stakeholder Group (WMSG) has been established to develop an updated strategy through a consultation process. Consultation will be used to establish broad directions for waste management, develop implementation plans, revise provincial regulations, and produce technical guidelines. The first meeting of the Group was held on November 28, 2003 to review its Terms of Reference and to identify the components of the Waste Strategy.

A number of technical questions and issues were identified during the review of discussion documents on hazardous waste treatment and importation in Alberta. To address these matters it was decided that a Hazardous Waste Technical Committee (HWTC) should be formed to clarify outstanding technical issues and provide recommendations to the WMSG. The following issues were referred to the HWTC for review and preparation of recommendations on a path forward:

- Hazardous waste classification;
- Hazardous waste landfill disposal restrictions;
- Waste treatment options and controls;
- Import and export of waste;
- The definition of recycling; and
- Harmonization with other jurisdictions including the Alberta Energy and Utilities Board.

Though the current system has served Alberta well the Committee recognized the need for improvement, particularly the waste classification criteria and the landfill disposal restrictions. The Committee decided to build on the work done by the Stakeholder Advisory Committee in 2000-01 regarding the update of the *Alberta User Guide for Waste Managers (Guide)* and adopted a number of key principles that the rationale for recommended changes must meet, including changes to chemical constituent numerical limits and waste exemptions. The proposed regulatory changes must meet the following key principles:

- be scientifically sound;
- ensure that the toxic leachate limits are protective of human health by basing them on drinking water standards[1];
- strive for consistency with criteria adopted by other relevant jurisdictions; and
- support continuous improvement by making appropriate changes to the *Waste Control Regulation.*

The recommendations of this report are consistent with these principles, and to be effective, must be implemented concurrently in both the *Waste Control Regulation* and the *Guide*.

[1] The US EPA developed the *Toxicity Characteristic Leaching Procedure* in 1986 based on a scenario that simulates mismanagement of hazardous waste and co-disposal with MSW into a non-engineered landfill. The model assumes a groundwater dilution attenuation factor equal to 100. Therefore the toxic leachate limit used for hazardous waste classification is 100 times the drinking water standard for that particular chemical constituent.

ABREVIATIONS AND ACRONYMS

The following abbreviations and acronyms are used in this document:

Abbreviation	Full Text
ADR	Activities Designation Regulation
AENV	Alberta Environment
AR	Alberta Regulation
AIP	Acceptable Industry Practices
BATEA	Best Available Technology Economically Achievable
BTEX	Benzene, Ethylbenzene, Toluene and Xylenes
CEPA	Canadian Environmental Protection Act
DOW	Dangerous Oilfield Waste
EIHWHRMR	Export and Import of HW and HR Material Regulations
EPEA or *Act*	Environmental Protection and Enhancement Act
ESM	Environmentally Sound Management
EUB	Alberta Energy and Utilities Board
Guide	Alberta User Guide for Waste Managers
HR	Hazardous Recyclable
HW	Hazardous Waste
HWTC	Hazardous Waste Technical Committee
MSDS	Material Safety Data Sheet
MOU	Memorandum of Understanding
MSW	Municipal Solid Waste
NORM	Naturally Occurring Radioactive Materials
OGCA	Oil and Gas Conservation Act
OGCR	Oil and Gas Conservation Regulations
P2	Pollution Prevention
PHW	Persistent Hazardous Waste
PIN	Personal Identification Number (EPEA)
PCB	Polychlorinated Bifenyls
RCRA	Resource Conservation and Recovery Act (US EPA legislation)
SRR	Substance Release Regulation
TCLP	Toxicity Characteristic Leaching Procedure
TOXNET	Toxicology Data Network of the US National Library of Medicine
TDGR	Transportation of Dangerous Goods Regulations
US EPA	United States Environmental Protection Agency
WCR	Waste Control Regulation
WMSG	Waste Management Stakeholder Group

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

1. BACKGROUND

Alberta Environment (AENV) is committed to protecting the province's air, land, and water and strives to be a leader in addressing waste management. This mandate includes the enhancement and wise use of the environment and the conservation of Alberta's resources through waste minimization and the environmentally sound management of waste including hazardous waste (HW).

The *Environmental Protection and Enhancement Act* (*EPEA*) and Regulations complemented by policies, programs, guides, and waste tracking tools establish a broad framework that support that mandate with respect to the management of all waste (i.e., hazardous waste, non-hazardous waste, and recyclables). This legal structure was established in the eighties with passing of legislation and the implementation of a comprehensive and integrated hazardous waste management system. Alberta's regulation of hazardous waste was and continues to be greatly influenced by the existence and operation in the Province of Canada's first integrated hazardous waste treatment and disposal facility, the Swan Hills Treatment Centre.

The operation of the facility since 1987 has resulted in the destruction of most Alberta's accumulated HW and of similar wastes from other Canadian jurisdictions. This fact associated with product and technology advancements, the need for further harmonization with other jurisdictions, and the need to reduce environmental liability are factors that need to be evaluated when framing Alberta hazardous waste management system.

1.1 Waste Strategy

Alberta Environment is implementing a long-term Waste Strategy for the province of Alberta that emphasizes resource conservation through the recovery of materials currently disposed of as wastes. The strategy encompasses and consolidates issues and initiatives related to municipal solid waste (MSW), industrial waste, agricultural waste, and biomedical waste including a component of all these wastes known as hazardous waste. The original proposal for "Improving Waste Management in Alberta" included a range of strategies dealing with such issues as: expanding the mandate of the Alberta Recycling Management Authority (ARMA) to manage more waste streams (e.g., tires and electronics), government leadership in sustainable development for government operations, consultation with stakeholders on issues such as landfill bans, importation of waste into the province, and waste classification, tracking and reporting.

A Waste Management Stakeholder Group (WMSG) has been established to conduct an integrated consultation process to develop a new Waste Strategy in Alberta. Consultation will be used to establish broad directions for waste management, develop implementation plans, produce technical guideline documents, and revise provincial regulations. The initial meeting of the Stakeholder Group was held on November 28, 2003 to review the Terms of Reference for the Group and a list of projects to be undertaken as part of the Waste Strategy. The WMSG has continued to meet to discuss the input received on the first discussion documents entitled "Waste Management Consultation Priorities", "Hazardous Waste Treatment in Alberta", "Waste Importation into Alberta", "The Feasibility of Landfill Prohibitions as a Regulatory Tool", and "Outcomes and Performance Measures". This Conservation Strategy has been expanded to address waste management/resource recovery and link to other government-wide strategies such as Alberta's Rural Development Strategy. The rural strategy includes a number of actions concerning bio-energy production from MSW, manure and wood residues from forest activities.

Final revisions to the Waste Strategy are tentatively scheduled for completion and release for public consultation in 2006.

Waste Management Stakeholder Group
Alberta Association of Municipal Districts and Counties
Alberta Economic Development
Alberta Energy and Utilities Board
Alberta Environmental Network Society
Alberta Forest Products Association
Alberta Infrastructure
Alberta Urban Municipalities Association
Calgary Region Partnership
Canadian Association of Petroleum Producers
Canadian Chemical Producers Association
Canadian Petroleum Products Institute
Capital Region Waste Minimization Advisory Committee
Class One Landfill Association
Composting Council of Canada
Consulting Engineers Association of Alberta
Environmental Services Association of Alberta
Northern Coordinated Action for Recycling Enterprises
Recycling Council of Alberta
Solid Waste Association of North America
Western Canada Auditing Roundtable
Alberta Environment, Regional Services
Alberta Environment, Environmental Assurance
Stakeholder Group Chair: Stantec Consulting Ltd.

1.2 Stakeholder Advisory Committee

One of the recurring recommendations received by AENV was that the Department should undertake consultation regarding regulatory changes before updating the *Alberta User Guide for Waste Managers (Guide)*, particularly with respect to the proposed changes to waste classification and hazardous waste landfill disposal restrictions.

In response to the overwhelming support shown for further regulatory consultation, a provincial Stakeholder Advisory Committee was established to work with AENV and the EUB to develop recommendations for regulatory changes to the *WCR* and the *ADR* and recommendations for updating the *Guide*. Invitations were sent out in April 2002 to industry associations, municipal associations, non-governmental organizations, the EUB, a consultant, and private landfill operators.

Stantec Consulting Ltd. was retained as a facilitator to chair the Committee, track discussions, follow up on actions items and prepared an interim report in February 2003 for the AENV Executive Committee, containing the Committee's findings and recommendations.

1.3 Hazardous Waste Technical Committee

A number of technical questions and issues were identified by the WMSG during the review of the Hazardous Waste Treatment and Waste Importation Discussion Documents. To address these matters it was decided that a Hazardous Waste Technical Committee (HWTC) should be formed to clarify outstanding technical issues, and provide recommendations to the WMSG. The following issues were referred to the HWTC for review and preparation of recommendations on a path forward:

- Hazardous waste classification
- Hazardous waste landfill disposal restrictions
- Waste treatment options and controls
- Import and export of waste
- The definition of recycling
- Harmonization with other jurisdictions

It was also an opportunity for the technical Committee to build on the work previously completed by the stakeholder advisory committee.

Hazardous Waste Technical Committee Members
Richard Hart – Shell Canada Ltd
Patrick Kalita – Pembina Area Landfill Ltd.
Graham Latonas – Gartner Lee Ltd.
Rhonda Rudnitski – Newalta Corporation
Alison Walker – Hazco Environmental Services, a Division of CCS Inc.
Don White – Clean Harbors Canada Inc.
Jennifer Fisher – Alberta Energy and Utilities Board
Tony Fernandes – Alberta Environment
Rod Schultz – Alberta Environment
Bob Rippon – Alberta Environment

2. ALBERTA'S WASTE MANAGEMENT LEGAL FRAMEWORK

Responsibility for the regulation of waste in Alberta is divided between Alberta Environment (AENV) and the Alberta Energy and Utilities Board (EUB), except for on-site management of agricultural wastes and biomedical wastes, subject to the Natural Resources Conservation Board and Regional Health Authorities, respectively. The EUB is responsible for the regulation of oilfield wastes that result from oil and gas exploration and production activities within Alberta, while AENV is responsible for establishing ambient and source standards and regulating the releases of gaseous, liquid, or solid pollutants into the environment including the regulation of all other wastes produced in Alberta (see Figure 1).

Reflecting that distinction, AENV's *Environmental Protection and Enhancement Act* (*EPEA*) legislation defines *waste* as:

> "any solid or liquid material or product or combination of them that is intended to be treated or disposed of, or that is intended to be stored and then treated or disposed of, but does not include recyclables."

and *oilfield waste* as:

> "an unwanted substance or mixture of substances that results from the construction, operation, abandonment or reclamation of a facility, well site or pipeline within the meaning of the *Oil and Gas Conservation Act* and the regulations under that Act but does not include an unwanted substance or mixture of substances from such a source that is received for storage, treatment, disposal or recycling at a facility authorized for that activity pursuant to the *Environmental Protection and Enhancement Act*;"

The EUB's *Oil and Gas Conservation Regulation* (*OGCR*) defines *oilfield waste* in a similar manner. A number of agreements between the two agencies have been formalized into Memoranda of Understanding to clarify regulatory jurisdiction and common waste issues.

The federal government also has responsibilities in this area under the *Canadian Environmental Protection Act* (*CEPA*) and the *Transportation of Dangerous Goods Regulations* (*TDGR*) on what relates to the

- import-export of hazardous waste,
- interprovincial movement of dangerous goods including hazardous waste,
- setting of national standards for the control of toxic substances and priority pollutants.

Note that *CEPA* makes little distinction between hazardous waste and hazardous recyclables with respect to transboundary movements of waste. The key regulatory components of Alberta Waste Management System include the following legislation and guidelines:

2.1 Alberta Environment

The ***Environmental Protection and Enhancement Act*** (*EPEA*) establishes the key principles and requirements that apply to waste management including environmental impact assessments, authorizations (approvals, registrations, or notices), substance release, waste minimization, and enforcement. *EPEA* also lists activities that have potential to adversely impact the environment and human health. Part 9 of the *Act* applies to the management of waste including hazardous waste (HW) and hazardous recyclables (HR). Key obligations include:

- ***Environmental impact assessment*** for mandatory HW management facilities.
- ***Approvals or registrations*** for listed waste management activities
- ***Personal identification numbers*** (PIN) issued by the Director to all persons who ship HW off the generator site, carry, or receive HW.
- ***Movement Documents/Manifests*** accompanying the movement of HW or **recycle dockets** for HR within Alberta.
- ***Financial security and insurance*** for persons holding a PIN or an approval.

These requirements are summarized in Figure 1 and detailed in the following *EPEA* regulations. Alberta legislation is available at http://www.qp.gov.ab.ca.

- ***Waste Control Regulation*** (*AR 272/2003* consolidated up to *AR 276/2005*)
  The *WCR* outlines the administrative and technical requirements for HW and HR including classification, manifesting, transport, importation, storage, landfill disposal restrictions, and financial security requirements. The first regulation to address HW was first enacted in 1985 (the Hazardous Waste Regulation) and was successively amended in 1987, 1993 (name change to Waste Control Regulation), 1996, 2003, and 2005

- ***Activities Designation Regulation*** (*AR 276/2003* consolidated up to *AR 157/2005*)
  The *ADR* identifies waste related activities that require an approval, registration, or notification. The respective activities are listed in Schedules 1, 2, 3 of Division 1 of the Regulation.

- ***Substance Release Regulation*** (*AR 124/93* consolidated up to *AR 177/99*)
  The *SRR* provide details on the legislative requirements that apply to substance releases from a wide range of activities affected or not by *EPEA* approvals.

- ***Approvals and Registrations Procedure Regulation*** (*AR 113/93*)
  The *ARPR* outlines the process and information required to obtain an approval or registration.

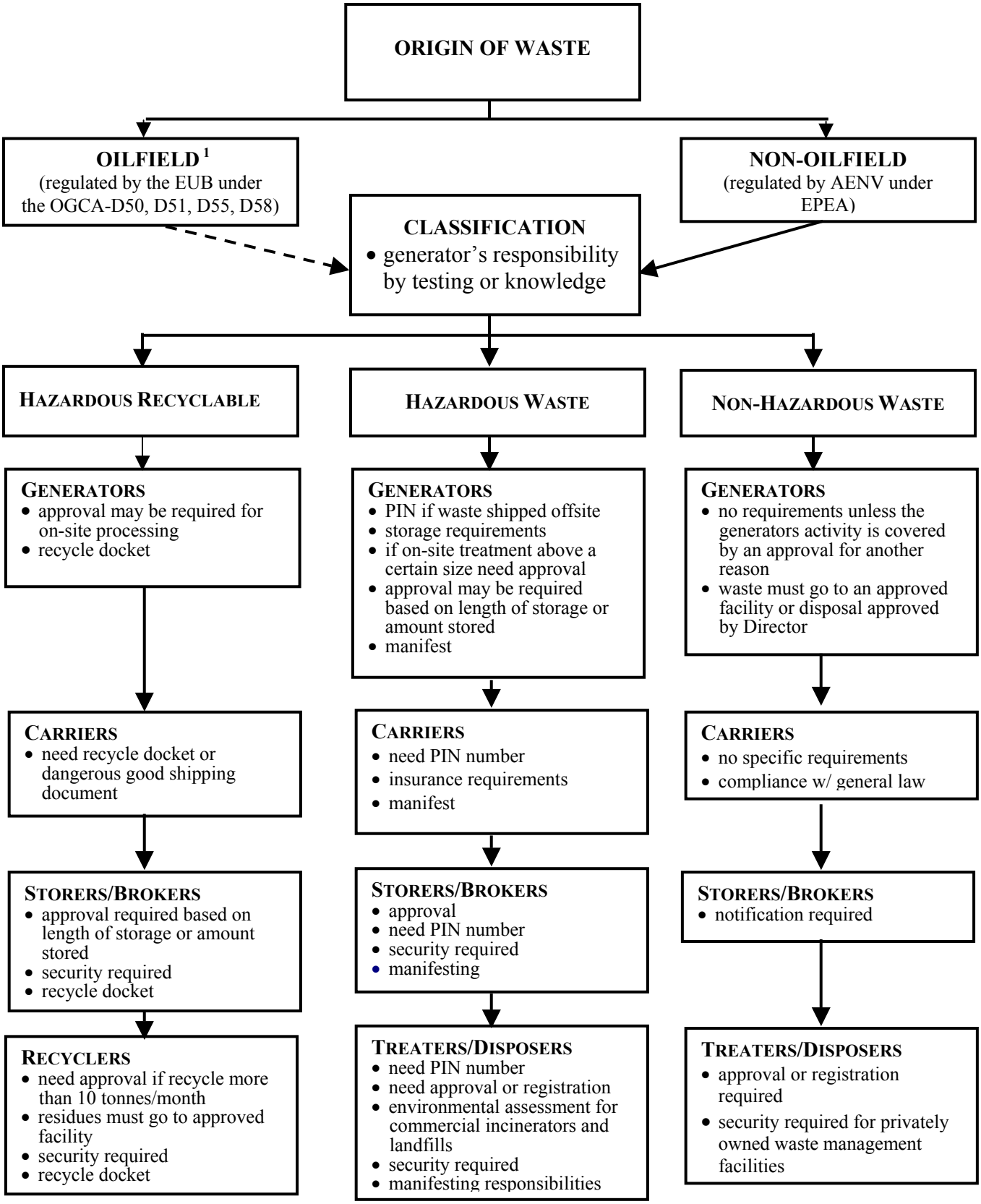
- ***Environmental Assessment (Mandatory and Exempted Activities) Reg.*** (*AR 111/93*)
  This Regulation lists activities for which an environmental impact assessment is required, and exempted activities, for which EIA is not required. ***Hazardous waste incinerators*** and ***hazardous waste landfills*** that accept off-site HW waste require an EIA.

- ***Codes of Practice*** – The codes relevant to hazardous waste/recyclable are the *Codes of Practice for Landfills, Compost Facilities, Energy Recovery, Small Incinerators,* and *Land Treatment of Soil Containing Hydrocarbons*. Proponents of activities identified in these codes and described in the *ADR* must register with AENV, prior to start operations.

- **The *Alberta User Guide for Waste Managers***
  The *Alberta User Guide for Waste Managers* is identified in the *WCR*. The *Guide* offers authorized advice in those areas that are consistent with the *WCR*. The *Guide* will be updated for regulatory consistency, to reflect the recommendations of this Committee, technological advances, and agreements between AENV and the EUB. This document is available at http://www3.gov.ab.ca/env/info/infocentre/PubListing.cfm.

  The *Guide* was first published in 1995 to assist managers, regulators, and more specifically, generators, carriers, and receivers of HW in understanding Alberta's HW legislation. The *Guide* interprets and explains the *WCR* and is meant to clarify the waste classification process, test methods, transportation, and manifest requirements. The *Guide* identifies extensive lists of HW and non-HW to minimize analytical testing in waste classification. Generators are also encouraged to use their knowledge of the waste to reduce the amount of analysis required in characterization and classification of waste.

Figure 1: WASTE MANAGEMENT REGULATORY RESPONSIBILITIES



[1] Oilfield waste is regulated by the EUB through an equivalent system and when it enters an EPEA approved facility the above process applies.

2.2 The Alberta Energy and Utilities Board

The Alberta Energy and Utilities Board (EUB) is an independent, quasi-judicial agency of the Government of Alberta responsible for regulating the development of Alberta's energy resources: oil, natural gas, oil sands, coal and electrical energy, and the pipelines and transmission lines to move these resources to market.

The EUB regulates oilfield waste under the authority of the:

- ***Oil and Gas Conservation Act*** (*OGCA*),
- ***Oil and Gas Conservation Regulations*** *(OGCR)* (*AR 151/71* consolidated up to *AR 153/2006*),
- ***Oil Sands Conservation Act***, and
- ***Oil Sands Conservation Regulation*** (*AR 76/1988* consolidated to *AR 191/2003*).

The EUB issues Directives (which replace interim directives, information letters, and guides). Directives are documents setting out new or amended EUB requirements or processes to be implemented and followed by licensees, permittees, and other approval holders under the jurisdiction of the EUB. Existing interim directives, informational letters, and guides will be reviewed and renamed in due course. Bulletins formerly named General Bulletins, contain announcements to inform the energy industry and the public of an EUB activity, such as a consultation, a new program, electronic submission of data, or a new publication. Bulletins do not set out EUB requirements.

Details regarding the management of oilfield waste at the generator's facility location, transportation of oilfield wastes on Alberta's public roads, and the treatment, storage and disposal at oilfield waste management facilities are outlined in the following EUB documents:

- ***ID 96-3 and Directive 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry,***
- ***IL 96-13 and Directive 50: Drilling Waste Management,***
- ***IL 94-2 and Directive 51: Injection and Disposal Wells, Well Classifications, Logging, and Testing Requirements,***
- ***ID 2001-9 and Directive 55: Storage Requirements for the Upstream Petroleum Industry,***
- ***Part 16.6 of the OGCR: Security,***
- ***ID 99-4: Deposition of Oilfield Waste into Landfills,***
- ***ID 2000-3: Harmonization of Waste Management,***
- ***ID 2000-4: An Update to the Requirements for the Appropriate Management of Oilfield Wastes,***
- ***IL 99-2: Use of Produced Sand in Road Construction,***
- ***IL 98-2: Suspension, Abandonment, Decontamination, and Surface Land Reclamation of Upstream Oil and Gas Facilities,***

- ***Il 98-1: Coordination of Release Notification Requirements and Subsequent Regulatory Response,***
- ***Directive 37: Service Rig Inspection Manual,***
- ***Directive 63: Requirements and Procedures for Oilfield Waste Management Facilities***
- ***Directive 36: Drilling Blowout Prevention Requirements and Procedures***
- ***Directive 64: Requirements and Procedures for Facilities, and***
- ***Directive 19: EUB Compliance Assurance – Enforcement.***

2.3 Joint EUB/AENV Memoranda of Understanding

The jurisdictional split between AENV and the EUB was established in 1993 based on the premise that each agency's requirements would provide an equivalent level of environmental protection and public safety, while acknowledging that operationally, AENV's and EUB's processes might not be exactly the same. To clarify waste management requirements, AENV and the EUB have developed joint Memoranda of Understanding (MOU) related to waste management. Copies of these MOU are available at www.eub.gov.ab.ca/bbs/default.htm.

