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GUIDANCE DOCUMENT

Title: **Environmental Standards for Municipal Solid Waste Landfill Sites**

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ENVIRONMENTAL STANDARDS FOR MUNICIPAL SOLID WASTE LANDFILL SITES
GD-PPD-049.1

Table of Contents

List of Appendices (posted as separate documents on the Departmental website)

1.0 PURPOSE

The purpose of these Standards is to outline the requirements for the construction and operation of a Municipal Solid Waste Landfill (MSWL) to provide a high level of environmental protection. The January 2010 version supercedes the May 7, 2007 version of the Guidance Document by the same title, authored by P. Pretty.

This document is intended to serve as guidance in applying for a Certificate of Approval for the Construction and Operation of a MSWL Waste Management system from the Department.

2.0 BACKGROUND

Modern municipal solid waste landfills (MSWL's) are designed to accommodate the environmentally sound disposal of non-hazardous residual solid waste, waste which cannot be reduced, recycled, or appropriately and safely treated/disposed in some other manner.

A properly designed MSWL is engineered with a low permeability liner system to provide for leachate collection, treatment and management, creating a dry entombment effect. A system to collect and utilize landfill gas (methane) may also be installed. Innovative planning is encouraged to facilitate productive use of the landfill property following site closure/decommissioning and to minimize the cost of post-closure care.

These Standards address the life cycle of the landfill including: siting, design, construction, operation, and decommissioning.

3.0 APPLICATION OF ENVIRONMENTAL STANDARDS

These standards apply to the development of new MSW containment landfills and to the lateral expansion of an existing containment landfill. They do not apply to existing unlined landfills or the lateral expansion of existing unlined landfills.

The Province may vary the standard requirements on a site specific basis while maintaining provisions for an equivalent environmentally sound design.

The General Environmental Standards for Municipal Solid Waste Management Facilities also apply to Municipal Solid Waste Landfills.

Alternative environmentally sound designs and technology may also be approved, in keeping with advancements in landfill and waste management science, and any resultant changes in regional waste composition or management practices. It is the responsibility of the proponent to demonstrate, to the satisfaction of the Department, that the proposed alternate design is capable of achieving an equivalent or higher level of environmental protection than the standards. Alternative designs and technology will be assessed on technical merit and evaluated on a case by case basis.

4.0 LEGISLATION AND APPROVALS

4.1 Legislative Authority

A MSW Containment Landfill is subject to registration in accordance with Part X of the *Environment Protection Act* and as detailed in the *Environmental Assessment Regulations*. The legislative authority for establishment, development and operation of a Municipal Waste Management system is provided through the *Environmental Protection Act,* Parts IV, V and XI; and the *Municipalities Act,* Part XIII.1. Applicable documentation to which these guidelines apply include, but is not limited to, the following:

Provincial legislation

- *Environmental Protection Act SNL 2002 cE-14.2. and Regulations*
- *Occupational Health and Safety Act (O.C. 96-478) and Regulations*
- *Municipalities Act* , 1999 *and Regulations*
- *Water Resources Act, 2004 and Regulations*

Federal legislation

- *Canadian Environmental Protection Act and Regulations*
- *Transportation of Dangerous Goods Act and Regulations*
- *Fisheries Act and Regulations*
- *National Fire Code*

Municipal

- Zoning Requirements and Building Codes as applicable

4.2 Certificate of Approval Process

Upon completion of the Environmental Assessment Process, a Certificate of Approval to construct and to operate a MSW landfill (waste management system) must be requested from the Department pursuant to the Environmental Protection Act, Parts IV, V and XI.

The information outlined in this document is required to support the application for a Certificate of Approval to construct and operate a landfill, but additional information may be requested by the Department. The application shall address the design of the landfill components and systems outlining all assumptions, and be completed by a Qualified Professional. Engineering drawings and technical descriptions must be provided in sufficient detail to allow evaluation of compliance with the environmental protection standards. A Quality Control/Quality Assurance program is also required for approval for all aspects of the facility, including design, construction, operation, and environmental monitoring.

Applications for a Certificate of Approval to construct and operate a municipal solid waste landfill site must be accompanied by a letter from the municipal unit where the landfill is to be located stating that the landfill site meets zoning, planning restrictions and such other by-laws as may exist.

4.3 Approval for Other On-Site Activities

The full scope of waste management activities associated with the construction and/or operation of a waste management system or facility are subject to approval from the Department. Although a single approval may be issued to a Regional Waste Management Authority or Regional Service Board as the responsible owner/operator, the technical design and operation of each activity or part of the system is subject to separate review and evaluation.

If activities other than MSW disposal, for example collection of household hazardous waste, material recovery, waste transfer or processing, are to be undertaken on the site, the site shall comply with all standards associated with the construction and operation of these activities. Approval from the Department is required for any and all activities additional to MSW disposal.

4.4 Public Notification and Information

The Environmental Assessment (EA) Process of the Department of Environment and Conservation includes provisions to notify the public of the proposed project. Once released, or if exempted from the EA process, there are public notification requirements to obtain a Certificate of Approval to Construct and Operate a Waste Management System.