- ***MOU on the Harmonization of Waste Management*** (*Interim Directive 2000-3*)
  This MOU outlines principles that the EUB and AENV have agreed upon to harmonize the requirements for the management of oilfield and non-oilfield wastes. It also clarifies jurisdictional roles of the EUB and AENV, reduces regulatory duplication, promotes an equivalent level of environmental protection and public safety, and reduces liability through appropriate waste management. The regulatory responsibilities of both agencies are divided based on the type of waste management facility or activity.

- ***MOU on the Deposition of Oilfield Waste into Landfills*** (*Interim Directive 99-04*)
  This MOU outlines oilfield waste quality criteria for total petroleum hydrocarbons (TPH) and chloride and landfill design requirements regarding the deposition of drilling mud and cuttings, produced sands, oily sludges, tank and treater bottoms, and flare pit material into Alberta Class II landfills.

- ***MOU on the Suspension, Abandonment, Decontamination and Surface Land Reclamation of Upstream oil and Gas Facilities*** (*Informational Letter 98-2*)
  This MOU details the division of responsibilities between the AENV and the EUB for suspension, abandonment, decontamination, and surface land reclamation activities at upstream oil and gas facilities. The MOU is intended to clarify the jurisdictional roles of AENV and the EUB, to reduce regulatory duplication and enhance protection of the environment and the public interest.

The Committee recognizes and supports the on-going joint EUB/AENV work on harmonization and clarification of outstanding waste management issues. These issues, ranging from the acceptance of non-oilfield wastes (Alberta's or imported) at EUB approved facilities to the management of specific wastes or facilities that may not distinguish between oilfield and non-oilfield wastes, affect both agencies. The Committee fully supports on-going work to further streamline, harmonize, and clarify the role of the two agencies in waste management.

3. CLASSIFICATION OF HAZARDOUS WASTE

The Committee discussions and recommendations strived for consistency with other jurisdictions. To achieve this goal the HWTC reviewed applicable legislation used by the US EPA, Ontario and BC; consulted the Transport Canada *Clear Language TDGR*, and examined the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (EIHWHRMR)* under *CEPA*. With the completion of those tasks the Committee arrived at the following recommendations on waste classification and land disposal restrictions. For purposes of classification, what applies to HW classification also applies to HR.

During initial discussions of HW classification, the Committee considered the possible adoption of additional US EPA *RCRA* hazardous waste definition, characterization and classification criteria and lists and put less emphasis on *TDGR*. As the work progressed, it was recognized that though there would be an advantage in adopting key components of the US system, there were good reasons to also keep a strong link between Alberta's hazardous waste legislation and *TDGR* for consistency in classification and to simplify shipment requirements applicable to dangerous goods, which include hazardous wastes when transported on public roads. Examples of that link include

- the manifest/movement document system and AENV's initiative to streamline it;
- the absence of US regulation of toxic leachates of certain chemical constituents (e.g., pentachlorophenol, some pesticides, and other halogenated organics); and
- the established Alberta standards and administrative/tracking procedures, which reflect *TDGR* or derived from *TDGR* requirements.

Waste characterization and classification is a regulatory requirement for generators of hazardous waste or hazardous recyclables prior to consignment for transportation (s 3.1, *WCR*). These tasks have to be done by waste managers to ensure proper storage, treatment, and disposal of the waste produced. Proper classification of waste can be done by

- conducting appropriate testing on representative samples for the chemicals of concern; or
- knowledge of the waste (previous testing, MSDS, understanding of raw materials, reactions, processes, final products or by-products).

The current classification criteria adopted by AENV and the EUB are the same and should remain the same.

3.1 Hazardous Waste Characteristics

The Stakeholder Advisory Committee on waste management was in agreement that the presence of one or more of the core hazardous waste characteristics of

- flammability,
- reactivity,
- corrosivity, or
- toxicity

should remain the primary criteria on which should be based the definition and classification of any hazardous waste. The identification of one or more of these characteristics is generally done

by testing representative samples using the methods identified in the *Guide* or based on the knowledge of the waste. For example, there is no need to test contaminated gasoline, seed treated with Lindane, PCB ballasts, known hazardous waste or off spec hazardous chemicals.

These examples bring about the use of lists of dangerous goods and hazardous chemicals in waste classification. These lists are identified in Appendix 3. If a generator is in possession of any waste or chemical described in one of the lists, then the material is a HW or a HR, if intended for disposal or recycling, respectively. In this situation testing is not required unless the hazardous classification is challenged or if additional information is required for proper storage, transport, treatment, processing and/or disposal of the waste. To minimize administrative and financial burdens and encourage environmental sound management, the Committee recommends a classification system based on the actual characteristics of the waste rather than a system based on descriptions and designated lists.

Recommendation 1 *(hazardous waste characteristics)*

For purposes of waste classification and landfill disposal prohibitions a waste is hazardous if a representative sample of the waste exhibits one or more of the following core characteristics: flammability, reactivity, corrosivity, or toxicity.

3.1.2 Flammability

Flammable (or ignitable) hazardous wastes are identified in Schedule 1, section s 1(a) and 1(b) of the *WCR*. The US EPA under *RCRA*, Ontario, BC, and EC in the *EIHWHRMR* use similar criterion to define a "flammable hazardous waste". That criterion is the flash point, which was changed from 61^{o} C to 60.5^{o} C, recently. The change has been made to reflect limitations of the test method, only. In addition, the definition includes existing provisions on flammability dispersed through various regulations and applied to different classes of flammable wastes and identified either in the *WCR* or the *TDGR*. Therefore, for comprehensiveness and to harmonize with those agencies, the Committee has agreed with the following:

Recommendation 2[1] *(flammability)*

Amend Schedule 1 of the Waste Control Regulation by repealing subsections 1(a), 1(b), and 1(c) and substituting the following:

"(a) a hazardous waste exhibits the characteristics of "flammability" if a representative sample of the waste

(i) is a flammable compressed gas

(ii) has a flash point less than or equal to 60.5 degrees Celsius,

(iii) ignites and propagates combustion in a test sample, or

(iv) contributes oxygen for combustion at a rate that it is equal to or greater than that provided by ammonium persulphate, potassium perchlorate or potassium bromate."

[1] The change recommended in *a(ii)* has been implemented as of September 30, 2005 with the passing of the amendments to the *Activities Designation Regulation* and the *Waste Control Regulation* to reflect the publication of waste related Codes of Practice by Alberta Environment.

3.1.3 Reactivity

Reactive hazardous wastes include substances liable to spontaneous combustion (i.e., pyrophoric and self-heating substances, *TDGR* class 4.2), water-reactive substances such as metallic sodium or magnesium (*TDGR* class 4.3), cyanide and sulphide containing wastes that may generate toxic gases under certain conditions, and materials that are capable of undergoing violent changes without detonation, explosive decomposition or reaction at standard temperature and pressure.

Recommendation 3 *(reactivity)*

Amend Schedule 1 of the WCR by repealing subsection 1(e) and substituting the following:

"(b) a hazardous waste exhibits the characteristics of "reactivity" if a representative sample of the waste

- ***(i) is normally unstable and readily undergoes violent change without detonation***
- ***(ii) reacts violently with water;***
- ***(iii) when mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human heath or the environment;***
- ***(iv) is capable of causing fire through friction, absorption of moisture or spontaneous chemical changes*** *(i.e., self heating or pyrophoric substances)**; or***
- ***(v) is a cyanide or sulfide bearing waste which when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.***

A generator is not obliged to test a waste for reactivity if standard tests are not reasonably available. In these situations, the person responsible should be able to classify the waste with based on their knowledge of the waste or information readily available, i.e., in material safety data sheets, databases, etc. Applicable test methods shall be identified, reviewed and incorporated in an updated *Guide*.

3.1.4 Corrosivity

Schedule 1, s. 1(e) of the WCR, defines corrosive hazardous waste if "it has a pH value less than 2.0 or greater than 12.5."

The Committee's discussion included the issue of consistency with the US EPA, Ontario, and the *EIHWHRMR* under *CEPA* and whether the pH test should continue to be applied to solids, thereby potentially necessitating the development of numerous exemptions.

It was decided that this definition should remain as is and continue to be applied to both liquids and solids, but that further work be carried out in developing appropriate exemptions for the corrosivity characteristic. The Committee recommended consulting other sources, such as the list of exempted goods under the *Clear Language TDGR* and the US EPA *RCRA* in developing a rationale for new or current exemptions under the *WCR*. The Committee also notes that the *Guide* will need to address test methods for corrosivity for both solids and liquids

Recommendation 4 *(corrosivity)*

A hazardous waste exhibits the characteristics of "corrosivity" if a representative sample of the waste has a pH value of less than 2.0 or greater than 12.5.

3.1.5 Toxicity

The toxicity of a substance is the ability of that substance to cause harmful health effects on humans, animals, or other organisms. In terms of impact, toxicity is described as low, moderate, severe, etc., depending on the amount needed to cause an effect. The type and severity of this impact can be immediately noticed as for instance the lethal effects of a poison on a person, or result in a slow progressing long term reversible or irreversible impairment or deterioration of the health, growth, reproduction or survival of the organism exposed to that substance.

Substances, including wastes or contaminated soils, which cause immediate health effects are known as "acute" toxic substances; when leading to long-term health impacts the substance shows "chronic" toxicity.

3.1.5.1 Acute Toxicicity

The acute toxicity of a substance is often assessed using indicators that reflect the number of individuals impacted when a population is exposed to the substance. Among others, one of those indicators used in classification of HW is the LD_{50}. This indicator is defined as the minimum amount of a substance, in milligrams per kilogram of the receptor's body weight that, if ingested, kills 50 per cent of the population exposed.

Until September 30, 2005 a waste was hazardous under Schedule 1, s. 1(d) of the *WCR* if

> *"(d) it is toxic because it*
>
> *(i) has an oral toxicity LD_{50} not greater than 5000 mg/kg,*
>
> *(ii) has a dermal toxicity LD_{50} not greater than 1000 mg/kg, or*
>
> *(iii) has an inhalation toxicity LC_{50} not greater than 10,000 mg/m^3 at normal atmospheric pressure."*

The LD_{50} criteria identified in (i) was introduced in 1993 to capture as HW a broader range of wastes such as PCB. Unfortunately, the adopted number was not based on science or technically defensible as it also captures an large number of common, generally benign, substances that are not otherwise considered acute toxics. Examples include sodium chloride or kitchen salt with a LD_{50} rat oral 3000 mg/kg or aluminum sulfate, a common water treatment coagulant, with a LD_{50} rat oral of 1930 mg/kg. For consistency with federal and other Canadian jurisdictions the Committee recommended substitution of these criteria by the one in place prior to the 1993 change and still used in *TDGR*.

Recommendation 5 [1] *(acute toxicity)*

Amend Schedule 1, s. 1(d) of the Waste Control Regulation to read that a hazardous waste exhibits the characteristics of "acute toxicity" if

> ***(d) it is toxic because it***
>
> ***(i) has a rat oral toxicity LD_{50} not greater than 200 mg/kg, if a solid, or 500 mg/kg, if a liquid,***

[1] Recommendation 1(d)(i) has been implemented as of September 30, 2005 with the passing of the amendments to the *ADR* and *WCR* that reflect changes related to the *Codes of Practice* published by AENV. The recommendation was identified and agreed upon by all stakeholders during the public consultation process conducted by AENV to update the *Guide* in 2000-2001

(ii) has a dermal toxicity LD_{50} not greater than 1000 mg/kg, or

(iii) has an inhalation toxicity LC_{50} not greater than 10,000 mg/m^3 at normal atmospheric pressure.

Part 1 of the *Guide* makes reference to the tests for determining LD_{50} and LC_{50} and states that toxicity values refer to tests conducted on rats. The Committee discussed the issues involved in carrying out toxicity testing and whether there is a more appropriate test for toxicity. Some Committee members were of the view that the LD_{50} (lethal dose) test for albino rats is not a reasonable option due to the cost and availability of the test. Similar issues arise with LC_{50} (lethal concentration).

The Committee agreed that the tests to classify waste as acute toxic are not practical on a routine basis, and that it is more sensible to use acute toxicity limits only when the database information is readily available. The TOXNET is one of such databases and an excellent reference for determining toxicity indicators. This issue is addressed in the *Guide* that states: "*wastes for which toxicological data are not readily available to the generator, or have not been published in the references listed in the Guide are not considered hazardous by reason of their acute toxicity under section 1(d) of Schedule 1, of the Waste Control Regulation."*

3.1.5.2 Chronic Toxicity

Long term human health or environmental impacts are more difficult to identify and measure. Chronic toxicity impacts occur when a recipient is exposed to low concentrations of toxic substances present in food, water, air, water, waste or contaminated soil. Potential long-term impact is called chronic toxicity and in waste management is measured by the amount of the toxic substance that leaches out from a waste or contaminated soil under defined conditions.

The concentrations of the leached chemicals are compared with known limits derived, in most cases, from drinking water standards, and limits for these substances are established. When these substances are present in a waste/soil and leach out in excess of that limit, under the conditions of the test, then the waste produces toxic leachates and is a hazardous waste. What follows summarizes the Committee discussions and recommendations on this topic.

To classify a waste, in terms of chronic toxicity, a standard leachability test (i.e., the *Toxicity Characteristic Leaching Procedure* or *TCLP*) is conducted on representative samples of that waste. The test was developed by the US EPA in 1986 and designed to determine the mobility of both organic and inorganic analytes present in wastes. The test is based on a model that assumes the co-disposal of hazardous and municipal solid waste in a non-lined landfill. The model predicted that due to dilution the concentration of the hazardous constituent in the groundwater would not exceed the drinking water standard if the concentration of that hazardous constituent in the waste does not exceed 100 times its drinking water standard.

The *TCLP* test may be avoided if the total analysis of the waste demonstrates that individual chemical constituents are not present in the waste, or that they are present but at such a low level that the regulatory limit could not possibly be exceeded. Since a dilution factor of 20 is used when conducting a TCLP test, the following rule of thumb can be used when classifying hazardous waste: if the total concentration of the chemical constituent divided by twenty is equal or less than the regulatory leachate limit then the waste is non-hazardous and can be managed as

such. If the total concentration divided by twenty is higher than the toxic limit then the *TCLP* should be done to classify the waste. This approach assumes that the toxic constituent in the waste is mobile and available to the liquid phase.

3.1.5.2.1 Principles and Rationale

One of the Committee's tasks was to identify the principles and rationale for updating the selected chemical constituents and proposed leachate limits. Relevant factors include:

- the current list of chemicals and limits in Table 2 of the *Guide*,
- the physical, chemical, and biological properties of those chemicals, and
- the chemicals and limits adopted by Alberta and other jurisdictions.

Table A1 in Appendix 1 summarizes and compares current chemicals and limits for Alberta, BC, Ontario, US EPA, and EC under *CEPA*. In assessing the appropriateness of the chemicals and limits selected for waste classification and waste landfill disposal prohibitions, the Committee adopted a number of principles to support the recommendations agreed upon. The rationale used to substantiate the changes is detailed in Appendix 2 and outlined below. It should be:

- scientifically sound,
- consistent with one hundred times the *Canadian Drinking Water Standards*, and
- strive for consistency with criteria adopted by other relevant jurisdictions.

3.1.5.2.2 Chemical Constituents and Leachate Limits

Waste toxic leachates are currently identified in section (g) of Schedule 1 to the *WCR*. This characteristic is measured in leachate extracts obtained from wastes in a dispersible form by subjecting representative waste samples to the *TCLP*. This test method, though initially developed by the US EPA, has been used in Alberta since 1993 and recently has also been adopted by Environment Canada, Ontario, Quebec, and British Columbia.

Alberta currently lists in Table 2 of the *Guide* 97 chemical constituents that if present in wastes may produce toxic leachates and render those wastes hazardous. Most of the chemicals listed are regulated at 100 times the *Canadian Drinking Water Standards* (CDWS), as Class 9.3. A second group of 61 chemicals is identified presently in Table 1 of the *Guide,* as Class 9.2, and regulated arbitrarily at 100 mg/L using the same test.

These two groups of chemicals and respective regulatory limits have been subject to a technical and scientific review by the Committee to assess their toxic, physical, and chemical properties, human health impacts, occurrence in Alberta wastes, and environmental fate. This work resulted in Table A of this report, proposed by the Committee to identify hazardous constituents and leachate limits that if exceeded render the waste hazardous toxic waste by reason of chronic toxicicity. The Committee recommends to the WMSG the replacement of Tables 1 and 2 of the *Guide* by Table A.

3.1.5.2.3 Committee's Recommendations

The Committee has decided to modify leachate limits and remove or add chemical constituents to Table 2 of the *Guide.* The reason for the change is that some of current regulated chemicals or limits are not scientifically defensible, or are not regulated in other jurisdictions, or have been arbitrarily set, and discrepancies between the *WCR* and the *Guide* on the landfill disposal of HW.

The recommendation is supported by an assessment of the properties of each chemical and limits subject to change. The primary reference for that work was the TOXNET, a database set by the United States National Library of Medicine with comprehensive toxicology and environmental information on the properties of about 5,000 chemicals. The TOXNET Hazardous Substances Data Bank is a reliable source of information and is available at http://toxnet.nlm.nih.gov. The assessment is outlined in Appendix 2.

Table A identifies the hazardous constituents and the limits proposed by the Committee. To put Alberta limits into perspective similar data from five jurisdictions is shown in Table A1 of Appendix 1. The numbers in **red** in the headings of Table A1 denote the number of parameters regulated by each jurisdiction. The chemicals and limits that have been changed to reflect 100 times the CDWS or other scientific reason are shown in **blue**. Those chemicals identified in **red** are regulated elsewhere in Canada and the Committee does not recommend the adoption of most of them by Alberta. Both types of chemicals have been assessed in detail and that evaluation is described in Appendix 2.

Recommendation 6 *(chronic toxicity)*

(a) Remove Table 1[1] from the Waste Control Regulation and the Guide; and

(b) Implement all 40 recommendations identified in Appendix 2 of this report and change Table 2 of the Guide accordingly by removing, adding or modifying the chemical constituents and limits as indicated in Table A of this report.

The chemical constituents and limits reviewed are high lighted in blue in Table A and Appendix 2 of this report. The rationale for the change is in Appendix 2 and is based on the following:

- the chemicals listed in *Table 1* of the Guide generally are not found in Alberta's industrial or hazardous wastes, and most are either captured by one or more of the core hazardous characteristics or *TCLP* test is not applicable;
- some chemical constituents are removed from or added to *Table 2* of the Guide for scientific reasons or for consistency with other Canadian jurisdictions; and
- some of the numerical leachate limits are being changed based on either the 100 times the CDWS or otherwise scientifically defensible criteria.

3.1.5.2.4 The BTEX Issue

The Committee has conducted an integrated review and made recommendations on three closely related and important issues. The first is the opening of off-site treatment of hazardous wastes to waste management facilities other than the Swan Hills Treatment Centre (SHTC). This issue is dealt with in section 6. The second is the removal of the exemption of testing for benzene,

[1] The 61 chemicals in Table 1 of the *Guide* are Alberta's remnants of the 426 chemicals identified by Environment Canada (EC) in a study of Great Lakes water quality in the late eighties. These chemicals were adopted and regulated by Transport Canada and EC as Class 9.2 dangerous goods or hazardous wastes, respectively. The regulatory limit was arbitrarily set at 100 milligrams per kilogram (in Alberta are regulated in TCLP leachates at 100 mg/L). 179 of these chemicals are still regulated in *TDGR* and *EIHWHRMR* as "environmentally hazardous substances" or "hazardous wastes", respectively, when going for disposal.

toluene, ethyl benzene, and xylene (BTEX) in wastes or soils contaminated only with crude or refined petroleum hydrocarbons. On this regard the Committee recommends that:

Recommendation 7 *(BTEX testing)*

Remove from the Guide the exemption for testing for BTEX in wastes, soils, sorbents, or dessicants contaminated only with fuels such as gasoline, kerosene, diesel, aviation fuel, fuel oil or crude petroleum hydrocarbons and having a flash point > 60.5 degrees Celsius.

The third issue is the change to the toxic leachate limits for toluene, ethylbenzene, and xylene based on their physical, chemical, and toxicological properties rather than the *Canadian Drinking Water Standards* (*CDWS*). A detailed assessment of the properties of BTEX and related is presented in section 4 and Table A2 of Appendix 2.

The current limits for benzene, toluene, ethylbenzene and xylene in toxic leachates is 0.5 mg/L for each. Except for benzene, the criteria were arbitrarily set in 1993. The Committee reviewed this topic and the first approach was to adopt a limit equal to 100 times the *CDWS* for these chemicals based on the US EPA model developed in the eighties. That would lead to: 0.5 mg/L for benzene, 2.4 mg/L for toluene; 0.24 mg/L for ethylbenzene; and 30 mg/L for xylene. Upon further discussion and more detail assessment of the rationale for the CDWS for these alkyl benzenes, it was found that the *CDWS* for toluene, ethylbenzene, and xylene were based on aesthetics rather than human health or environmental factors (i.e., on the physical, chemical, or toxic properties of these chemicals).

The Committee also recognized that Environment Canada, Transport Canada (in *TDGR*), and BC regulate alkyl benzenes in wastes or soils at a total concentration of 100 mg/kg. Therefore, the 5.0 mg/L criteria chosen by the Committee not only reflects the properties of these chemicals but is also consistent with that federal limit assuming, in the worst case scenario, that in wastes or soils going for disposal these chemicals are mobile, soluble and available to the *TCLP* extract. This rationale is consistent with the *TCLP* methodology that introduces a dilution factor of 20 applied to total concentrations of chemicals in wastes or contaminated soils.

Upon careful assessment of the above and

- the BTEX properties,
- the current test exemption in the *Guide*,
- the present policy on off-site treatment and disposal of HW (see recommendation 14),
- the current Alberta waste management structure, and
- the environmental and economic implications of various options,

the Committee has reached consensus on the following recommendation:

Recommendation 8 *(limits for BTEX)*

Change the limits for ethylbenzene, toluene and xylenes in toxic leachate wastes from 0.5 mg/L to 5.0 mg/L to reflect the physical, chemical and biological properties of these chemicals rather than the 100 times the drinking water standards. The limit for benzene should remain the same at 0.5 mg/L.

Table A – Chemical Constituents and Leachate Limits in Alberta

Item	AB	Constituent			Regulatory Limit (mg/L) 97 → 86[1]
1	LA1	Aldicarb			0.9
2	L3	Aldrin + Dieldrin	**POP**[2]	**HOC**[3]	0.07
		Aluminium[4]		**M**[5]	NR[6]
	LA2	Ammonia[7]			100.0 → NR[8]
3	L4	Antimony[9]		**M**	500.0 → 0.6
4	L4	Arsenic		**M**	5.0 → 2.5
5	LA4	Atrazine+N-dealkylated metab.		**HOC**	6.0 → 0.5
6	LA5	Azinphos-methyl			2.0
7	L5	Barium		**M**	100.0
8	LA6	Bendiocarb			4.0
9	LA7	Benzene			0.5
		Benzo(a)pyrene[10]			NR
	LA8	Beryllium		**M**	5.0
10	L6	Boron			500.0
		Bromate			NR
11	LA9	Bromoxynil		**HOC**	0.5
12	L7	Cadmium		**M**	1.0 → 0.5
13	L8	Carbaryl			9.0
14	LA10	Carbofuran			9.0
15	LA11	Carbon tetrachloride		**HOC**	0.5
		Chloramines			NR
16	L9	Chlordane	**POP**	**HOC**	0.03
17	LA41	Chlorobenzene (mono)		**HOC**	100.0
18	LA12	Chloroform		**HOC**	6.0 → 10.0
19	LA13	Chlorpyrifos		**HOC**	5.0 → 9.0
20	L10	Chromium		**M**	5.0
	LA14	Cobalt		**M**	100.0 → NR
21	LA15	Copper		**M**	100.0
22	LA16	Total cresols (o-, m-, p-)			200.0
23	LA17	Cyanazine		**HOC**	1.0

[1] The two numbers in the column heading denote the total number of chemical constituents regulated in TCLP toxic leachates, at present time and as proposed.
[2] **POP** means priority organic pollutant.
[3] **HOC** stands halogenated organic compounds.
[4] The chemical constituents currently with a numerical limit and identified in **blue** have been regulated in Alberta only, except for ethylbenzene, toluene, and xylene, which have also been regulated in BC at 100 times the CDWS and recently by EC (EIHWHRMR) at 100 mg/kg. These constituents and those addressed in note 10 are discussed in Appendix 2.
[5] **M** stands for metal.
[6] NR stands for not regulated..
[7] The TCLP is not appropriate to test ammonia and its salts as producing waste toxic leachates. Ammonia and some of its salts are captured as hazardous waste due to other properties other than originating toxic leachates.
[8] The first number, the current limit, is tied to a second number, which represents the proposed limit or NR.
[9] Antimony is only regulated in wastes, which produce toxic leachates due to the presence in the waste of antimony pentachloride, antimony potassium tartrate, antimony tribromide, antimony trichloride, and antimony trioxide.
[10] Chemical constituents identified in **red** are regulated elsewhere in Canada but not in Alberta.

Item	AB	Constituent			Regulatory Limit (mg/L) 97 → 86[1]
24	L11	Cyanide			20.0
25	L2	2, 4-D (dichlorophenoxyacetic acid)		**HOC**	10.0
26	L13	Diazinon			0.02 → 2.0
27	LA18	Dicamba		**HOC**	12.0
28	LA19	1, 2-Dichlorobenzene		**HOC**	20.0
29	LA20	1, 4-Dichlorobenzene		**HOC**	7.5 → 0.5
30	LA21	1, 2-Dichloroethane		**HOC**	0.5
31	LA22	1, 1-Dichloroethylene		**HOC**	0.7
32	L12	DDT + metabolites	**POP**	**HOC**	3.0
33	LA23	Dichloromethane		**HOC**	5.0
34	LA24	2, 4-Dinitrotoluene			0.13
35	LA25	2, 4-Dichlorophenol		**HOC**	90.0
36	LA26	Dichlofop-methyl		**HOC**	0.9
37	LA27	Dimethoate			2.0
38		Dinoseb			NR → 1.0
39		Dioxins & Furans[11]	**POP**	**HOC**	0.001→ $3.0x10^{-6}$
40	LA28	Diquat or diquat dibromide)		**HOC**	7.0
41	LA29	Diuron		**HOC**	15.0
42	L14	Endrin	**POP**	**HOC**	0.02
43	LA30	Ethylbenzene			0.5 → 5.0
44	L15	Fluoride			150.0
	LA31	Formaldehyde			100.0 → NR
45	LA32	Glyphosate			28.0
46	L16	Heptachlor and epoxide	**POP**	**HOC**	0.008
47	LA33	Hexachlorobenzene	**POP**	**HOC**	0.13
48	LA34	Hexachlorobutadiene		**HOC**	0.5
49	LA35	Hexachloroethane		**HOC**	3.0
	LA35	Iron		**M**	1000.0 → NR
50	L17	Lead[12]		**M**	5.0 → 1.0
51	L18	Lindane		**HOC**	0.4
52	LA37	Malathion			19.0
53	L19	Mercury		**M**	0.2 → 0.1
54	L20	Methoxychlor		**HOC**	10.0 → NR
55	LA38	Methyl ethyl ketone			200.0
56	L21	Methyl parathion			0.7
57	LA39	Metolachlor		**HOC**	5.0

[11] The only wastes to be tested for dioxins and dibenzofurans in leachates, as dioxin toxic equivalent (TEQ), are wastes F020 through F023 and F026 through F028, described in List F of Appendix 3 or leachates from wastes such as "wastes from industrial use in the formulation of halogenated pesticide/preservatives", or as specified in writing by the regulatory authority.

[12] The presence of lead or other hazardous constituents in paints led Alberta Environment to define Waste Type 205. AENV does not require the removal and testing of paints from rigid surfaces for *TCLP* testing prior to disposal. However, spent shot blasting waste that has been segregated should be tested and managed accordingly.

Item	AB	Constituent		Regulatory Limit (mg/L) 97 → 86[1]
58	LA40	Metribuzin		8.0
59	LA42	Naphthalene[13]		0.5 → 5.0
		1-Naphthyl-N-methyl carbamate		NR
	LA43	Nickel		5.0 → NR
60	L22	Nitrate (as nitrate-nitrogen)		1000.0
61	L23	Nitrilotriacetic acid (NTA)		5.0 → 40.0
62	L24	Nitrite (as nitrite-nitrogen)		100.0
63	LA44	Nitrobenzene		2.0
64	LA45	Paraquat		1.0
65	L26	Parathion		3.5 → 5.0
66	LA46	Pentachlorophenol	**HOC**	100.0 → 6.0
	LA47	Phenol		100.0 → NR
67	LA48	Phorate		0.2
68	LA49	Picloram	**HOC**	19.0
69	LA50	Pyridine		5.0
70	L27	Selenium	**M**	1.0
	L28	Silver	**M**	5.0 → NR
71	LA51	Simazine	**HOC**	1.0
72	LA54	Temephos		28.0 → NR
73	LA55	Terbufos		0.1
74	LA53	Tetrachloroethylene	**HOC**	0.7 → 3.0
	LA52	Thallium	**M**	5.0 → NR
75	LA62	Toluene		0.5 → 5.0
76	L29	Toxaphene **POP**	**HOC**	0.5 → 0.3
77	LA57	2,3,4,6-Tetrachlorophenol	**HOC**	10.0
	LA56	Triallate	**HOC**	23.0
78	LA58	Trichloroethylene	**HOC**	0.5 → 5.0
		1,1,1-Trichloro-2, 2-bis (p-mp)eth	**HOC**	NR
79	LA59	2,4,5-Trichlorophenol	**HOC**	400.0
80	LA60	2,4,6-Trichlorophenol	**HOC**	2.0 → 0.5
81	L1	2,4,5-TP (Silvex)	**HOC**	1.0
		2,4,5-Trichlorophenoxy acetic acid	**HOC**	NR
82	LA61	Trifluralin	**HOC**	4.5
83	L30	Trihalomethanes	**HOC**	35.0 → 10.0
84	L31	Uranium	**M**	2.0
	LA36	Vanadium	**M**	100.0 → NR
85	LA64	Vinyl chloride	**HOC**	0.2
86	LA65	Xylene		0.5 → 5.0
		Zinc	**M**	500.0 → NR
		Zirconium	**M**	500.0 → NR

[13] The only wastes to be tested for naphthalene are wastes or contaminated soils containing mixtures of polyaromatic hydrocarbons such as coal tars and creosote or as specified in writing by the regulatory authority.

3.2 Listed Hazardous Waste

The lists of HW identified in Appendix 3 are recommended by the Committee to assist in the classification of HW by facilitating the role of waste manager in waste characterization and classification. The Committee has reviewed Schedule 1 of the *WCR*, and the position of four relevant agencies on this matter: Environment Canada, Ontario, British Columbia, and the US EPA *RCRA*. To minimize administrative and financial burdens and encourage environmental sound management, the Committee recommends a classification system based on actual characteristics of the waste rather than a system based on descriptions and designated lists. Therefore, Committee recommends the following:

Recommendation 9 *(listed hazardous waste)*

(1) The lists of hazardous wastes in Appendix 3 are provided to facilitate waste classification and minimize analytical testing. A listed waste or chemical is hazardous unless proven otherwise, i.e., analytical testing is required to prove that specific hazardous characteristics associated with a listed chemical or listed waste are absent.

(2) Except as allowed in the WCR, there shall not be a formal de-listing protocol that applies to hazardous waste. The onus is on the generator to classify the waste. Upon testing of a representative sample(s) of a listed hazardous waste, the waste is automatically de-listed if the hazardous characteristic(s) is not present in that particular waste.

(3) US EPA RCRA and EC EIHWHRMR lists F, K, P, and U shall be further reviewed and consolidated with the current TDGR list in Schedule 3 to streamline and avoid overlap between the listed chemicals or wastes. An updated list similar to the present Table 4A and Table 4B of the Guide is recommended.

(4) As a consequence of (1) through (3), and the current wording of section 2 of Schedule 1 to the WCR, this Schedule should be amended by repealing subsections 2(a) through 2(g) and substituting the following:

> ***"2 The following waste is hazardous waste unless proven otherwise:***
>
> ***(a) waste types from non-specified sources listed in Table F;***
>
> ***(b) waste types from specified sources listed in Table K***
>
> ***(c) commercial products, off-specification products, or by-products listed in Table P;***
>
> ***(d) commercial products, off-specification products, or by-products listed in Table U;***
>
> ***(e) commercial products, off-specification products, or by-products listed in Schedule 1 or Schedule 3 of the Transportation of Dangerous Goods Regulations, Canada;***
>
> ***(f) a container, other than an empty container, that has an internal volume greater than 5 L and contains a substance listed in (a) through (e);***

(g) a number of containers, other than empty containers, that have an ggregate internal volume greater than 5 L and contain a substance listed in (a) through (e);

(h) an unrinsed empty container that has an internal volume greater than 5 L and contained a substance listed in (c); or

(i) a number of unrinsed empty containers that have an aggregate internal volume greater than 5 litres and contained a substance listed in (c).”

3.3 Test Methods

EPEA and the *WCR* require proper characterization and classification of hazardous waste prior to consignment for transportation. In addition, Schedule 1 of the *WCR* states that a waste or a recyclable is hazardous if, when tested according to test methods set out in the *Guide,* or as authorized in writing by the Director. The Committee has agreed that the testing required and associated sampling and analytical protocols have to be clear, comprehensive, and be reasonably available. The Committee has also agreed that when no tests are reasonably available and reliable information is absent, the generator is not required to test the waste. The main purposes of the test methods is to identify:

- solids, liquids, and dispersible forms,
- properties of HW as defined in the *WCR* for waste characterization and classification,
- properties of HW to assess their suitability for landfill disposal, and
- appropriate management of the waste.

The Committee has agreed that applicable sections of the *Guide* should be reviewed, updated, or expanded as they apply to sampling and analytical protocols, waste classification, and landfill disposal to ensure effective implementation of the recommendations of this report. Further the Committee also recommends the following:

Recommendation 10 *(test methods)*

The test methods to be used in waste characterization and classification are the same for hazardous wastes and hazardous recyclables and are outlined in the updated Alberta User Guide for Waste Managers or as authorized in writing by the Director.

3.4 Exemptions and Acceptable Industry Practices

Schedule 2 of the *WCR*, which identifies wastes that are exempted from the definition of HW for the purposes of *EPEA*, was reviewed by the Committee. It was determined that section (g) properly reformulated and possibly expanded could provide an effective regulatory tool in supporting a strategy towards the management of waste as a resource in support of the new Waste Strategy being developed. Therefore, the Committee considers that specific wastes, even if they exhibit hazardous properties, are better managed under an exemption that will reflect an equivalent level of management defined by acceptable industry practices (AIP), or by the beneficial use of the waste as a product for which a Material Safety Data Sheet (MSDS) has been developed. The first case is illustrated by asbestos waste managed under Alberta Environment

Guidelines for Disposal Asbestos Waste and the second by wastes often managed as resources. Examples of the second may include scrap metal, cement kiln dust, lime sludges, coal and wood fly ashes, produced sand, and phosphogypsum. After reviewing this matter the Committee has endorsed the following recommendation:

Recommendation 11 (*(beneficial uses and acceptable industry practices)*

To encourage sound management, the beneficial use of waste, and address environmental liability associated with that use, the Committee recommends that all of Alberta's exempted wastes, either based on beneficial use or acceptable industry practices, shall be exempted on the basis of scientific and technical reasons and supported by a rationale that meets the following conditions:

(a) an acceptable industry practice applied to the management of that particular waste has been developed and approved in writing by the Director;

(b) beneficial uses and markets have been identified;

(c) the beneficial use can occur, with or without processing, and within or outside waste management facilities;

(d) any beneficial use has to be supported by a Material Safety Data Sheet (MSDS) pursuant to the Hazardous Products Act (Canada); and

(e) Schedule 2 of the WCR shall be expanded to include exemptions based on the beneficial use and acceptable industry practice, accompanied by a rationale for the exemption.

The Committee has noted that Alberta produces many hazardous wastes already exempted or candidates to AIP. It was also observed that in most of these cases a rationale for the exemption is missing in the *Guide* or the applicable AIP has not been documented by AENV. The Committee recognizes that the beneficial use of waste and AIP should be strongly encouraged by simplifying their regulation and properly documenting their management. Consequently, the Committee has further agreed to the following:

Recommendation 12

Wastes for which a beneficial use or an acceptable industry practice have been identified and developed shall be partially or totally exempted from testing and these sound management options shall be recognized in the WCR and reflected in an updated Guide. All regulated exemptions must be accompanied by appropriate rationale.

4. LANDFILL DISPOSAL OF HAZARDOUS WASTE

The current landfill disposal criteria in section 13 of the *Waste Control Regulation* has been adopted by the Committee as a starting point in designing future Alberta's landfill disposal prohibitions. This criteria expanded and clarified, as required, will define which solid hazardous wastes can be disposed of in Alberta's Class I landfills. A related issue dealt with by the Committee was the presence of persistent chemicals in the HW. These persistent chemicals,

albeit in a different form or bonded to a matrix, may still be present even after treatment of the waste. This leads to a need to provide special care when disposing of these wastes. The following approach for handling the disposal of HW containing persistent chemicals balances effective waste treatment and disposal with environmental protection.

4.1 Persistent Hazardous Waste

When assessing HW treatment and land disposal options, key factors to consider include: regulatory requirements and disposal policies, the chemical and physical characteristics of the waste, treatment technologies, facility design, trends in other jurisdictions, and the environmental fate of the waste constituents.

As a starting point, the Committee has decided to define *persistent hazardous waste* (PHW) as a waste that results from the treatment of HW that was hazardous due to the presence of specific heavy metals or persistent halogenated organics, and even upon successful treatment, still contains in its composition one or more of these chemicals. An example would be stabilized or solidified hazardous waste or hazardous contaminated soil containing persistent hazardous constituents such as lead or pentachlorophenol.

A list of PHW that would require disposal into secure landfills has been developed. The list includes treated HW that still contains one or more of the chemical constituents identified as **HOC** or **M** in Table A, pages 26-28. Metals are easier to identify than persistent halogenated organics. If a HW is treated and the persistent hazardous constituents are no longer present, the treated waste is no longer considered PHW for purposes of landfill disposal and consequently can be disposed of in a Class II landfill. Otherwise, the PHW has to go to a Class I landfill.

In Table A, the names of specific chemical constituents that produce toxic leachate waste are associated with the acronyms such as POP for priority organic pollutant, HOC for halogenated organic compound, or M for metal, as applicable.

4.2 Class I Landfills

(a) Class I landfill shall not accept for disposal hazardous waste that:

(i) contains one or more hazardous halogenated organic compounds in a **total combined concentration** (sum) that is equal to or exceed 1000 milligrams per kilogram, of which no more than 50 milligrams per kilogram is polychlorinated biphenyls; or

(ii) contains one or more of the organic solvents identified in section 13.2(c) of the *Waste Control Regulation* in a **total combined concentration** (sum) that is equal to or exceed 1000 milligrams per kilogram; or

(iii) produces a leachate extract that contains one or more metals listed in Table B (Hazardous Waste Prohibited from Landfill Disposal) in concentrations that exceed the limits indicated in that table; or

(iv) is flammable, reactive, corrosive, or acute toxic, under the conditions of disposal;

Table B – Hazardous Waste Prohibited from Landfill Disposal

Hazardous Waste Type	**Limits** (units as indicated)[1]
Liquid	All
Halogenated organic compounds listed in Table 1	≥ 1000 mg/kg
Organic solvents in section 13.2(c) of the *WCR*	≥1000 mg/kg
Polychlorinated biphenyls	≥ 50 mg/kg
Metal-containing waste with one or more of the following metals:	TCLP leachate extract:
Arsenic	≥ 250 mg/L
Beryllium	≥ 500 mg/L
Cadmium	≥ 100 mg/L
Chromium (VI)	≥ 500 mg/L
Lead	≥ 100 mg/L
Mercury	≥ 10 mg/L
Selenium	≥ 100 mg/L
Uranium	≥ 200 mg/L

[1] Total concentrations, in milligrams of chemical constituent per kilogram of waste (mg/kg), are obtained by using appropriate methods, including total digestion or extraction of the waste; leachate concentrations in milligrams of chemical constituent per litre of TCLP leachate extract (mg/L) are obtained using the TCLP, as described in the *Guide.*

(b) For purposes of (a)(iv) core hazardous characteristics include any one of more of the following characteristics:

(i) flammability,

(ii) reactivity,

(iii) corrosivity, or

(iv) acute toxicity.

(c) The landfill disposal restriction identified in section 4.2(a) do not apply to hazardous wastes or hazardous contaminated soils which have a pH exceeding 12.5

(d) The halogenated organic compounds affected by 1(a) are identified in the 3rd column of Table 1 (Hazardous Constituents and Leachate Limits), attached.

4.3 Class II Landfills

(a) Class II landfills shall not accept for disposal any waste that:

(i) is hazardous waste as defined in the Waste Control Regulation; or

(ii) does not meet the hazardous waste definition but resulted from the treatment of hazardous waste which had and still has in its composition one or more *persistent hazardous constituents.*

(b) For purposes of (a)(ii) *persistent hazardous constituents* are those chemicals present in treated hazardous waste that was hazardous because its composition included:

(a) one or more of the halogenated organic compounds at concentrations greater than the limits identified in column 3 of Table A as **HOC**; or

(b) one or more of the metals at concentrations greater than the limits identified in column 3 of Table A as **M**.

4.4 Class III Landfills

Class III landfills shall not accept for disposal any waste other than inert waste.

4.5 Exemptions to Land Disposal Restrictions

The land disposal restrictions identified in sections 4.2 through 4.4 do not apply to:

(a) Waste or contaminated soils treated, beneficially used and/or landfill disposed when the treatment, beneficial use, or disposal is allowed by the *Waste Control Regulation* (i.e., in Schedule 2 of the *WCR);*

(b) Wastewaters discharged pursuant an *EPEA* or *OGCA* authorization; or

(c) Waste or contaminated soils treated, beneficially used, or disposed of in a manner that has been authorized in writing by the Director.

Recommendation 13

Based on the above, the Committee recommends that Alberta's hazardous waste landfill disposal prohibitions be adopted as described in sections 4.2 through 4.5.

5. PRE-TREATMENT OF HAZARDOUS WASTE

The Committee discussed the pre-treatment of hazardous waste and the processing of hazardous recyclables to clarify the role of brokers of HW or HR, the storage of HW or HR, and the importation of HW for treatment or HR for processing and storage as identified in the *Activities Designation Regulation* and *Waste Control Regulation.*

"Pre-treatment" is defined as any activity that does not change any of the hazardous characteristics of a HW. This means that all the hazardous characteristics of a waste have to be present in at least one or more phases of the waste subject to "pre-treatment". Facilities that store HW or HR are allowed to conduct "pre-treatment" activities. For this purpose "pre-treatment" of includes:

- volume reduction and consolidation;
- commingling or blending of materials to make maximum use of available container or tank capacity provided the resultant mixture has the same hazard class of any of the individual components;
- phase separation of materials by gravity settling including filtration or centrifugation;
- dispersion of solids into liquids by natural or mechanical means provided the resultant mixture has the same hazard class as the original liquid;
- physical segregation of hazardous from non-hazardous articles or components from the same container by non-mechanical means; and
- crushing of filters solely for volume reduction and liquid recovery.

6. TREATMENT OF HAZARDOUS WASTE

Currently, the Hazardous Waste Treatment Facility at Swan Hills is the only facility in Alberta approved to treat third-party hazardous waste. This means that the imported and "pre-treated" hazardous waste or its hazardous components cannot be blended with other substances and disposed of by landfill or deepwell injection.

In 2002, the Stakeholder Advisory Committee and more recently the WMSG, following its review of the discussion document entitled Hazardous Waste Treatment in Alberta (January 2004), have previously agreed that off-site treatment of HW should be allowed for specific HW. Allowing the treatment of HW at facilities other than the Swan Hills Treatment Centre (SHTC) was considered **ESSENTIAL** if the land disposal restrictions identified in this report were to be implemented. This important issue was reviewed again, and the Committee strongly recommends opening off-site treatment of hazardous waste to facilities other than the SHTC.

Pursuant to *Environmental Protection and Enhancement Act*, "treat" means to apply any method, technique or physical, chemical, thermal or biological processes that is designed to change the character or composition of a substance. When applied to hazardous waste it means to conduct any of the above in such a manner that results in reduction or elimination of one or more of the hazardous characteristics present in a waste.

The scope of treatment is further delineated by section 16 of the *Waste Control Regulation*, which rules out mixing or division when those actions are conducted for purposes of dilution or of avoiding the requirements of the regulation under the pretext of treatment. Of course, section 16 does not limit legitimate treatments that may either involve the segregation of hazardous components or the chemical or physical stabilization of the toxic constituents of a waste or contaminated soil.

Whereas all generators are allowed to treat their own waste on-site in compliance with the specific facility approval issued by the agency responsible for the activity, off-site treatment of HW or dangerous oilfield waste in Alberta is prohibited unless the activity is conducted at a facility authorized pursuant to the *EPEA* or the *OGCA*, respectively.

Recommendation 14

Off-site treatment of hazardous waste shall be allowed for specific hazardous wastes. Allowing the treatment of hazardous waste at facilities other than the Swan Hills Treatment Centre is ESSENTIAL and consistent with the Committee's recommended changes to landfill disposal prohibitions.

6.1 Waste Treatment Technologies

An Environment Canada (EC) study (2001) summarizes physical-chemical-biological treatment processes available in Canada, in the US and abroad to treat hazardous waste. That work together with the US EPA *RCRA* identification of treatment standards expressed as specified technologies, constitutes a good reference to identify the best available technology economically achievable (BATEA) on which waste managers could base their assessment of available options. The final choice is case specific and takes into account many other factors such as regulatory requirements, policies, and local waste management systems.

The Committee recognizes the specificity of each particular situation and offers only general guidance in this regard which includes the respect for established regulatory requirements, encouragement for the use of the BATEA for waste treatment and disposal, and the minimization or elimination of environmental liability.

7. TREATMENT AND DISPOSAL OF CONTAMINATED SOIL

The following principles are suggested when managing contaminated soil, including hazardous contaminated soil:

(a) Characterization and classification criteria identified in Part 3 for hazardous wastes also apply to contaminated soils;

(b) Landfill disposal restrictions identified in Part 4 for hazardous wastes, also apply to excavated contaminated soils and shall be the same for hazardous wastes and hazardous contaminated soils.

(c) The off-site treatment, beneficial use, or disposal contaminated soils has to respect:

  (i) disposal requirements as defined by the *WCR*;

  (ii) an *EPEA* or *OGCA* authorization; or

  (ii) specifications for beneficial use defined on a case-by-case basis.

(d) The land disposal restrictions do not apply to:

  (i) contaminated soil treated, beneficially used and/or landfill disposed when the treatment, beneficial use, or disposal is allowed by the *Waste Control Regulation* (i.e., Schedule 2 of the *WCR);*

  (ii) contaminated soil treated, beneficially used, or disposed of in a manner that has been authorized in writing by the Director.

Recommendation 15

The criteria for classification and landfill disposal of hazardous waste and excavated hazardous contaminated soil shall be the same.

8. WASTE IMPORT AND EXPORT

Based on the discussion document Waste Importation into Alberta, the HWTC agreed that the prohibition on the importation of hazardous waste for disposal in s.15(2) of the *Waste Control Regulation* should be maintained. There was also agreement that the importation of hazardous waste for recycling (hazardous recyclables) should continue to be allowed. The next section show flow charts summarizing the steps and current Alberta requirements when importing hazardous waste or hazardous recyclables into the Province.

8.1 Importation of Hazardous Waste

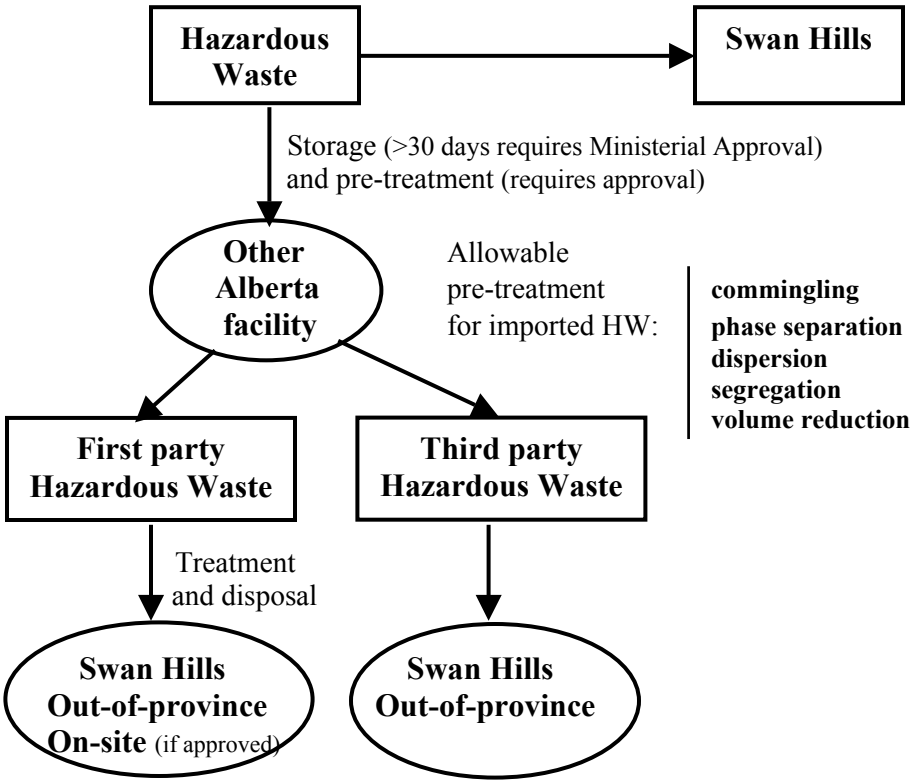
The importation of hazardous wastes into Alberta for treatment and disposal is currently subject to the following requirements:

(a) Third party HW cannot be imported into Alberta for treatment and disposal except when the waste is intended for final treatment and disposal at the Swan Hills Treatment Centre.

(b) No first party HW can be imported into Alberta for treatment and disposal unless the proposed treatment is covered by an *Environmental Protection and Enhancement Act* (EPEA) approval or the waste goes to the SHTC.

(c) Residuals from the treatment of HW or hazardous contaminated soil that contain persistent chemicals must be disposed in a Class I landfill.

These requirements are visualized below:



Within Alberta's waste management system, including importation, ***first party waste*** means waste produced incidentally to industrial manufacturing, services, or waste treatment and recycling activities. ***Third party waste*** means waste produced by somebody else other than the owner of the facility where the waste has been received to undergo further treatment or recycling prior to disposal.

The importation of HW into Alberta waste for treatment raised some controversy due to the "exclusive" access of the Swan Hills Treatment Centre to imported hazardous waste with the Committee recommending the following:

Recommendation 16

From a technical perspective, the Committee recommends that approved facilities other than the Swan Hills Treatment Centre should be allowed to import hazardous waste for treatment. However, the Committee recognizes that this issue goes beyond pure technical merit, and that a policy review is required.

9. DEFINITION AND IMPORTATION OF HAZARDOUS RECYCLABLES

Concern has been expressed that the definition of recycling is not specific enough to ensure that imports of hazardous recyclables into the province are being legitimately recycled. It was determined that it would be more practical to provide this control through the review of proposed imports of hazardous recyclables. Criteria, such as the following, expanded from U.S. EPA requirements, could be considered when defining and importing hazardous recyclables:

- The material must provide a useful contribution to the recycling process and/or product.
- Include a description of the intended beneficial use and economics of the transaction.
- The recycling process should include the recovery of a valuable product or intermediate that, for example, is either (1) sold to a third party, or (2) recycled as an effective substitute for product or as raw material or ingredient in an industrial process.
- The importation of HR into Alberta is a case-by -case process and each situation should be assessed with basis on its own merits. Routine export/import of valuable hazardous recyclables should be simplified by adopting of proper descriptors of the affected materials including MSDS, when applicable.

Recommendation 17

Maintain the current definition of "recycle" and "recyclable".

9.1 Importation of Hazardous Recyclables

Alberta Environment exercises control of what can be imported into Alberta as a hazardous recyclable at two points. The first occurs when the owner of a recycling facility files an application under the *EPEA* for an approval or registration. The second is triggered when a prospective importer of a HR files a request for Ministerial Authorization as required by the WCR, section 21. On this basis the Committee has found that there are no compelling reasons to change the current definition of recycling.

Four cases may occur when hazardous waste is imported into Alberta for recycling. These different scenarios are summarized in Table C and reflect the characteristics of the component being recycled and of the waste or residue resulting from the recycling process.

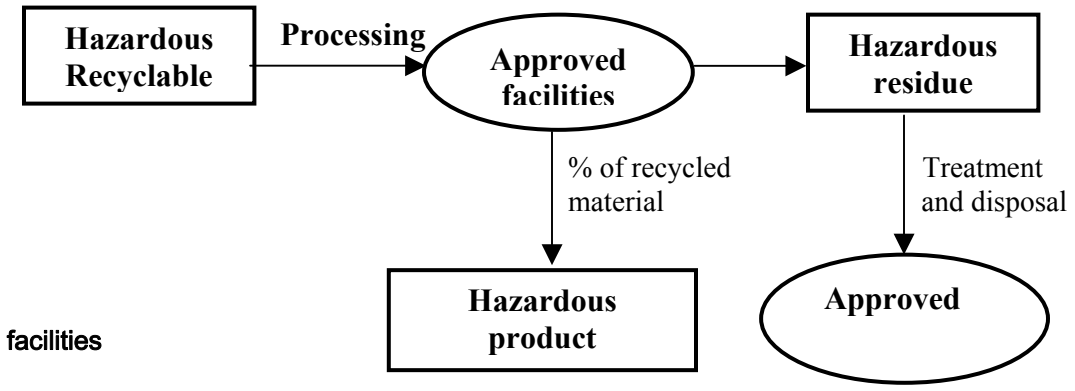
Table C – Imported Hazardous Recyclables

Component recovered / Residue	Hazardous	Non-Hazardous
Hazardous	H/H	NH/H
Non-hazardous	H/NH	NH/NH

The applicable HR pathway is described in detail next to ensure compliance with current legal, policy, and approval requirements. Appendix 4 includes definitions of terms used here such as hazardous residue, on-site treatment, out-of-Province, and percentage of recycled material.

(a) First Case (H/H)

Both the recovered component and the non-recyclable constituent or residue is hazardous.



Examples: **Used solvents and solvent sludges** (solvent-H + sludge-H)
Gunwash from car body shops (varsol-H + sludge-H)
Certain catalysts poisoned with organics/heavy metals.

Off-site treatment of the hazardous residue is allowed only at approved facilities or out-of-province. On-site treatment of the hazardous residue by incineration at the generator's site is allowed subject to approval or registration under the *Code of Practice for Small Incinerators.*

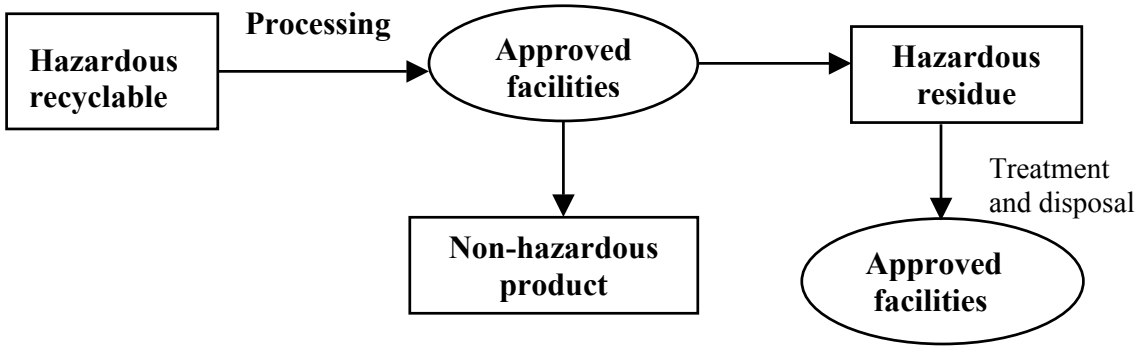
(b) Second Case (H/NH)

The component being recovered is hazardous but not the residue from recycling.

Examples: **Mercury instrumentation/fluorescent lamps** (mercury-H + glass/metal-NH).
Solvent recovery (solvent-H + soils/sorbent/activated carbon-NH)
Caustic/acidic solutions/slurries (caustic/acid-H + solids-NH)

(c) Third Case (NH/H)

The constituent being recovered is non-hazardous and the residue is hazardous.

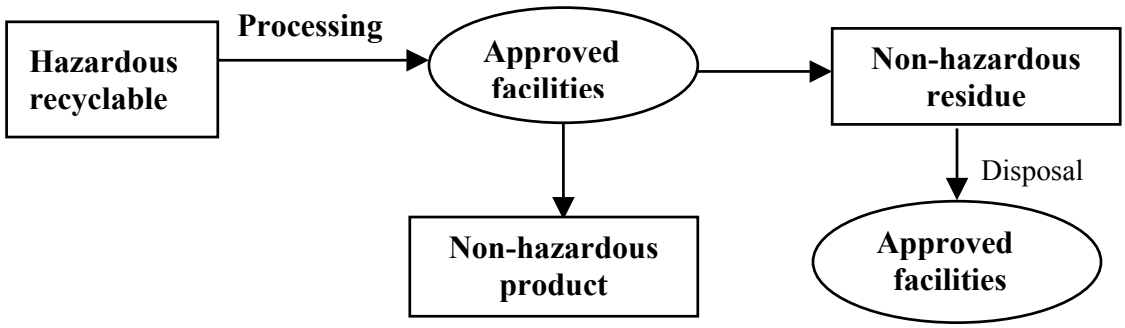


Examples: **Gunwash** (varsol/NH + sludge/H)
Used oil (oil/NH + sludge/H)
Lead Acid Batteries (lead, plastic/NH + $H_2SO_4/PbSO_4$ solution/H)

On-site treatment of the hazardous residue at the generator site is allowed in accordance with the approval or registration issued for the facility as required under *EPEA*.

(d) Fourth Case (NH/NH)

Both the component recovered and the residue are non-hazardous.



Examples: **Spent acid or bases**
Soil with HC
Compressed aerosol cans

Based on the previous analysis and descriptions, the Committee has agreed that there is no need to change the status quo on importation of hazardous recyclables. Accordingly, the following is recommended on this topic.

Recommendation 18

Maintain the current regulations and policies controlling the importation of hazardous recyclables into Alberta.

10. HARMONIZATION WITH THE EUB

AENV and the Alberta Energy and Utilities Board (EUB) have developed two Memoranda of Understanding (MOUs) to clarify waste management requirements and explain the jurisdictional division between the two agencies. The MOUs are: (i) Harmonization of Waste Management (EUB ID 2000-03), and (ii) Deposition of Oilfield Waste Into Landfills (EUB ID 99-04). Provided the MOUs are enforced, harmonization was considered to be reasonably effective.

The Committee recognizes and supports further joint EUB/AENV work on harmonization and clarification of outstanding waste management issues. These issues range from the acceptance of non-oilfield wastes (Alberta's or imported) at EUB approved oilfield waste management facilities to the management of specific wastes at facilities capable of handling both oilfield and non-oilfield waste. The Committee fully supports further work to streamline, harmonize, and clarify the role of the two agencies in waste management.

Recommendation 19

The Alberta Energy Utilities Board and Alberta Environment should further streamline, harmonize, and clarify the role of the two agencies in waste management.

SUMMARY OF RECOMMENDATIONS

The Committee's recommendations, which are to be taken as a comprehensive package, are outlined below.

Recommendation 1 *(hazardous waste characteristics)*

For purposes of waste classification and landfill disposal prohibitions a waste is hazardous if a representative sample of the waste exhibits one or more of the following core characteristics: flammability, reactivity, corrosivity, or toxicity.

Recommendation 2 *(flammability)*

Amend Schedule 1 of the Waste control Regulation by repealing subsections 1(a), 1(b), and 1(c) and substituting the following:

"(a) a hazardous waste exhibits the characteristics of "flammability" if a representative sample of the waste

(i) is a flammable compressed gas,

(ii) has a flash point less than or equal to 60.5 degrees Celsius,

(iii) ignites and propagates combustion in a test sample; or

(iv) contributes oxygen for combustion at a rate that it is equal to or greater than that provided by ammonium persulphate, potassium perchlorate or potassium bromate."

Recommendation 3 *(reactivity)*

Amend Schedule 1 of the WCR by repealing subsection 1(e) and substituting the following:

"(b) a hazardous waste exhibits the characteristics of "reactivity" if a representative sample of the waste

(i) is normally unstable and readily undergoes violent change without detonation

(ii) reacts violently with water;

(iii) when mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human heath or the environment;

(iv) is capable of causing fire through friction, absorption of moisture or spontaneous chemical changes (i.e., self heating or pyrophoric substances); or

(v) is a cyanide or sulfide bearing waste which when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment;"

Recommendation 4 *(corrosivity)*

A hazardous waste exhibits the characteristics of "corrosivity" if a representative sample of the waste has a pH value of less than 2.0 or greater than 12.5.

Recommendation 5 *(acute toxicity)*

Amend Schedule 1, s. 1(d) of the Waste Control Regulation to read that a hazardous waste exhibits the characteristics of "acute toxicity" if

(d) it is toxic because it

(iii) has a rat oral toxicity LD_{50} not greater than 200 mg/kg, if a solid, or 500 mg/kg, if a liquid,

(iv) has a dermal toxicity LD_{50} not greater than 1000 mg/kg, or

(iii) has an inhalation toxicity LC_{50} not greater than 10,000 mg/m^3 at normal atmospheric pressure.

Recommendation 6 *(chronic toxicity)*

(a) Remove Table 1 from the Waste Control Regulation and the Guide; and

(b) Implement all 37 recommendations identified in Appendix 2 of this report and change Table 2 of the Guide accordingly by removing, adding or modifying the chemical constituents and limits as indicated in Table A of this report.

Recommendation 7 *(BTEX testing)*

Remove from the Guide the exemption for testing for BTEX in wastes, soils, sorbents, or dessicants contaminated only with fuels such as gasoline, kerosene, diesel, aviation fuel, fuel oil or crude petroleum hydrocarbons and having a flash point > 61 degrees Celsius.

Recommendation 8 *(limits for BTEX)*

Change the limits for toluene, ethylbenzene, and xylene in toxic leachate wastes from 0.5 mg/L to 5.0 mg/l to reflect the physical, chemical and biological (toxic) properties of these chemicals rather than the 100 times the Canadian Drinking Water Standards. The limit for benzene remains the same at 0.5 mg/L.

Recommendation 9 *(listed hazardous waste)*

(1) The lists of hazardous wastes in Appendix 3 are provided to facilitate waste classification and minimize analytical testing. A listed waste or chemical is hazardous unless proven otherwise, i.e., analytical testing is required to prove that specific hazardous characteristics associated with a listed chemical or listed waste are absent.

(2) Except as allowed in the WCR, there shall not be a formal de-listing protocol that applies to hazardous waste. The onus is on the generator to classify the waste. Upon testing of a representative sample(s) of a listed hazardous waste, the waste is automatically de-listed if the hazardous characteristic(s) is not present in that particular waste.

(3) US EPA Resource Conservation and Recovery Act (RCRA) and Environment Canada's (EC) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (EIHWHRMR) lists F, K, P, and U should be further reviewed and amalgamated or consolidated with the current Transportation of Dangerous Goods Regulations (TDGR) list in Schedule 3 for

streamlining and avoid overlap between the listed chemicals or wastes. An updated list similar to the present Table 4A and Table 4B of the Guide is recommended.

(4) As a consequence of (1) through (3), and the current wording of section 2 of Schedule 1 to the WCR, this Schedule should be amended by repealing subsections 2(a) through 2(g) and substituting the following:

"2 The following waste is hazardous waste unless proven otherwise:

- *(v) waste types from non-specified sources listed in Table F;*
- *(vi) waste types from specified sources listed in Table K*
- *(vii) commercial products, off-specification products, or by-products listed in Table P;*
- *(viii) commercial products, off-specification products, or by-products listed in Table U;*
- *(ix) commercial products, off-specification products, or by-products listed in Schedule 1 or Schedule 3 of the Transportation of Dangerous Goods Regulations, Canada;*
- *(x) a container, other than an empty container, that has an internal volume greater than 5 L and contains a substance listed in (a) through (e);*
- *(xi) a number of containers, other than empty containers, that have an aggregate internal volume greater than 5 L and contain a substance listed in (a) through (e);*
- *(xii) an unrinsed empty container that has an internal volume greater than 5 L and contained a substance listed in (c); or*
- *(xiii) a number of unrinsed empty containers that have an aggregate internal volume greater than 5 litres and contained a substance listed in (c)."*

Recommendation 10 *(test methods)*

The test methods to be used in waste characterization and classification are the same for hazardous wastes and hazardous recyclables and are outlined in the updated Alberta User Guide for Waste Managers, or as authorized in writing by the Director.

Recommendation 11 *(beneficial uses and acceptable industry practices)*

To encourage sound management and the beneficial use of waste and address environmental liability associated with that use, the Committee has agreed and recommends that all Alberta's exempted wastes, either based on beneficial use or acceptable industry practice, shall be exempted based on sound scientific and technical reasons and supported by a rational that meets the following conditions:

- *(a) an acceptable industry practice applied to the management of that particular waste has been developed and approved in writing by the Director;*
- *(b) beneficial use and markets have been identified;*
- *(c) the beneficial use can occur, with or without processing, and within or outside waste management facilities;*
- *(d) any beneficial use has to be supported by a Material Safety Data Sheet (MSDS) pursuant to the Hazardous Products Act (Canada); and*
- *(e) Schedule 2 of the WCR should be expanded to include exemptions based on the beneficial use and acceptable industry practice, accompanied by a rationale for the exemption.*

Recommendation 12

Wastes for which a beneficial use or an acceptable industry practice have been identified and developed shall be partially or totally exempted from testing and these sound management options shall be recognized in the WCR and reflected in an updated Guide. All regulated exemptions must be accompanied by appropriate rationale.

Recommendation 13

Alberta's hazardous waste landfill disposal prohibitions shall be adopted as described in Sections 4.2 through 4.4.

Recommendation 14

Off-site treatment of hazardous waste should be allowed for specific hazardous wastes. Allowing the treatment of hazardous waste at facilities other than the Swan Hills Treatment Centre is ESSENTIAL and consistent with the Committee's recommended changes to landfill disposal prohibitions.

Recommendation 15

The criteria for classification and landfill disposal of hazardous waste and excavated hazardous contaminated soil shall be the same.

Recommendation 16

From a technical perspective, the Committee recommends that approved facilities other than the Swan Hills Treatment Centre should be allowed to import hazardous waste for treatment. However, the Committee recognizes that this issue goes beyond pure technical merit, and that a policy review is required.

Recommendation 17

Maintain the current definition of "recycle" and "recyclable".

Recommendation 18

Maintain the current regulations and policies controlling the importation of hazardous recyclables into Alberta.

Recommendation 19

The Alberta Energy Utilities Board and Alberta Environment should further streamline, harmonize, and clarify the role of the two agencies in waste management.

APPENDIX 1

Table A1 - HAZARDOUS CONSTITUENTS AND LEACHATE LIMITS BY JURISDICTION

Item	Code Number		Constituent	Regulatory Limits (mg/L)					
	AB	US		AB 97→86[1]	US 37	BC 36→92[1]	ON 88	Federal 89	CDWS
1	LA1		Aldicarb	0.9	-	0.9	0.9	0.9	0.009
2	L3		Aldrin + Dieldrin **POP** [2] **HOC** [3]	0.07	-	0.07	0.07	0.07	0.0007
			Aluminium [4] **M** [5]	NR [6]					
	LA2		Ammonia [7]	100.0 → NR	-	-	-	-	-
3	L4		Antimony [9] **M**	500.0 → 0.6	-	-	-	-	0.006
4	L4	D004	Arsenic **M**	5.0 → 2.5	5.0	5.0 → 2.5	2.5	2.5	0.025
5	LA4		Atrazine+N-dealkylated metab.	6.0 → 0.5	-	- → 0.5	0.5	0.5	0.005
6	LA5		Azinphos-methyl	2.0	-	- 2.0	2.0	2.0	0.02
7	L5	D005	Barium **M**	100.0	100.0	100.0	100.0	100.0	1.0
8	LA6		Bendiocarb	4.0	-	- → 4.0	4.0	4.0	0.04
9	LA7	D018	Benzene	0.5	0.5	0.5	0.5	0.5	0.005
			Benzo(a)pyrene [10]	NR	-	- → .001	0.001	0.001	0.00001
	LA8		Beryllium **M**	5.0	-	-	-	-	-
10	L6		Boron	500.0	-	500.0	500.0	500.0	5
11	LA9		Bromoxynil **HOC**	0.5	-	- → 0.5	0.5	0.5	0.005
12	L7	D006	Cadmium **M**	1.0 → 0.5	1.0	0.5	0.5	0.5	0.005
13	L8		Carbaryl	7.0	-	9.0	9.0	9.0	0.09
14	LA10		Carbofuran	9.0	-	- → 9.0	9.0	9.0	0.09
15	LA11	D019	Carbon tetrachloride **HOC**	0.5	0.5	0.5	0.5	0.5	0.005
			Chloramines	NR	-	- →300.0			
16	L9	D020	Chlordane **POP** **HOC**	0.03	0.03	0.7	0.7	0.7	-
17	LA41		Chlorobenzene (mono) **HOC**	100.0	-	- → 8.0	8.0	8.0	0.08
18	LA12	D022	Chloroform **HOC**	6.0→ 10.0	6.0	-	10.0	10.0	-
19	LA13		Chlorpyrifos **HOC**	5.0 → 9.0	-	- → 9.0	9.0	9.0	0.09
20	L10	D007	Chromium **M**	5.0	5.0	5.0	5.0	5.0	0.05
	LA14		Cobalt **M**	100.0 → NR	-	-	-	-	-
21	LA15		Copper **M**	100.0	-	100.0	-	-	1.0
22	LA16	**D023-26**	Total cresols (o-, m-, p-)	200.0	200.0	- →200.0	200.0	200.0	-
23	LA17		Cyanazine **HOC**	1.0	-	- → 1.0	1.0	1.0	0.01

Item	Code Number		Constituent	Regulatory Limits (mg/L)					
	AB	US		AB 97→86[1]	US 37	BC 36→92[1]	ON 88	Federal 89	CDWS
24	L11		Cyanide	20.0	-	20.0	20.0	20.0	0.2
25	L2	D016	2,4-D(diClphenoxyacet acid) **HOC**	10.0	10.0	10.0	10.0	10.0	0.1
26	L13		Diazinon	0.02 → 2.0	-	2.0	2.0	2.0	0.02
27	LA18		Dicamba **HOC**	12.0	-	- → 12.0	12.0	12.0	0.12
28	LA19		1, 2-Dichlorobenzene **HOC**	20.0	-	- → 20.0	20.0	20.0	0.20
29	LA20	D027	1, 4-Dichlorobenzene **HOC**	7.5 → 0.5	7.5	7.5→ 0.5	0.5	0.5	0.005
30	LA21	D028	1, 2-Dichloroethane **HOC**	0.5	0.5	0.5	0.5	0.5	0.005
31	LA22	D029	1, 1-Dichloroethylene **HOC**	0.7	0.7	0.7 → 1.4	1.4	1.4	0.014
32	L12		DDT + metabolites **POP HOC**	3.0	-	3.0	3.0	3.0	-
33	LA23		Dichloromethane **HOC**	5.0	-	- → 5.0	5.0	5.0	0.05
34	LA24	D030	2, 4-Dinitrotoluene	0.13	-	- → 0.13	0.13	0.13	-
35	LA25		2, 4-Dichlorophenol **HOC**	90.0	-	- → 90.0	90.0	90.0	0.9
36	LA26		Dichlorfop-methyl **HOC**	0.9	-	- → 0.9	0.9	0.9	0.009
37	LA27		Dimethoate	2.0	-	- → 2.0	2.0	2.0	0.02
38			Dinoseb	NR → 1.0	-	- → 1.0	1.0	1.0	0.01
39			Dioxins & Furans [11] **POP HOC**	**0.001→3.0x10^{-6}**	-	-	$1.5x10^{-6}$	$1.5x10^{-6}$	-
40	LA28		Diquat or diquat dibromide) **HOC**	7.0	-	- → 7.0	7.0	7.0	0.07
41	LA29		Diuron **HOC**	15.0	-	- → 5.0	15.0	15.0	0.15
42	L14	D013	Endrin **POP HOC**	0.02	0.02	0.02	0.02	0.02	-
43	LA30		Ethylbenzene	0.5 → 5.0	-	0.24	-	-	0.0024
44	L15		Fluoride	150.0	-	150.0	150.0	150.0	1.5
	LA31		Formaldehyde	100.0 → NR	-	-	-	-	-
45	LA32		Glyphosate	28.0	-	- → 28.0	28.0	28.0	0.28
46	L16	D031	Heptachlor and epoxide **POP HOC**	0.008	0.008	0.3	0.3	0.3	-
47	LA33	D032	Hexachlorobenzene **POP HOC**	0.13	0.13	0.13	0.13	0.13	-
48	LA34	D033	Hexachlorobutadiene **HOC**	0.5	0.5	- → 0.5	0.5	0.5	-
49	LA35	D034	Hexachloroethane **HOC**	3.0	3.0	- → 3.0	3.0	3.0	-
	LA35		Iron	1000.0 → NR	-	-	-	-	0.3
50	L17	D008	Lead [12] **M**	5.0→ 1.0	5.0	5.0	5.0	5.0	0.01
51	L18	D013	Lindane **HOC**	0.4	0.4	0.4	0.4	0.4	-
52	LA37		Malathion	19.0	-	- → 19.0	19.0	19.0	0.19
53	L19	D009	Mercury **M**	0.2 → 0.1	0.2	0.1	0.1	0.1	0.001
54	L20	D014	Methoxychlor **HOC**	10.0 → NR	10.0	90.0	90.0	90.0	0.9

Item	Code Number		Constituent	Regulatory Limits (mg/L)					
	AB	US		AB 97→86[1]	US 37	BC 36→92[1]	ON 88	Federal 89	CDWS
55	LA38	D035	Methyl ethyl ketone	200.0	200.0	- → 200.0	200.0	200.0	-
56	L21		Methyl parathion	0.7	-	- → 0.7	0.7	0.7	-
57	LA39		Metolachlor **HOC**	5.0	-	- → 5.0	5.0	5.0	0.05
58	LA40		Metribuzin	8.0	-	- → 8.0	8.0	8.0	0.08
59	LA42		Naphthalene[13]	0.5→5.0	-	-	-	-	-
			1-Naphthyl-N-methyl carbamate	NR	-	- → 9.0	-	-	-
	LA43		Nickel	5.0 → NR	-	-	-	-	-
60	L22		Nitrate (as nitrate-nitrogen)	1000.0	-	1000.0 ...	1000.0	…	45 (NO_3^-)
61	L23		Nitrilotriacetic acid (NTA)	5.0→40.0	-	5.0 → 40.0	40.0	40.0	0.4
62	L24		Nitrite (as nitrite-nitrogen)	100.0	-	- →320.0	-	-	3.2(NO_2^-)
63	LA44	D036	Nitrobenzene	2.0	2.0	2.0	2.0	2.0	-
64	LA45		Paraquat	1.0	-	- → 1.0	1.0	1.0	0.01
65	L26		Parathion	3.5→ 5.0	-	5.0	5.0	5.0	0.05
66	LA46	D037	Pentachlorophenol **HOC**	100.0 → 6.0	100.0	3.0	6.0	6.0	0.06
	LA47		Phenol	100.0 → NR	-	-	-	-	-
67	LA48		Phorate	0.2	-	- → 0.2	0.2	0.2	-
68	LA49		Picloram **HOC**	19.0	-	- → 19.0	19.0	19.0	0.19
69	LA50	D038	Pyridine	5.0	5.0	- → 5.0	5.0	5.0	-
70	L27	D010	Selenium **M**	1.0	1.0	1.0	1.0	1.0	0.01
	L28	D011	Silver	5.0→ NR	5.0	5.0	5.0	-	-
71	LA51		Simazine **HOC**	1.0	-	- → 1.0	1.0	1.0	0.01
72	LA54		Temephos	28.0→ NR	-	28.0	28.0	28.0	-
73	LA55		Terbufos	0.1	-	- → 0.1	0.1	0.1	0.001
74	LA53	D039	Tetrachloroethylene **HOC**	0.7→ 3.0	0.7	0.7 3.0	3.0	3.0	0.03
	LA52		Thallium	5.0→ NR	-	-	-	-	-
75	LA62		Toluene	0.5→ 5.0	-	2.4	-	-	0.024
76	L29	D015	Toxaphen **POP** **HOC**	0.5→ 0.3	0.5	- 0.5	0.5	0.5	-
77	LA57		2, 3, 4, 6-Tetrachlorophenol **HOC**	10.0	-	0.1→10.0	10.0	10.0	0.1
	LA56		Triallate **HOC**	23.0→ NR	-	-	-	-	-
78	LA58	D040	Trichloroethylene **HOC**	0.5→ 5.0	0.5	- → 5.0	5.0	5.0	0.05
			1, 1, 1-TriCl-2, 2-bis (p-mp)eth **HOC**	NR	-	- → 90.0	-	-	-
79	LA59	D041	2, 4, 5-Trichlorophenol **HOC**	400.0	400.0	- →400.0	400.0	400.0	-
80	LA60	D042	2, 4, 6-Trichlorophenol **HOC**	2.0→ 0.5	2.0	- → 0.5	0.5	0.5	0.005

Item	Code Number		Constituent		Regulatory Limits (mg/L)					
	AB	US			AB 97→86[1]	US 37	BC 36→92[1]	ON 88	Federal 89	CDWS
81	L1	D017	2, 4, 5-TP (Silvex)	**HOC**	1.0	1.0	-	1.0	1.0	-
			2, 4, 5-TriClphenoxy acet acid	**HOC**	NR	-	28.0	28.0	28.0	-
82	LA61		Trifluralin	**HOC**	4.5	-	- → 4.5	4.5	4.5	0.045
83	L30		Trihalomethanes	**HOC**	35.0→10.0	-	35.0→10.0	-	10.0	0.1
84	L31		Uranium	**M**	2.0		10.0	10.0	10.0	0.02
	LA36		Vanadium		100.0→ NR	-	-	-	-	-
85	LA64	D043	Vinyl chloride	**HOC**	0.2	0.2	- → 0.2	0.2	0.2	0.002
86	LA65		Xylene		0.5→ 5.0	-	30.0	-	-	0.3
			Zinc	**M**	500.0→ NR	-	500.0	-	-	5.0
			Zirconium	**M**	500.0→ NR	-	-	-	-	-

EXPLANATORY NOTES

1. The numbers in the column headings denote the total number of chemical constituents regulated in TCLP toxic leachates in various jurisdictions.
2. **POP** means priority organic pollutant.
3. **HOC** stands halogenated organic compounds.
4. The chemical constituents with a numerical limit and identified in **blue** have been regulated in Alberta only, except for ethylbenzene, toluene, and xylene, which have also been regulated in BC at 100 times the CDWS and recently by EC (EIHWHRMR) as well, in this case at 100 mg/kg. These constituents are discussed in Appendix 2.
5. **M** stands for metal.
6. NR stands for not regulated.
7. The TCLP is not appropriate to test ammonia and its salts as producing waste toxic leachates. Ammonia and some of its salts are captured as hazardous waste due to other properties other than originating toxic leachates.
8. The first number, the current limit, is tied to a second number, which representing the proposed limit or NR.
9. Antimony is only regulated in wastes, which produce toxic leachates due, to the presence in the waste of the one or more of the following compounds: antimony pentachloride, antimony potassium tartrate, antimony tribromide, antimony trichloride, and antimony trioxide.
10. Chemical constituents identified in **red** are regulated elsewhere in Canada but not in Alberta. These constituents, and those addressed in note 4, are discussed in Appendix 2.
11. The only wastes to be tested for dioxins and dibenzofurans in leachates, as dioxin toxic equivalent (TEQ), are wastes F020 through F023 and F026 through F028, described in List F of Appendix 4 or leachates from wastes such as "wastes from industrial use in the formulation of halogenated pesticide/preservatives", or as specified in writing by the regulatory authority.
12. The presence of lead or other hazardous constituents in paints led to the definition by Alberta Environment of Waste Type 205. Alberta does not require the removal of these paints from rigid surfaces or TCLP testing demolition debris that may contain these paints prior to disposal. However, paints or spent shot blasting wastes that may contain hazardous substances should be segregated, and managed as hazardous waste, unless proven otherwise.
13. The only wastes to be tested for naphthalene are wastes or contaminated soils containing complex mixtures of polyaromatic hydrocarbons such as coal tars and creosote or as specified in writing by the regulatory authority.
14. There is great similarity between the 1996 Alberta's toxic leachate limits and the limits recently adopted by Ontario, the federal government in TDGR and EC (EIHWHRMR), and British Columbia.

15. Currently, Alberta (97+61 chemicals), BC (92), TDGR (83), EC (89 in EIHWHRMR), and TC (83 in TDGR) regulate substances as hazardous waste or "environmentally hazardous substances" if they produce TCLP toxic leachates. The criteria have been originally derived from the US EPA and TDGR.
16. Despite the "transfer of responsibilities" for waste classification from Transport Canada to Environment Canada in 2001, TDGR continues to regulate in Part 2, Appendix 4 (83) and Appendix 5 (179) certain substances intended for final disposal as dangerous goods under the designation of "environmentally hazardous substances", UN3082, if liquid, n.o.s, or UN3077, if solid, n.o.s..
17. The 179 "environmentally hazardous substances' identified in TDGR, Part 2, Appendix 5, and by British Columbia and Environment Canada in the EIHWHRMR are regulated when their concentration exceeds 100 mg/kg in a waste, except for PCB regulated at 50 mg/kg.
18. The BC list of toxic leachate constituents has been amended recently (July 2004) and includes 92 chemicals. Previously, the BC list was, exception made for TEX, similar to the US list. Of note is the fact that BC uses distilled water solution as the extraction media instead of the TCLP acidic solution.
19. Environment Canada identifies 89 chemical constituents in the draft of the EIHWR. There are some discrepancies between EC and the Ontario lists, specifically for nitrates+nitrites, silver, PCB and D&F.
20. Ontario lists 88 substances, including benzo(a)pyrene, PCB and D&F, these ones absent from the Alberta list.
21. The US identifies 37 (or 40 substances, depending on how these substances are defined).

APPENDIX 2

RATIONALE FOR HAZARDOUS CONSTITUENTS AND LIMITS IN TOXIC LEACHATES IN TABLE A

INTRODUCTION

In Alberta a group of 97 chemicals are identified in Table 2 of the *Alberta User Guide for Waste Managers* (Guide) with potential to form toxic leachable hazardous waste. These chemicals are regulated at 100 times the *Canadian Drinking Water Standards* (CDWS). A second group of 61 chemicals, identified in Table 1 of the *Guide* as Class 9.2, are regulated in Alberta at 100 mg/L also by using the *Toxicity Characteristic Leaching Procedure* (TCLP).

These two groups of regulated chemicals and respective leachate limits have been subject to a scientific review to reflect updated information on the toxicity, human health impacts, and environmental fate to support a rationale for their regulation. The final Table 1 identifies Hazardous Constituents and Leachate Limits used to classify leachable toxic waste. The Committee recommends that Tables 1 and 2, that identify toxic leachates in the *Guide,* be replaced by Table A of this report in an updated *Guide*.

The numbers in the headings of Table A denote the parameters regulated by each jurisdiction. Some chemicals in the first group mentioned above are only regulated in Alberta. The chemicals for which the regulatory limits have been changed to reflect 100 times the CDWS or for scientific reasons are shown in **blue** in Table 1. The chemicals identified in **red** are regulated elsewhere in Canada.

The primary reference used in developing a scientific rationale for the recommended regulatory limits is the TOXNET, a toxicology and environmental health data bank set by the US National Library of Medicine. This constitutes a major source of information on relevant properties of the chemicals assessed. I am available at http://toxnet.nlm.nih.gov.

CHEMICALS ASSESSMENT

The review of the chemical constituents identified is limited to those for which changes have been proposed because of new CDWS, scientific reasons, consistency in regulation or because they have raised questions or concerns amidst the Committee members.

1. **Aluminium**

   There is no health-based CDWS for aluminium. TDGR, EC, and BC regulate aluminium sulphate at 100 mg/kg as a class 9 waste. Aluminium phosphide is a RCRA P006 hazardous waste (R, T). Otherwise, no jurisdiction uses aluminium in TCLP leachates to regulated toxic wastes.

   Aluminium compounds are present in soils at high levels. The broad use of aluminium-based coagulants in water treatment plants led to the adoption by Health Canada of a CDWS as an *operational guideline* for water treatment plants, only (0.1 or 0.2 mg/L depending on the type of plant).

   Recommendation 1*: Remove aluminium from Table A.*

2. **Ammonia – NH_3**

Ammonia hazards stem from its toxicological properties and reactivity. Exposure to this colorless gas (liquid, if compressed or in aqueous solution) may occur from its use as a fertilizer, chemical intermediate, alkalizer, metal treating/extraction agent, and household cleaner. Ammonia is a hazardous substance under the US Water Pollution Control Act and regulated by the Clean Water Act. In Canada ammonia and its compounds are regulated under TDGR and CEPA as environmentally hazardous substances when the concentration in a waste or soil exceeds 100 mg/kg.

Ammonia is highly soluble in water, about 40% at 25^{o}C forming alkaline solutions with a pH of about 11. Ammonia in water under normal conditions (aerobic) is rapidly converted to nitrate by nitrification and the principal water contaminant becomes the nitrate.

The TCLP has not been designed to identify ammonia-based compounds in wastes or contaminated soils. Ammonia and some of its salts are dangerous goods under different classes. When becoming a waste these substances are still captured as hazardous waste under different criteria . ie., they are listed either in TDGR, as a corrosive, compressed gas, or identified in List P, when the hazardous characteristic is present. Consequently, the TCLP is not recommended or applicable on this case.

Recommendation 2*: Considering that the TCLP is not suitable to test ammonia and many of its salts and that these substances are captured as hazardous due to hazardous properties other than leachability, ammonia should be removed from Table 2 of the Guide.*

3. **Antimony**

The rationale for current Alberta regulatory limit of 500 mg/L could not be found. TDGR and EC regulate the following antimony compounds at 100 mg/kg. Based on its potential adverse human health impact, the Canadian and US drinking water standard for antimony is 6 μg/L.

US drinking water standards and guidelines (units in μg/L):

EPA	6	standard
Arizona	14	guideline
Minnesota	6	guideline

Comments on specific Sb compounds:

Antimony pentachloride

- Designated as a hazardous substance under the US Water Pollution Control Act; regulated by the US Clean Water Act; US EPA DWS: 6 μg/L.
- Listed as a hazardous air pollutant known or suspected to cause serious health problems.
- Regulated under the US Toxic substance Control Act (TSCA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Antimony potassium tartrate (leather and textile industry mordent, pesticide, etc.)

- It is the most potent and most toxic of the Sb compounds (TOXNET).
- Designated as a hazardous substance under the US Water Pollution Control Act; regulated by the US Clean Water Act; US EPA DWS: 6 μg/L.
- Regulated under the US Toxic substance Control Act (TSCA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Antimony tribromide

- Probable carcinogenic to humans (TOXNET).
- Designated as a hazardous substance under the US Water Pollution Control Act; regulated by the US Clean Water Act; US EPA DWS: 6 µg/L.
- Regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Antimony trichloride

- Probable carcinogenic to humans.
- Designated as a hazardous substance under the US Water Pollution Control Act; regulated by the US Clean Water Act; US EPA DWS: 6 µg/L.
- Regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Antimony trioxide

- Probable carcinogenic to humans.
- Designated as a hazardous substance under the US Water Pollution Control Act; regulated by the US Clean Water Act; DWS (USEPA): 6 µg/L.
- Regulated under the US Toxic substance Control Act (TSCA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

***Recommendation 3**: Keep antimony in the Table 2 of the Guide, but change the regulatory limit from 500 mg/L to 0.6 mg/L (i.e., 100 times the CDWS).*

4. **Benzene, ethylbenzene, toluene, and xylene** (BTEX)

Relevant physical, chemical and biological properties of benzene, alkyl benzenes, benzo(a)pyrene, naphthalene, and 2,3,4,5-tetrachlorodibenzodioxin are identified in Table I.

Table A2 - Properties and Regulatory Limits for Specific Chemicals

Chemical	Toxicity LD_{50} (mg/kg)	Solubility (mg/L)	CDWS (mg/L)	BC (mg/L)	US & Ontario (mg/L)	EC (EIHWR) & TDGR	AB (mg/L)
Benzene	3306	1 790	0.005	0.5	0.5	0.5 mg/L	0.5
Toluene	2600-7500	526	0.024	2.4	-	100 mg/kg	0.5
Ethyl benzene	3500-5460	169	0.0024	0.24	-	100 mg/kg	0.5
Xylene	4300-8600	174	0.3	30.0	-	100 mg/kg	0.5
B(a)P[1]	250 ipl	0.0016	0.00001	0.001	0.001	0.001mg/L	-
Naphthalene	490	31	-	-	-	100 mg/kg	0.5
Dioxin[2]	22.4 µg/L	19.3 ng/L	-		0.0000015		0.001

Chemical	Taste threshold (mg/L)	Vapor pressure (mm Hg)	Half-life			Mobility in soils
			Air	Water	Soil	
Benzene	0.5-4.5	94.8	2-13days	2.5 days	70 days	High
Toluene		28.4	3 days	4 days	Hours to 71 days	Moderate to high
Ethyl benzene		9.6	2.5 days	2-3 days		Moderate
Xylene		8.0	1-2 days	3 h-4 days		Moderate to high
B(a)P[1]		$5.49x10^{-9}$	PM[3]	16-22 days	120-270 days	No to low
Naphthalene		0.085	18 hours	0.8-43 days	2-18 days	Moderate to low
Dioxin[2]						No

[1] B(a)P = Benzo(a)pyrene

[2] 2,3,4,5 Tetrachlorodibenzodioxin

[3] B(a)P is expected to exist solely in the particulate phase in the ambient atmosphere. Particulate-phase BaP may be physically removed from the air by wet and dry deposition.

The occurrence, use, and environmental regulation of BTEX are discussed below.

(a) **Benzene**

Benzene is an aromatic hydrocarbon that occurs naturally in crude oil, is present in fuels, and is produced by forest fires, volcanoes, and plants. It is used as a solvent or an intermediate in the manufacture of chemicals. Benzene is a known human carcinogen.

The CDWS for benzene is 5 ug/L (or 0.005 mg/L) based on adverse health impact. Benzene is regulated in the US under RCRA as D018 (in TCLP extracts at 0.5 mg/L), or F005 (from a nonspecific source), or U019 (when benzene as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste).

US drinking water standards and guidelines (units in μg/L):

EPA	5	standard
California	1	"
Florida	1	"
New Jersey	1	"
Arizona	1.3	guideline
Connecticut	1	"
Maine	12	"
Minnesota	10	"

Recommendation 4: *Do not change the toxic leachate limit for benzene in Table 2 of the Guide (i.e., keep it at 0.5 mg/L or 100 times the CDWS).*

(b) **Ethylbenzene**

Ethylbenzene is present in crude oil, fuels, and is produced by forest fires and volcanoes.

The CDWS for ethylbenzene of 0.0024 mg/L is based on aesthetics. Ethylbenzene is a confirmed animal carcinogen with unknown relevance to humans. Ethylbenzene has low acute and chronic toxicity for both animals and humans. Similarly to other aromatic and aliphatic light molecular weight hydrocarbons it is toxic to the central nervous system and an irritant of mucous membranes and the eyes.

In Canada, this chemical is regulated as a hazardous waste only in Alberta and B.C. Under the U.S. RCRA, ethylbenzene is classified as a hazardous waste, i.e., F003 spent solvent that must be managed according to state and/or federal hazardous waste regulations.

US federal and state drinking water guidelines (units in μg/L):

EPA	700
Arizona	680
Florida	30
Maine	70
Minnesota	700

Recommendation 5: *Change the standard for ethylbenzene from 0.5 mg/L to 5.0 mg/L.*

(c) **Toluene**

Is a natural constituent of crude oil, present in fuels, and is produced by forest fires and volcanoes. There is inadequate evidence for the carcinogenicity of toluene in humans and there is evidence that suggests lack of carcinogenicity in experimental animals. Toluene has low acute and chronic toxicity for both animals and humans. It is toxic to the central nervous system and is an irritant of mucous membranes and the eyes. It is not a carcinogen.

Toluene is regulated in toxic leachates in Alberta and BC, only. Toluene is also regulated at 100 mg/kg by EC and TDGR. The CDWS for toluene is 0.024 mg/L and is based only on aesthetics.

Toluene is regulated as hazardous waste in the US as a F005 spent solvent from non-specific sources. Toluene is a RCRA U220 hazardous waste when as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

US federal and state drinking water guidelines (units in μg/L):

EPA	1000	standard
California	150	"
Arizona	2000	guideline
Florida	40	"
Maine	1400	"
Minnesota	1000	"
Washington	800	"

Recommendation 6: *Keep toluene in Table 2 of the User Guide but change the standard from 0.5 mg/L to 5.0 mg/L.*

(d) **Xylens**

Xylene occurs naturally in crude oil petroleum, is produced by forest fires, and volatiles from plants. Produced in very large quantities, is extensively employed in a broad spectrum of applications, primarily as a solvent for which its use increases as a safe replacement for benzene, and in gasoline as part of the BTX component. It is also used as a raw material in resins, rubber, coatings, polymers and intermediate in chemical manufacturing.

There is inadequate evidence for the carcinogenicity of xylenes in humans or in experimental animals.

Xylene is regulated as TCLP toxic leachate in Alberta and BC, only. The CDWS for xylene is 0.3 mg/L and is based on aesthetics. Xylene has low acute and chronic toxicity for both animals and humans. It is toxic to the central nervous system and is an irritant of mucous membranes and the eyes. It is not a carcinogen.

The US regulates xylene under RCRA as a F003 hazardous waste when xylene is a spent solvent waste from a non-specific sources, or as a U239 when xylene, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste becomes a waste.

US federal and state drinking water standards and guidelines (units in µg/L):

EPA	10 000	standard and guideline
New Jersey	1 000	"
Arizona	440	guideline
Maine	14 000	"
Minnesota	10 000	"

Recommendation 7*: Keep xylene in Table 2 of the User Guide, but change the limit from 0.5 mg/L to 5.0 mg/L.*

5. **Benzo(a)pyrene [B(a)P]**

Benzo(a)pyrene is regulated in wastes as a leachable toxic at 1.0 µg/L (i.e., 100 times the CDWS of 0.00001 mg/L) by several Canadian jurisdictions.

BaP is ranked as one of the most hazardous chemicals, it is a probable human carcinogen and there is sufficient evidence of its carcinogenicity in animals. BaP is one of the many polycyclic aromatic hydrocarbons (PAH) that make up to about 85 % of creosote in which the BaP concentration is below 1%.

The solubility of BaP in water is very low, 1.6 µg/L at 25 degrees Celsius (ranges from 0.2 to 6.1 µg/L depending on the temperature). This appears to indicate that the TCLP regulatory limit of 1.0 µg/L adopted by various Canadian jurisdictions may not be scientifically sound to classify wastes or contaminated soils as hazardous due to BaP. Regardless of its concentration, these substances may never fail the *TCLP* test. The data in Table A illustrates critical properties of BaP vis-à-vis naphthalene.

RCRA identifies B(a)P in List U, as U022 (note that creosote is listed as U051) when as a commercial chemical product, chemical intermediate, or off-specification product becomes a waste. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

The US Clean Water Act has established criteria for B(a)P in potable water at 8 ng/L. Any attempt to develop a drinking water criterion for PAH as a class has been hindered by several gaps in the scientific database: (1) The PAH is a class of numerous compounds having diverse biological effects and varying carcinogenic potential. A "representative" PAH mixture, has not been defined. (2) The common practice of using data derived from studies with BaP to make generalizations concerning the effects of environmental PAH may not be scientifically sound. (3) No chronic animal toxicity studies involving oral exposure to PAH mixtures exist. (4) No direct human data concerning the effects of exposure to defined PAH mixtures exist.

US drinking water standards and guidelines illustrate US approach (units in µg/L):

EPA	0.2	standard
Arizona	0.003	guideline
New Hampshire	0.003	"

Recommendation 8: *Do not include B(a)P in Table A of this report considering that the solubility of B(a)P (0.2-6.1 µg/L) overlaps with the regulatory limit used by some Canadian jurisdictions (1.0 µg/L). If included, the regulatory limit for B(a)P should be well below the solubility of this compound in water. Testing contaminated soil or waste for naphthalene or classifying it as a listed hazardous waste (U051) better captures coal tar or creosote-containing soil or waste. Naphthalene is more soluble in water then B(a)P and thus a better indicator of the presence of PAH in wastes, contaminated soils, or wastewaters.*

6. **Beryllium**

Beryllium does not have a CDWS. Except for Alberta where beryllium has been regulated in TCLP leachates at 5.0 mg/L since 1996, this metal is not regulated in toxic leachates by any of the jurisdictions identified in Table 1. TDGR, BC and EC regulate beryllium chloride in wastes and contaminated soils at 100 mg/kg.

US federal and state drinking water standard or guidelines (units in µg/L):

EPA	4	standard
Arizona	0.007	guideline
Minnesota	0.08	"

Beryllium and its compounds are carcinogenic to humans. There is sufficient evidence for the carcinogenicity of beryllium and beryllium compounds in humans and animals exposed to airborne beryllium (lung cancer). Beryllium has also been identified as the cause of the beryllium disease, which sometimes occurs in metal mining workers.

Beryllium and beryllium compounds, including $BeCl_2$, are identified in US EPA legislation as a hazardous air pollutant generally known or suspected to cause serious health problems. RCRA lists beryllium in list P as a P015 acute hazardous chemical by reason of its acute toxicity. Spilled or off spec beryllium is a hazardous waste when going for disposal.

No technical or scientific reasons have been found to justify the removal of beryllium from Table 1. Beryllium is also regulated by other Canadian jurisdictions when its concentration exceeds 100 mg/kg. Its regulation at 5 mg/L in TCLP leachates is equivalent to a minimum total concentration of 100 mg/kg the assuming that all beryllium is available to the aqueous phase. Exception made for beryllium phosphate, beryllium salts are very soluble in water

Recommendation 9: *Keep beryllium in Table 2 of the Guide at the same limit, i.e., 5.0 mg/L.*

7. **Bromate**

The US and CDWS and for bromate is 0.01 mg/L. No jurisdiction regulates bromate in waste toxic leachates.

Recommendation 10: *Remove bromate from Table A of this report.*

8. **Chloramines**

The CDWS for chloramines is 3.0 mg/L. Chloramines are by-products of the action of chlorine-based water disinfectant on organic matter. BC is the only jurisdiction to regulate these compounds in TCLP toxic leachates at 300 mg/L.

Recommendation 11*: Remove chloramines from Table A of this report.*

9. **Chlordane**

Chlordane does not have a CDWS. The US regulates chlordane as a hazardous substance under the federal Water Pollution Control Act and in the Clean Water Act.

US federal and state drinking water standard or guidelines (units in μg/L):

EPA	2	standard
California	0.1	"
New Jersey	0.5	"
Arizona	0.022	guideline
Connecticut	0.3	"
Maine	0.3	"

TDGR, BC, ON and EC regulate chlordane in TCLP leachates from wastes or soils at 0.7 mg/L. However, this number has little or no scientific value as the solubility of chlordane in water is 0,056 mg/L at 25 degrees Celsius. This means that solid wastes with chlordane, even pure chlordane, never fail the test in those jurisdictions.

RCRA lists chlordane as a D020. A waste containing chlordane may become characterized as a hazardous waste when subjected to the Toxicity Characteristic Leaching Procedure the leachate shows a concentration exceeding 0.03 mg/L.

RCRA also lists chlordane as a U036 hazardous chemical when chlordane as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

Chlordane is possibly carcinogenic to humans. However there is sufficient evidence in experimental animals for the carcinogenicity of chlordane.

Recommendation 12: *Given that the solubility of chlordane in water is 0.056 mg/L the limit of 0.03 mg/L in Table 2 of the Guide, used also in the US, should not be changed.*

10. **Chloroform**

Chloroform does not have a CDWS. The US regulates chloroform as a hazardous substance under the federal Water Pollution Control Act and in the Clean Water Act.

US federal and state drinking water standard or guidelines (units in μg/L):

EPA	80	standard
Arizona	0.49	guideline

Florida	6	"
Maine	57	"
Massachusetts	5	"
Minnesota	60	"
New Hampshire	70	"
Wisconsin	6	"

TDGR, BC, ON and EC regulate chloroform at 10 mg/L in TCLP leachates from wastes or soils. Chloroform is highly soluble in water.

RCRA lists chloroform as a D022. A waste containing chloroform may become characterized as a hazardous waste when subjected to the Toxicity Characteristic Leaching Procedure the leachate shows a concentration exceeding 6.0 mg/L.

RCRA also lists chlroform as a U044 hazardous chemical when chloroform as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

Chloroform is possibly carcinogenic to humans. However there is sufficient evidence in experimental animals for the carcinogenicity of chloroform.

Recommendation 13: *Keep chloroform in Table 2 of the Guide, but change the limit from 6.0 mg/L to 10.0 mg/L for consistency with other Canadian jurisdictions.*

11. **Cobalt**

Cobaltous bromide, formate and sulphamate are regulated by TDGR, EC, and BC at 100 mg/kg each. These chemicals are not identified as dangerous goods in Schedules 1 or 3 of TDGR. Also, none of these chemicals is regulated as a hazardous chemical under RCRA.

Cobalt and its compounds do not have a drinking water standard in either Canada or the US. However, Arizona and Wisconsin have drinking water standards for these compounds at 0.70 µg/L and 40 µg/L, respectively.

Cobaltous bromide –A hazardous air pollutant under the US Clean Air Act.

Cobaltous formate - A hazardous air and water pollutant under the US Clean Air and Clean Water Act.

Cobaltous sulphamate - A hazardous air and water pollutant under the US Clean Air and Clean Water Act.

Recommendation 14: *Remove cobalt from Table 2 of the Guide.*

12. **Copper**

Copper is regulated by US EPA and Health Canada with a drinking water standard of 1.0 mg/L. In Canada is regulated for aesthetic reasons only.

US drinking water standards and guidelines illustrate US approach (units in µg/L):

EPA	1300	standard & 1000 guideline
Arizona	1300	guideline

Some copper compounds are regulated as dangerous goods. These include copper-based pesticides, chloride, cupric acetate, oxalate, sulphate, and tartrate, which are regulated by TDGR, EC and BC as "environmentally hazardous substances" at 100 mg/kg. Copper (II) chloride and oxalate are used as catalysts. Cu-based pesticides include cupric acetate. Copper (II) sulphate, ammoniated and copper (II) tartrate are not mentioned in TOXNET. Finally, copper (II) sulphates and tartrate oxalates are recognized by FDA as additives to animal feed as nutritional dietary supplements. Exception made for Cu-based pesticides, these chemicals are not regulated under RCRA.

Recommendation 15: *Keep the parameter in Table 2 of the User Guide.*

13. **Dinoseb**

Dinoseb is regulated in toxic leachates by EC, TDGR, and BC. The US EPA drinking water standard is 7.0 μg/L.

Dinoseb is a pesticide identified under RCRA with the code P020 when as a commercial chemical product, chemical intermediate, off-specification chemical product becomes a waste, it must be managed according to federal and/or state hazardous waste regulations. The same applies to any container or inner liner used to hold this waste or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Small quantities of this waste may qualify for partial exclusion from HW regulations.

Recommendation 16: *Include dinoseb in Table 2 of the Guide at 1.0 mg/L (100 times the Canadian Drinking Water Standards).*

14. **Dioxins & Furans (D&F)**

Currently, the Alberta limit for D&F does not have a scientific basis because the solubility of D&F in water is lower than the regulatory limit. For instance, 2.3,7,8-tetrachlorodibenzo-p-dioxin, the most toxic one, has a solubility in water of only 2.0×10^{-4} mg/L at 25 degrees Celsius or five times less than Alberta's regulatory limit. This means that right now pure 2,3,7,8-TCDD may be disposed of in Alberta Class I landfills. 1, 2,3,7,8-pentachlorodibenzo-p-dioxin, t he second congener in terms of toxicity, has a solubility in water of 1.2×10^{-4} mg/L at 20 degrees Celsius, more than eight times less that the regulatory limit.

The LD_{50} rat (male) oral for 2.3,7,8-tetrachlorodibenzo-p-dioxin is 22.0 μg/kg.

US federal and state drinking water guidelines (units in μg/L) are:

EPA	0.00003	standard (or 3×10^{-8} mg/L)
Florida	0.000003	guideline
Maine	0.000007	

"

The regulatory limit adopted by Environment Canada and Ontario for D&F in leachable wastes or contaminated soils is 1.5×10^{-6} mg/L. Applying the one hundred times factor to the

US DWS we get a limit of 3×10^{-6} mg/L that doubles the limit adopted by other Canadian jurisdictions.

Testing all wastes for D&F cannot be justified for environmental reasons, as only a few wastes streams are likely to contain D&F at levels of concern. Therefore, the only wastes to be tested for D&F are F020 through F023 and F026 through F028 or any other as requested in writing by the agency with jurisdiction over the waste. Those dioxin-bearing wastes are included in the US EPA list F that describes hazardous wastes from non-specific sources and are result from manufacturing processes of specific chemicals or specific chemicals used in the production of pesticides and soils or wastes containing these chemicals.

Recommendation 17:

(1) Change the regulatory limit in the Waste Control Regulation for dioxins and dibenzofurans in TCLP leachates from 0.001 mg/L to 3.0×10^{-6} mg/L [Schedule 1, section 1(g)(iii), WCR]

(2) Wastes to be tested for D&F using the TCLP are:

- *F020 through F023 and F026 through F028 (RCRA, CFR, subchapter I, Part 261, subpart D, 261.31, Hazardous Waste from Non-Specific Sources); or*
- *Any other waste or contaminated soil as specified in writing by the regulatory agency.*

15. **<u>Formaldehyde</u>**

Formaldehyde is ubiquitous in the environment and an important endogenous chemical that occurs in most life forms, including humans. It readily biodegrades under both aerobic and anaerobic conditions in the environment. It is a probable human carcinogen based on limited evidence in humans, and sufficient evidence in animals.

Formaldehyde is regulated as a toxic leachate only in Alberta.

Formaldehyde is a listed chemical (U122) when as a commercial product or off-specification product becomes a waste it must be managed according to US HW regulations. Also defined as a HW is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may qualify for partial exclusion from HW regulations (40 CFR 261.5).

US drinking water standards and guidelines illustrate US approach (units in μg/L):

EPA	1000	guideline
California	30	standard & guideline
Florida	600	guideline
Maine	30	"
Minnesota	1000	"
New Jersey	100	"
Wisconsin	1000	"

Recommendation 18*: Remove formaldehyde from Table 2 of the Guide.*

16. **Iron**

The CDWS for iron is based on aesthetic considerations, only.

The reason for its regulation in toxic leachates Alberta appears to be the listing of specific iron compounds in TDGR – ferric ammonium oxalate, chloride, nitrate, sulphate, and ferrous ammonium sulphate, chloride, and sulphate. These compounds are regulated by TDGR, EC, and BC as "environmentally hazardous substances" at 100 mg/kg (former Class 9.2). This approach appears to be unrealistic as some of these compounds are present in water and wastewater treatment sludges due to their wide used as coagulants. Its enforcement would be translated into great cost with little or no environmental or human health benefits.

Recommendation 19: *Remove iron from Table 2 of the Guide.*

17. **Lead**

The CDWS for lead was reduced from 0.05 mg/L to 0.01 mg/L in 1996. The measurement for lead is made in a free flowing sample of water (flushed sample). The MAC for lead has been developed to protect the population most at risk, namely infants and young children. This information has been discussed with and confirmed by Alberta's representative on the Federal-Provincial-Territorial Committee on Drinking Water of the FPT CE&OH. British Columbia, Ontario, and Environment Canada have not updated the toxic leachate limit of 100 times the previous CDWS.

Recommendation 20

(1) Change the limit for lead in TCLP toxic leachates from 5.0 mg/L to 1.0 mg/L in Table 2 of the Guide for consistency with 100 times the current CDWS

(2) Include a note in the User Guide explaining that, with regards to Waste Type 205, when handling rigid structures that received lead paint there will be no requirement to grind a section of the structure to obtain representative samples and then conduct leachate tests on those samples or to scrap the lead coating from the rigid structure.

(3) Regardless of (2), flaking leaded paint or, more generally, paint residues that may contain other hazardous substances such as mercury, chromium, and PCB should be segregated and managed as Waste Type 205.

(4) Testing is required when the generator handles friable paint waste residues suspect or containing hazardous constituents or when wants to challenge the hazardous character of Waste Type 2005, as described in the Guide.

(5) In all cases, rigid demolition debris with such paints should be disposed of in Class I or Class II landfills, only.

18. Methoxychlor or **1,1,1-Trichloro-2,2-bis (p-methoxyphenyl) ethane**

Methoxychlor is regulated as U247 in the US under EPA RCRA as stipulated in 40 CFR 261.33. When methoxychlor as a commercial chemical product or manufacturing chemical intermediate or an off-specification product becomes a waste, it must be managed according to federal and/or state hazardous waste regulations. Also defined as a hazardous waste is any

residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on land, of this waste.

A solid waste containing methoxychlor may become characterized as a hazardous waste in Alberta and the US (D014) when subjected to the Toxicity Characteristic Leaching Procedure, if the leachate exceeds 10.0 mg/L of methoxychlor.

US drinking water standards and guidelines for methoxyclhor (included for curiosity to document US consistency or lack of it; units in µg/L):

EPA	40	standard and guideline
Arizona	340	guideline
Maine	35	"

A search in the TOXNET (the United States Library of Medicine database available at http://www.toxnet.nlm.nih.gov) shows that methoxychlor has low toxicity to humans or other mammals (LD_{50} rat oral varies from 3640 to 6000 mg/kg) and is practically insoluble in water, 0.1 mg/L at 25 degrees Celsius. This indicates that the TCLP regulatory limits adopted elsewhere and identified in Table 1 have no scientific back up as those values far exceed the solubility of the chemical in water

Similar concern may also be raised with respect to the CDWS set by Health Canada (0.9 mg/L), though we understand that the CDWS was based in ADI (acceptable daily intake). The immediate consequence of this discrepancy is that in Canada solid wastes or soils containing methoxychlor will never fail the TCLP test under normal conditions of pressure and temperature unless methoxychlor is attached to suspended solids that do not exceed 0.5 % of the sample.

Recommendation 21*: Remove methoxychlor from Table 1 of the Guide. If kept, there is a need to change the regulatory limit to a value lower than its solubility in water.*

19. **Methyl parathion**

Methyl parathion is an organophosphorus insecticide that is relatively insoluble in water (55 mg/l at 20 degrees Celsius), poorly soluble in petroleum ether and mineral oils, and readily soluble in most organic solvents. It is highly acute toxic chemical with a LD_{50} rat male oral of 14 mg/kg. It is not classifiable as to its carcinogenicity to humans. The FAO/WHO acceptable daily intake is 0.02 mg/kg. Methyl parathion is not classifiable as to its carcinogenicity to humans.

Under RCRA, methyl parathion is an acute hazardous chemical **(**P071) that when as a chemical product, or chemical intermediate, or an off-spec chemical becomes a waste; it must be managed according to federal and/or state hazardous waste regulations. Also defined as a hazardous waste is any container or inner liner used to hold this waste or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or land, of this waste.

There is no CDWS set for methyl parathion. However, methyl parathion is a designated hazardous substance under the US Water Pollution Control Act.

US federal and state drinking water standards and guidelines (units in µg/L):

EPA	2	guideline
Arizona	1.8	"
California	2	"
Florida	10	"
Maine	2	"

Recommendation 22: *No rational for the US limit has been found. However, based on the above and considering that methyl parathion is an acute toxic hazardous chemical, the chemical should be kept in Table 2 of the Guide at the same level.*

20. **Methyl ethyl ketone** (MEK)

MEK or 2-butanone does not have a CDWS. US federal and state drinking water guidelines for MEK are (units in µg/L):

Arizona	170	guideline
Florida	4 200	"
Massachusets	350	"
Maine	1 440	"
Minnesota	4 000	"
North Carolina	170	"
New Hampshire	170	"
New Jersey	270	"
Wisconsin	460	"

Under the USEPA, RCRA, when MEK as a commercial chemical product, chemical intermediate or an off-spec chemical product or intermediate and becomes a waste, it must be managed according to federal and/or state hazardous waste regulations (U159). Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. When MEK becomes a spent solvent, it is classified as a hazardous waste from a nonspecific source (F005), as stated in 40 CFR 261.31, and must be managed according to State and/or Federal hazardous waste regulations. MEK is not toxic. The LD_{50} rat oral varies from 2.9 to 5.52 g/kg.

A brief review of the environmental fate of MEK is summarized next.

Terrestrial fate:

MEK is expected to have very high mobility in soil. Volatilization of MEK from dry soil surfaces is expected based upon a vapor pressure of 91 mm Hg at 25 deg C. The volatilization half-life of ME from silt and sandy loams was measured as 4.9 days. MEK is easily biodegraded under both aerobic and anaerobic conditions.

Aquatic fate:

MEK is not expected to adsorb to suspended solids and sediment in water. MEK volatilizes from water surfaces readily. Estimated half-lives for a model river and model lake are 19 and

197 hours, respectively. Biodegradation of this compound is expected based upon numerous screening tests.

Atmospheric fate:

MEK will exist solely as a vapor in the ambient atmosphere. Vapor-phase MEK is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be about 14 days. MEK is also expected to undergo photodecomposition in the atmosphere by natural sunlight. Photochemical degradation of MEK by natural sunlight is expected to occur at approximately 1/5 the rate of degradation by photochemically produced hydroxyl radicals.

Environmental Biodegradation:

MEK is readily oxidized by microorganisms in activated sludge following selection and/or adaptation, with over 80% being removed in 24 h.

FDA Requirements:

MEK is an indirect food additive for use only as a component of adhesives, or as a basic component of single and repeated use food contact surfaces. MEK is a direct food additive permitted as a synthetic flavoring substance and adjuvant in accordance with the following conditions: 1) the quantity added to food does not exceed the amount reasonably required to accomplish its intended physical, nutritive, or other technical effect in food, and 2) when intended for use in or on food it is of appropriate food grade and is prepared and handled as a food ingredient.

Occupational health (OSHA Standards):

Permissible exposure limit: 8-h time weighted average: 200 ppm (590 mg/m^3) and short-term exposure limit (15 minutes): 300 ppm (885 mg/m^3).
Immediately Dangerous to Life or Health: 3 000 ppm (8 850 mg/m^3)

Recommendation 23: *Based on the above and considering that MEK is already captured as a highly flammable (f. p. –18 degrees Celsius) hazardous chemical also included in list U, and that no rationale for the 200 mg/L used by the US EPA has been found, we recommend dropping MEK from Table 2 of the Guide.*

22. **Naphthalene**

Naphthalene is regulated in toxic leachates in Alberta since 1995 when its concentration in TCLP extracts exceeds 0.5 mg/L. Naphthalene is also regulated by TDGR, EC, and BC as *environmentally hazardous substance* at 100 mg/kg. Table A summarizes this information.

Identified in RCRA, with the code U165. Naphthalene is possibly carcinogenic to humans. This is based on the inadequate data of carcinogenicity in humans exposed to naphthalene and the limited evidence of carcinogenicity in animals. Naphthalene is also listed as a hazardous air and water pollutant (US Clean Air & Water Acts).

Naphthalene and its substituted derivatives are commonly found in crude oil and oil products. Naphthalene is, at about 10 %, the most significant polycyclic aromatic hydrocarbon (PAH) present in creosote. PAHs constitute about 85 % of the 150 to 200 chemicals present in coal tar creosote. Considering that:

- naphthalene and benzo(a)pyrene [B(a)P] have similar acute toxicity and carcinogenic characteristics
- naphthalene is present in creosote at much higher concentrations than B(a)P (about 10% versus less that 1%);
- naphathalene solubility in water is higher than BaP (31.7 mg/L vis-à-vis 1.6 µg/L at 25 degrees Celsius), then it makes sense to use naphthalene as a good indicator of the presence of PAH instead of B(a)P, to characterize the hazardous character of wastes and soils due to the presence of creosote or coal tar in wastes or contaminated soils.

US drinking water standards and guidelines for naphthalene (included just for curiosity to document US consistency or lack of it; units in µg/l):

EPA	20	guideline
New Jersey	300	standard
Maine	25	guideline
Minnesota	300	"
Washington	14	guideline
Wisconsin	40	"
Florida	6.8	"

Recommendation 24*: Maintain naphthalene in Table 2 of the Guide but change the limit to 5.0 mg/L for consistency with other Canadian jurisdictions. Naphthalene is more reliable than B(a)P to identify the hazardous character of coal tar or creosote wastes or contaminated soils because it is expected to be present at much higher concentrations and is quite more soluble in water than B(a)P. The Guide should specify the conditions when a waste or contaminated soil is to be tested for naphthalene.*

23. **1-Naphthyl-N-methyl carbamate**

This parameter is not currently listed in Alberta. Regulated by BC and EC at 9.0 mg/L because it is in Appendix 4 of TDGR. This chemical does not have a CDWS. No rationale has been found for the TDGR number and there is no information readily available.

Recommendation 25: *Remove 1-naphthyl-N-methyl carbamate from Table 2 of the Guide because no science-based rationale has been found.*

24. **Nickel**

Nickel is a trace metal and occurs in soil, water, air and the biosphere. The primary uses for nickel compounds, aside from nickel refining and electroplating, are in steel making, catalysts, storage batteries, specialty chemicals, and specialty ceramics. The substance is added directly to human food and generally recognized as safe.

Nickel ammonium sulphate, chloride, hydroxide and sulphate are "environmentally hazardous substances" under TDGR, EC, and BC. Nickel does not have a drinking water standard both in Canada or the US and is regulated as toxic leachate in Alberta, only.

There is inadequate evidence in humans for the carcinogenicity of metallic nickel and nickel alloys. There is sufficient evidence in humans for the carcinogenicity of nickel sulfate, and of the combinations of nickel sulfides and oxides encountered in the nickel refining industry.

US drinking water guidelines (units in μg/L):

EPA	100
Arizona	150
Massachusetts	100
Maine	150
Minnesota	100

Recommendation 26*: Remove nickel from Table 2 of the Guide.*

25. **Pentachlorophenol**

Alberta regulates PCP in TCLP leachates at 100 mg/L as well as the US EPA under RCRA. This does not make sense because PCP wastes, contaminated soils or even pure PCP cannot ever originate aqueous leachates under standard conditions with such high levels of PCP. The solubility of PCP in water is 5 mg/L at 0 ^{o}C and 14 mg/L at 20 ^{o}C.

Recommendation 27*: Keep this parameter in Table 2 of the Guide but substitute 6.0 mg/L for 100.0 mg/L.*

26. **Phenol**

Phenol is regulated as a toxic leachate in Alberta (100 mg/L) and BC (6.0 mg/L), only. Phenol is also regulated by TDGR, EC, and BC as an "environmentally hazardous substance" at 100 mg/kg. There is no CDWS for phenol.

Listed as U188 under RCRA when phenol, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a HW is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

Phenol is naturally produced in decaying organic matter and also released from wood stoves, vehicle exhaust and other combustion processes. Phenol is very soluble in water (67 g/L at 25 degrees Celsius) and in most of the organic liquid compounds.

US drinking water guidelines (units in μg/L):

EPA	4000
California	5
Florida	10
Minnesota	4000
New Hampshire	4200
Wisconsin	6000

Recommendation 28*: Remove phenol from Table 2 of the User Guide.*

27. **Polychlorinated biphenyls** (PCB)

PCB are man-made chlorinated organic compounds chemically inert, non-flammable, and have a high resistance to electrical currents. The manufacture of PCB has been banned in the US and Canada since 1977. Former uses included electrical equipment dielectrics, heat transfer media, hydraulic fluids, plasticizer in synthetic resins and rubbers, adhesives, wax and pesticide extenders, paints, dedusting agents, inks, lubricants, cutting oils, and carbonless reproducing paper.

Lower chlorinated PCB are colorless mobile oils. Increasing chlorine content results in increasingly viscous liquids, sticky resins, or white powders. Solubility in water of PCBs is extremely low; they are soluble in oils and organic solvents.

Although studies have proven the carcinogenicity of PCB in animals, PCB are probably carcinogenic to humans since there is no conclusive evidence that exposure to polychlorinated biphenyls increases the incidence of cancer in humans. PCB accidentally ingested trigger clinical symptoms such as chloracne, pigmentation of skin and nails, swelling of eyelids, increase in liver enzymes, etc.

PCB are not very toxic or soluble in water. The following table illustrates this point:

PCB (Aroclor)	**LD_{50} rat oral** (mg/kg)	**Solubility in water at 25°C** (µg/L)
1242	794 to 4 250	240
1248	11 000	54
1254	1 010 to 2 000	12
1260	4 000 to 10 000	27

Ontario is the only jurisdiction in Canada that regulates PCB waste as hazardous wastes when its TCLP leachate exceeds at 0.3 mg/L of PCBs. At this level, most common PCBs are not captured by the test even if the waste is pure PCBs under standard conditions.

US federal and state drinking water standards and guidelines (units in µg/L):

EPA	0.5	standard
New Jersey	0.5	"
Arizona	0.008	guideline
Connecticut	0.5	"
Minnesota	0.04	"
Maine	0.5	"
Wisconsin	0.03	"

***Recommendation 29**: Based on the above, the PCB limit should be removed from Table 2 of the User Guide. Given the PCB very low solubility in water it is not appropriate use aqueous leachates to classify PCB wastes*

28. **Temephos**

Regulated as a leachable toxic in AB, BC, Ontario, EC and listed in Appendix 4 of TDGR at 28 mg/L. There is no drinking water standard for temephos in either Canada or the US.

Temephos is almost insoluble in water: 0.001 mg/L, so it does not make scientific sense to regulate the chemical in *TCLP* leachates at 28 mg/L.

There is little information available about the fate and behavior of temephos in the environment. Based on its very low solubility in water, it would probably have a high affinity for soil. Based on this, a half-life of 30 days has been estimated [19], indicating a low to moderate persistence.

Temephos is an organophosphorus insecticide used to control mosquito, black fly larvae, etc. It is used in lakes, ponds, and wetlands. It also may be used to control fleas on dogs and cats and to control lice on humans.

Recommendation 30*: Remove the parameter from Table 2 of the Guide.*

30. **Tetrachloroethylene (or PERC)**

Tetrachloroethylene production and use as a dry cleaning and degreasing agent and as a chemical intermediate in the production of fluorocarbons will result in its release to the environment through various waste streams. If released to air, its half-life is estimated to be 96 days. The half-lives of tetrachloroethylene, also known as perchloroethylene (PERC), in aerobic and anaerobic waters were reported to be 180 and 98 days, respectively. Volatilization from water is an important fate process and river and lake models predict a estimated volatilization half-lives of 1 hour and 5 days, respectively.

Tetrachloroethylene is a confirmed animal carcinogen, but there is limited evidence of the carcinogenicity of PERC in humans.

Under RCRA, PERC wastes or contaminated soils are considered a D039 HW when the PERC concentration exceeds 0.7 mg/L in the TCLP extract; PERC is also listed HW (F002) from a non-specific sources as a spent halogenated solvent.

In Canada, PERC is identified in TDGR, EC and other provinces legislation as hazardous waste when its concentration exceeds 3.0 mg/L in TCLP leachates. The CDWS maximum acceptable concentration is 0.03 mg/L.

US federal and state drinking water standards and guidelines for PERC are (units in μg/L):

EPA	5	standard
Florida	3	"
New Jersey	1	guideline
Arizona	0.67	"
Connecticut	5	"
Maine	7	"
Minnesota	7	"
Washinton	4	"

Recommendation 31*: Change the limit from 0.6 mg/L to 3.0 mg/L in Table 2 of the Alberta User Guide for Waste Managers based on a CDWS of 0.03 mg/L and consistently with other Canadian jurisdictions.*

29. **Thallium**

Regulated in Alberta as waste toxic leachate at 5.0 mg/L. It is also in Alberta land disposal restrictions at 200 mg/L. Thallium sulphate is identified in TDGR, EC, and BC as an "environmentally hazardous substance' and regulated at 100 mg/kg.

Thallium and thallium compounds are used in electronic (alloys with Hg) and analytic equipment), catalyst, pesticide, crystals, optical systems, for coloring glass and lenses, etc. Thallium compounds are extremely toxic and because they are tasteless, there are many accounts of their criminal use.

US drinking water standards and guidelines (units in µg/L):

EPA	2	standard (and guideline at 0.5)
Arizona	13	guideline
Maine	0.4	"
Minnesota	0.6	"

Recommendation 32*: Remove thallium from Table 2 of the User Guide.*

31. **Toxaphene**

Toxaphene is a very toxic pesticide (LD_{50} rat oral 70-80 mg/kg) not produced in US since the eighties but is still allowed in specific uses. The ADI for toxaphene is 1.25 µg/kg. Solubility of toxaphene in water is low. Literature values vary from 0.55 mg/L to 3 mg/L at 20^{o} C.

There is sufficient evidence in experimental animals for the carcinogenicity of toxaphene, but not for its carcinogenicity in humans**.** Under RCRA toxaphene is a P123 acute toxic chemical that when becomes a waste must be managed according to hazardous waste regulations. A solid waste containing toxaphene may or may not become characterized as D015 hazardous leachable toxic waste when subjected to the Toxicity Characteristic Leaching Procedure its leachate contains an excess of 0.5 mg/L of toxaphene.

There is no CDWS set for toxaphene. However, toxaphene is a hazardous substance under both the US EPA Clean Air Act and the Water Pollution Control Act/Clean Water Act. US federal and state drinking water standards and guidelines (units in µg/L) are**:**

EPA	3	standard
Arizona	0.03	guideline
Maine	0.3	"
Minnesota	0.3	"

Recommendation 33: *No rationale to the US limit of 0.5 mg/L has been found. The recommended value in Table 2 of the Guide should be changed to 0.3 mg/L to be in line with 100 times the US drinking water standard. In this case the number adopted in Alberta will differ from that used by other Canadian jurisdictions.*

31. **Triallate**

Triallate is a halogenated pesticide for which there is no established CDWS. Triallate has a LD_{50} rat oral between 200 mg/kg and 1100 mg/kg and is regulated in the US as a hazardous

chemical, U389. Alberta is the only jurisdiction in Canada to regulate this chemical as a toxic leachate. The solubility of triallate in water is 2 mg/L at 25 degrees Celsius.

Recommendation 34*: It does not make sense to regulate triallate at 23.0 mg/L. in addition, considering that the chemical is not regulated as a toxic leachate elsewhere, triallate should be removed from Table 2 of the Guide.*

32. **2,4,6-Trichlorophenol**

2,4,6-Trichlorophenol has not been produced in the US and Canada since the early nineties. Previously, it was used in the manufacture of Prochloraz, a fungicide and Chloranile, a bleaching agent. Its former use as a defoliant, herbicide and fungicide may have lead to its release to the environment.

This compound is moderately soluble in water (800 mg/L at 25 degrees C and 2430 mg/L at 96 degrees) and it is expected to biodegrade in the environment with aerobic and anaerobic biodegradation half-lives of about 5 and 20 days respectively in soils. If released to air, its half-life is estimated to be 26 days. Volatilization from water is an important fate process and river and lake models predict an estimated volatilization half-lives of 20 and 150 days, respectively.

2,4,6-Trichlorophenol is a confirmed animal carcinogen and evidence of its carcinogenicity in humans is limited.

Under RCRA, 2,4,6-Trichlorophenol wastes or contaminated soils are considered a D042 HW when its concentration in TCLP leachates exceeds 2.0mg/L; 2,4,6-Trichlorophenol is also listed HW (F027) from discarded or unused formulations.

In Canada, 2,4,6-Trichlorophenol is identified in TDGR, EC and other provinces legislation as HW when its concentration exceeds 0.5 mg/L in TCLP leachates. The CDWS maximum acceptable concentration is 0.005 mg/L.

US state drinking water guidelines for 2,4,6-Trichlorophenol are (units in μg/L):

Arizona	1.8	guideline
Florida	10	“
Maine	32	“
Minnesota	30	“
New Hampshire	3	“
New Jersey	1	“

Recommendation 35*: Change the regulatory limit in Table 2 of the Guide from 2.0 mg/L to 0.5 mg/L for consistency with the 100 times the CDWS and other Canadian jurisdictions.*

33. **2,4,5-Trichlorophenoxy acetic acid or 2, 4, 5 T**

Not regulated in Alberta. TDGR, BC and Ontario have adopted 28.0 mg/L. There is no CDWS for 2,4,5-T. Water solubility: 268 mg/l at 25 degrees Celsius.

2,4,5-T use as an herbicide has been banned in several countries, including Canada and the US. The US military used it during the defoliation campaigns in Vietnam (mixture of 2,4,5-T

and 2,4-D). These mixtures contained a significant amount of TCDD (**2**,3,7,8-tetrachlorodibenzo-p-dioxin), which caused severe illnesses. 2,4,5-T as a salt or ester is generally applied in combination with other phenoxy acids. Its usage is restricted in some countries. The agent is possibly carcinogenic to humans.

2,4,5 T is listed as a F027, a hazardous waste type from non-specific sources under RCRA when discarded unused formulations contain tri-, tetra-, or pentachlorophenol or compounds derived from these chlorophenols.

Recommendation 36*: Remove this chemical from Table 2 of the User Guide.*

34. **2,4,5-TP (Silvex)**

2,4,5-TP (Silvex) is moderately toxic (LD_{50} rat oral varies from 650 to 1070 mg/kg body, depending on the reference.

The ADI (acceptable daily intake) for 2,4,5-TP is 0.00075 mg/kg/day due to potential oncogenicity, mutagenicity, and fetotoxicity action. 2,4,5-TP is not classifiable as a human carcinogen.

Under RCRA, 2,4,5-TP is listed as a F027 hazardous waste from non-specific sources. Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulation containing compounds derived from these chlorophenols. (This listing does not include formulations containing hexachlorophene synthesized from pre-purified 2,4,5-trichlorophenol as the sole component.)

A solid waste containing 2,4,5-TP (Silvex**)** may also become a D017 hazardous waste if when subject to the Toxicity Characteristic Leaching Procedure the concentration of 2,4,5-TP in the leachate exceeds 1.0 mg/L.

2,4,5-TP is designated as a hazardous substance under the US Water Pollution Control Act and further regulated by the Clean Water Act.

US federal and state drinking water standard or guidelines (units in μg/L):

EPA	50	standard and guideline
New York	10	"
Arizona	52	guideline
Minnesota	60	"

Recommendation 37*: No rationale for the US limit of 1.0 mg/L has been found, except that the current number is 100 times the drinking water standard adopted by some US states. We recommend keeping the limit in Table 2 at the same level consistently with other Canadian jurisdictions.*

35. **Vanadium**

No CDWS has been established for vanadium. This parameter is regulated in Alberta, only. Vanadium pentoxide and vanadyl sulphate are regulated by TDGR, EC, and BC as "environmental hazardous substances" at 100 mg/kg.

US state drinking water guidelines (units µg/L):

Arizona	7	guidelines
Florida	49	"
Minnesota	50	"
Wisconsin	30	"

Vanadium pentoxide is subject to RCRA. It is toxic substance (P120) when as a commercial chemical product, manufacturing chemical intermediate, or an off-specification chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to federal and/or state HW regulations. Also defined as a hazardous waste is any container or inner liner used to hold this waste or any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste.

V_2O_5 is not classifiable as a human carcinogen

Major uses of are as an oxidation catalyst, ceramic coloring material, inhibiting UV transmission in glass, photographic developer, dyeing textiles. V_2O_5 is fairly soluble in water at 8 g/L.

Recommendation 38*: Remove vanadium from Table 2 of the Guide.*

36. **<u>Zinc</u>**

Zinc occurs naturally in the earth's crust and it is an essential element for life found in virtually all living organisms. Zinc compounds occur often as zinc sulfide (sphalerite), zinc carbonate (smithsonite) and zinc oxide (zincite). Zinc is not classifiable as to human or animal carcinogenicity.

Brief assessment of zinc compounds (Class 9.2):

Zinc acetate is used in preserving wood, as mordant in dyeing, glazes for painting in porcelain, reagent for medical testing, medication, and a cross-linking agent for polymers, etc. Zinc acetate is an indirect food additive for use only as a component of adhesives. Trace minerals added to animal feeds as nutritional dietary supplements.

Zinc carbonate occurs as smithsonite and zincspar. It is added to animal feeds as nutritional dietary supplement. Zinc carbonate is also used as fire-proofing filler, cosmetics, zinc salts mfr, porcelains, rubber, paint pigment, and medication.

The information for the remaining zinc compounds is similar, except zinc ammonium chloride and phenolsulphonate for which no data was found in the TOXNET

Zinc phosphide, a US EPA RCRA listed hazardous chemical, P122, is a highly toxic and odorous poison used mostly as a rodenticide but not available for household use. It reacts with water to produce the gas phosphine, used as fumigant or a "weapon of mass destruction" to take care of rats, mice and another rodents.

The CDWS for zinc is 5.0 mg/L (aesthetic reasons) and it is regulated in leachates by Alberta and BC, only. TDGR, EC, and BC also regulate some zinc compounds (acetate, ammonium chloride, carbonate, chloride, formate, phenolsulphonate, phosphide, and sulphate as Class 9 "environmentally hazardous substances" at 100 mg/kg.

US drinking water standards and guidelines (units μg/L)

EPA	5000 or 2000	guideline
Illinois	5000	standard
Arizona	5000	guideline
Minnesota	2000	guideline

Recommendation 39*: Remove the parameter from Table 2 of the Guide.*

37. **Zirconium**

Zirconium is only regulated by Alberta. Zirconium sulphate is identified as a "environmentally hazardous substance" by TDGR and consequently regulated as HW at 100 mg/kg by EC, and BC. No US environmental standards are available for zirconium

Zr is used in cast iron and steel mfr, optics and electronics as polishing powder for lens, magnets, surgical appliances, tanning agent, catalyst, explosives, non-corrosive alloys, satellites, as a containing material for nuclear fuels, etc.

Recommendation 40*: Remove the parameter in Table 2 of the User Guide.*

APPENDIX 3

TDGR Schedule 3 and US RCRA Lists F, K, P, U

Transportation of Dangerous Goods Regulation (TDGR)

Table 1 – Schedule 3 of the Transportation of Dangerous Goods Regulation identifies 2869 dangerous goods in alphabetical order. This Schedule is available at www.tc.gc.ca/tdg/clear/schedule3.asp.

Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act is the United States Environmental ProtectionAgency law that creates the framework for the proper management of hazardous and non-hazardous solid waste. RCRA, including Tables 2 through 4 is available on-line at www.epa.gov/epaoswer/osw/laws-reg.htm#regs.

Table 2 – List F: Hazardous Wastes from Non-Specific Sources

Table 3 – List K: Hazardous Wastes from Specific Sources

Table 4 – List P: Acute Hazardous Chemicals
This list identifies acute toxic commercial chemical products, manufacturing chemical intermediates, off-specification or residues of these chemicals)

Table 5 – List U: Hazardous Chemicals
This list is constituted by non-acute toxic commercial chemical products, manufacturing chemical intermediates, off-specification or residues of these chemicals)

These four Tables directly available by clicking on the site identified below. This is home of the US Electronic Code of Federal Regulation (e-CFR), specifically Title 40, Part 261 on the Identification and Listing of Hazardous Wastes.

http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=4ce9cf4ddbacd352215671b3ce82b169&rgn=div5&view=text&node=40:25.0.1.1.2&idno=40

APPENDIX 4

DEFINITIONS

(a) "**agricultural wastes**" means waste generated by a farmer;

Note: *Agricultural wastes are not hazardous waste for the purposes of the Act and the WCR as they are regulated under the Agricultural Operation Practices Act (AOPA).*

*"**farmer**" means a person engaged in an agricultural operation; and*

*"**agricultural operation**" means an agricultural activity conducted on agricultural land for gain or reward or in the hope or expectation of gain or reward, and includes*

- *the cultivation of land,*
- *the raising of livestock, including domestic cervids within the meaning of the Livestock Industry Diversification Act and poultry,*
- *the raising of fur-bearing animals, pheasants or fish,*
- *the production of agricultural field crops,*
- *the production of fruit, vegetables, sod, trees, shrubs and other specialty horticultural crops,*
- *the production of eggs and milk,*
- *the production of honey,*
- *the operation of agricultural machinery and equipment, including irrigation pumps,*
- *the application of fertilizers, insecticides, pesticides, fungicides and herbicides, including application by ground and aerial spraying, for agricultural purposes,*
- *the collection, transportation, storage, application, use, transfer and disposal of manure, composting materials and compost, and*
- *the abandonment and reclamation of confined feeding operations and manure storage facilities;*

(b) "**alternate fuel**" means a liquid that

(i) is capable of being pumped,

(ii) is derived from recyclables,

(iii) has a net heat value equal to or greater than 12 780 kilojoules per kilogram (5 500 BTU per pound),

(iv) meets all of the quality limits for the parameters as specified in Table 10-1 of the *Code of Practice for Energy Recovery, 2005*, published by the Department, as amended or replaced from time to time, and

(v) may contain, without limitation, one or more of the following substances:

(A) refined or synthetic petroleum-based oils, including but not limited to, automotive lubricating oil, compressor oil, fuel oil, gear oil or hydraulic oil;

(B) fuels, including but not limited to, diesel, naphtha, gasoline or kerosene;

(C) condensate that contains less than 0.2 parts per million of hydrogen sulphide;

(D) antifreeze;

(E) glycols;

(F) alcohols;

(G) non-halogenated solvents that contain less than 0.2 parts per million of hydrogen sulphide;

(H) animal or vegetable based oils;

(c) "**beneficial use of waste**" means the management of a waste as a resource for purposes other than disposal and includes recycling and waste-to-energy options.

Note : *Products derived from waste should be characterized by identifying their physical, chemical, or biological properties and intended use in a MSDS. The quality required from products derived from wastes shall not be achieved by diluting or attenuating persistent hazardous or non-hazardous characteristics in order to avoid disposal and thus contravening the Waste Control Regulation.*

(d) "**burning waste as fuel**" means the thermal destruction of waste or a recyclable in a thermal converter, combustion unit or space heater for the purposes of producing heat or electricity, but does not include

(i) the burning of alternate fuel,

(ii) the burning of 4500 litres or less of used oil per year where the used oil

(A) is generated on-site, and

(B) is burned in equipment that meets CSA standards,

or

(iii) an activity that is governed by an authorization issued under the *Oil and Gas Conservation Act*;

(e) "**Class I landfill**" means a landfill for the disposal of waste that has

(i) two liners of which at least one is a synthetic liner,

(ii) a leachate collection and removal system,

(iii) a leak detection system between the two liners, and

(iv) a groundwater monitoring system;

(f) "**Class II landfill**" means a landfill for the disposal of waste, not including hazardous; waste

(g) "**Class III landfill**" means a landfill for the disposal of inert waste;

(h) "**dangerous goods**" means a product, substance or organism that is by its nature or by the regulations under the *Transportation of Dangerous Goods Act, 1992* (Canada) included in any of the classes listed in the Schedule to that Act;

(i) "**deepwell injection**" means the subsurface disposal or storage of fluids through a well into deep geological formations isolated from useable groundwater and other resources by layers of impermeable rock.

(j) "**dispersible form**" means any of the following or a mixture of them:

(i) a liquid;

(ii) a solid that can pass through a 9.5 mm mesh opening;

(iii) a friable solid that can be reduced by grinding in a mortar and pestle to a particle size that can pass through a 9.5 mm mesh opening;

Note*: The Toxicity Characteristic Leaching Procedure applies only to wastes or recyclables in a dispersible form.*

(k) "**dispose**", when used with respect to waste at a landfill or by deepwell injection, means the intentional placement of waste on land as its final resting place;

(k) "**energy recovery**" means
(i) the production of alternate fuel, or
(ii) burning waste as fuel;

(m) "**first party waste**" means waste produced incidentally to industrial manufacturing activities or through waste treatment and recycling;

(n) "**hazardous constituent**" means the component of a waste or recyclable, which has one or more of the hazardous characteristics identified in Schedule 1 of the Waste Control Regulation;

(o) "**hazardous recyclable**" means a recyclable that has one or more of the properties described in Schedule 1 of the WCR;

(p) "**hazardous residue**" means waste with hazardous characteristics that results from waste treatment or recycling;

(q) "**hazardous waste**" means waste that has one or more of the properties described in Schedule 1, but does not include those wastes listed in Schedule 2;

(r) "**hazardous waste management facility**" means a facility for the collection, storage, treatment or disposal of hazardous waste, but does not include an on-site facility;

(s) "**inert waste**" means solid waste that, when disposed of in a landfill or –re-used, is not reasonably expected to undergo physical, chemical or biological changes to such an extent as to produce substances that may cause an adverse effect, and includes, but is not limited to demolition debris, concrete, asphalt, glass, ceramic materials, scrap metal and dry timber or wood that has not been chemically treated;

(t) "**land treatment**" means
(i) the controlled application of a substance on the land surface and the incorporation of the substance into the upper soil zone,
(ii) the controlled application of soil containing hydrocarbons on the land surface, with or without incorporation of the soil containing hydrocarbons into the upper soil zone, or
(iii) the controlled application of soil containing hydrocarbons onto a man-made surface or containment system,
in such a manner that physical, chemical or biological removal or degradation of the substance or hydrocarbons takes place, but does not include
(iv) the controlled application to land of sludge as defined in the *Wastewater and Storm Drainage Regulation* (AR 119/93), or
(v) the controlled application of a substance to land where that activity constitutes an agricultural operation as defined in the *Agricultural Operation Practices Act*;

(u) "**landfill**" means a waste management facility at which waste is disposed of by placing it on or in land, but does not include a land treatment facility, a surface impoundment, a salt cavern or a disposal well;

(v) "**liquid**", when used with respect to waste, means a waste that has free liquids;

(w) "**oilfield waste**" means an unwanted substance or mixture of substances that results from the construction, operation, abandonment or reclamation of a facility, well site or pipeline, within the meaning of the *Oil and Gas Conservation Act* and the regulations under that Act but does not include an unwanted substance or mixture of substances from such a source that is received for storage, treatment, disposal or recycling at a facility authorized for that activity pursuant to the *Environmental Protection and Enhancement Act.*

(x) "**oilfield waste management facility**" means a facility that is approved under the *Oil and Gas Conservation Act* and the regulations under that Act to process, treat, dispose of, store or recycle oilfield waste;

Note on EUB definitions *(OGCA and OGCR):*

*"**facility**" means any building, structure, installation, equipment or appurtenance over which the Board has jurisdiction and that is connected to or associated with the recovery, development, production, handling, processing, treatment or disposal of hydrocarbon-based resources or any associated substances or wastes, and includes, without limitation, a battery, a processing plant, a gas plant, an oilfield waste management facility, a central processing facility as defined in the Oil Sands Conservation Regulation (AR 76/88), a compressor, a dehydrator, a separator, a treater, a custom treating plant, a produced water-injection plant, a produced water disposal plant, a miscible flood injection plant, a satellite or any combination of any of them, but does not include a well, a pipeline as defined in the Pipeline Act, a mine site or processing plant as defined in the Oil Sands Conservation Regulation (AR 76/88) or a mine site or coal processing plant as defined in the Coal Conservation Act;*

*"**oilfield waste management facility**" means a facility, the operation of which is approved by the Board, including, without limitation, a waste processing facility, a waste storage facility, a waste transfer station, a surface facility associated with a disposal well, a biodegradation facility, an oilfield landfill, a thermal treatment facility and any other facility for the processing, treatment, storage, disposal or recycling of oilfield waste;*

(y) "**on-site facility**" means a facility that is used solely to deal with wastes or recyclables generated on property that is owned, rented or leased by the person responsible for the facility;

(z) "**on-site treatment**" means the treatment of waste at facilities owned, rented or leased by the person responsible for the facility.

(aa) "**persistent hazardous constituent**" means a chemical constituent identified either as halogenated organic compound (HOC) or as metal (M) in column 3 of Table A of this report.

(bb) "**persistent hazardous waste**" means a that results from the treatment of HW that was hazardous due to the presence of persistent hazardous constituents and that even upon successful treatment still contains in its composition one or more of those chemicals.

(cc) "**person responsible**" for a facility of any kind under the WCR means
- (i) the owner or previous owner of the facility,
- (ii) every person who has or has had charge, management or control of the facility or any portion of the facility,
- (iii) any successor, assignee, executor, administrator, receiver, receiver-manager or trustee of a person referred to in subclause (i) or (ii), and
- (iv) a person who acts as a principal or agent of a person referred to in subclauses (i), (ii) or (iii);

(dd) "**pre-treatment**" when applied to hazardous waste means one or more of the following techniques:
- (i) ***commingling*** of materials to make maximum use of available or tank capacity provided the resultant mixture has the same hazard class as any one of the individual components;
- (ii) ***phase separation*** of materials by gravity settling without the addition of any chemicals designed to accelerate settling;
- (iii) ***dispersion*** of solids into liquids by natural or mechanical means provided the resultant mixture has the same hazard class as the original liquid;
- (iv) ***segregation*** of hazardous from non-hazardous articles or components from the same container; and
- (v) ***volume reduction*** by crushing, compacting, bailing or similar operations.

(ee) "**production of alternate fuel**" means the collection and processing of recyclables to produce alternate fuel, where 10 tonnes or less of recyclables per month are used for that purpose, but does not include an activity that is governed by an authorization issued under the *Oil and Gas Conservation Act*;

(ff) "**processing**" when used with reference to hazardous recyclables includes but is not limited to;
- (i) the incorporation of hazardous recyclables into a product without pre-treating them, and
- (ii) processing by means of physical, chemical, thermal or biological processes;

(gg) "**percentage of reduction in hazardous constituent**" means the percentage of decrease of the hazardous constituents that is achieved during the recycling of hazardous constituents.

(hh) "**recyclable**" means a substance or mixture of substances of them that is intended to be recycled;

(ii) "**recycle**" means to do anything that results in providing a use for a thing that otherwise would be disposed of or dealt with as waste, including collecting, transporting, handling,

storing, sorting, separating and processing the thing, but does not include the application of waste to land or the use of a thermal destruction process;

(jj) "**recycling**" means to do anything that results in providing a use for a thing that otherwise would be disposed of or dealt with as waste, including collecting, transporting, handling, storing, sorting, separating and processing the thing, but does not include the application of waste to land or the use of a thermal destruction process.

(kk) "**small incinerator**" means

(i) a mobile incinerator that, by means of burning under controlled conditions, treats waste that contains

(A) halogenated organic compounds in an amount of not more than 1000 milligrams per kilogram of waste,

(B) polychlorinated biphenyls in an amount of not more than 50 milligrams per kilogram of waste,

(C) lead in an amount of not more than 100 milligrams per kilogram of waste, or

(D) mercury in an amount of not more than 2 milligrams per kilogram of waste,

or

(ii) an incinerator that, by means of burning under controlled conditions, treats not more than 10 tonnes of waste per month and

(A) is fixed to one location, or

(B) is operated at any one location for a total of more than 365 days in 2 consecutive calendar years,

but does not include an incinerator that

(iii) is used by one single-family detached dwelling to burn household waste that is generated only by that household,

(iv) is used for burning kitchen camp wastes at a mining, construction, demolition, drilling or exploration site,

(v) is used for burning human bodies at a crematory that is licensed under the *Cemeteries Act*, or

(vi) is governed by an authorization issued under the *Oil and Gas Conservation Act*;

(ll) "**soil containing hydrocarbons**" means soil that is contaminated with only gasoline, kerosene, jet fuel or diesel fuel, or any combination of them;

(mm) "**storage site**" means a waste management facility, where waste, other than hazardous waste, is

(i) stored,

(ii) sorted, compacted, shredded, ground or processed, or

(iii) collected and held for removal to another waste management facility;

(nn) "**third party waste**" means waste produced by someone other than the owner of the facility where the waste has been received.

(oo) “**treat**” 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;

(pp) “**treatment**” means to apply a method, technique or process including without limitation neutralization and stabilization that is designed to change the physical, chemical or biological characteristics or composition of a substance.

(qq) “**unrinsed empty container**" means an empty container that previously held a hazardous waste

(i) that has not been rinsed 3 times, using for each rinse a clean solvent that is in an amount equal to 10% of the container volume and that is capable of removing the previously contained hazardous waste, or

(ii) that, in the opinion of the Director, has been rinsed or cleaned by a method that does not produce results equal to or better than those produced by the method set out in subclause (i).

(rr) “**waste**" means any solid or liquid material or product or combination of them that is intended to be treated or disposed of, or that is intended to be stored and then treated or disposed of, but does not include recyclables;

(ss) "**waste management facility**" means a facility for the collection, storage, treatment or disposal of waste.