If environmental assessment registration is not required, public notification shall consist of: either posting a public notice in a local newspaper once per week for three consecutive weeks; or serving notice by registered mail on the occupiers of property situated within 1.6 kilometres of the proposed site. The notice shall be provided to the Department for approval before posting or distribution. A municipal plan amendment notice may also serve as the public notice of intent to establish a site.

In all cases, and on an ongoing basis, it remains the responsibility of the owner / operator of the waste management system to ensure that participants in the system are kept informed.

4.5 Financial Assurance / Environmental Insurance

The facility owner/operator is required to ensure that appropriate and adequate financial assurances and/ or environmental impairment liability (pollution abatement) insurance and automotive insurance policies are in place for all operators contracted to construct and to support the operations of a waste management facility, including a MSW landfill. In most cases Regional facilities would be owned / operated by the Regional Waste Management Authority or Regional Service Board. Financial assurance/insurance requirements for Regional Service Boards may be implemented at a later date.

The purpose for financial assurance / insurance are further discussed in Appendix A. This requirement also applies to public and private owners / operators of waste management systems, unless specific exemptions are permitted, or separate provisions are allowed.

5.0 ENVIRONMENTAL STANDARDS

The following section outlines the requirements for the siting, design, construction, operation, and decommissioning of a MSW Containment Landfill. All landfill components should be designed to function effectively for the life of the facility. All systems and features shall be technically sound, and demonstrated to meet performance standards set by the Department.

5.1 Site Selection

Table I provides a brief summary of siting criteria for new MSW Landfills, including recommended minimum setback distances. It is advised to exceed these recommendations where possible to reduce potential conflict with other land users. The Department may alter setback requirements based on site specific information, provided that the proposed design and setback distance continues to achieve an equivalent or higher level of environmental protection.

5.2 Site Investigation: Hydrogeology, and Baseline Surface Water and Groundwater Quality

An environmental baseline study, to provide information on regional and local hydrogeology and surface water and groundwater conditions to establish the background conditions of the proposed site, will be required prior to approval for construction. A proposed outline of the study shall be presented to the Department for approval before implementation. The scope of a baseline study is further outlined in the General Standards for Municipal Solid Waste Management Facilities and in Appendix C respecting a typical Surface and Groundwater Monitoring Program/Parameters.

Table 1: MSW Landfill Siting Requirements and Recommended Setback Distances

Siting Requirement	***Criteria***	
Land Use	Containment landfills shall not be sited in environmentally sensitive areas (flood plains, parks, nature reserves, areas where there may be endangered species of plants or animals, wildlife migration corridors, wetlands, etc).	
Access and Road Restrictions	Access roads shall be accessible year round by the weight and type of vehicles anticipated.	
Soil Conditions	The lowest point of the constructed landfill liner system shall be at least 1m above the seasonal high groundwater table. Alternatively, a suitable under drain system shall be installed. There shall not be any bedrock or other rock outcroppings closer than 300 mm to the bottom of the liner system.	
Hydrogeology	Areas where there is a reasonable depth of native soils and no useful groundwater resources are preferred locations.	
Separation Distances from Landfill Property Boundary	Feature	Recommended Separation Distances (m)
	Active disposal area (The 15 m closest to the property boundary must be reserved for natural or landscaped screening (berms or vegetative screens).	100
	Residential, Industrial, Commercial and Institutional Properties	1600
	Provincial Highway	100
	The High Water Mark of a significant waterbody as defined under the Water Resources Act and/or as assessed by the Department.	100
	Water Supply Area[a] or Any Well[b] Used as a Water Supply	300
	Airports (Consult with Transport Canada to confirm distance)	8000
Unstable Area	Landfills are not to be located within 100 metres of an unstable area[c]	100

[a] As indicated in: The Atlas of Protected Public Water Supply Areas, Department of Environment and Lands, Water Resources Management Division (Live Document; Updated Continuously).
[b] Except for a well utilized solely by the facility.
[c] Landfills are not to be located in geologically unstable areas, or in coastal areas subject to impact from a rise in sea level.

5.3 Landfill Design

MSWL sites shall be designed and constructed to protect groundwater and surface water resources. The requirements include a system for leachate collection, treatment and management and controls for diversion of storm water, run-on to, and run-off from the site, to minimize erosion and siltation.

Environmental monitoring programs are developed in consultation with the Department to ensure these control measures and systems function effectively to meet the legislated criteria for wastewater discharge to the environment. Further information is also provided in Section 13.0 on Environmental Monitoring.

The design of the actual MSWL site shall be shown on plans certified by a Professional Engineer and described in written form. Specifications, maps, cross section plans and profile drawings in a suitable level of detail to allow a proper evaluation of the facility design are to be provided. Information that must be submitted includes the following:

For the Site:

- ✓ an accurate description of the proposed location
- ✓ aerial photos;
- ✓ a legal survey;
- ✓ plans showing all property boundaries, buildings, roads, utility corridors, contours, drainage channels, water bodies, rights of way, easements, forested areas and adjacent land uses; and
- ✓ GPS coordinates/GIS system mapping of facility features in manageable format and detail
- ✓ site compatibility with other land uses, and any environmental sensitivity of the area must be commented and addressed.

For the landfill:

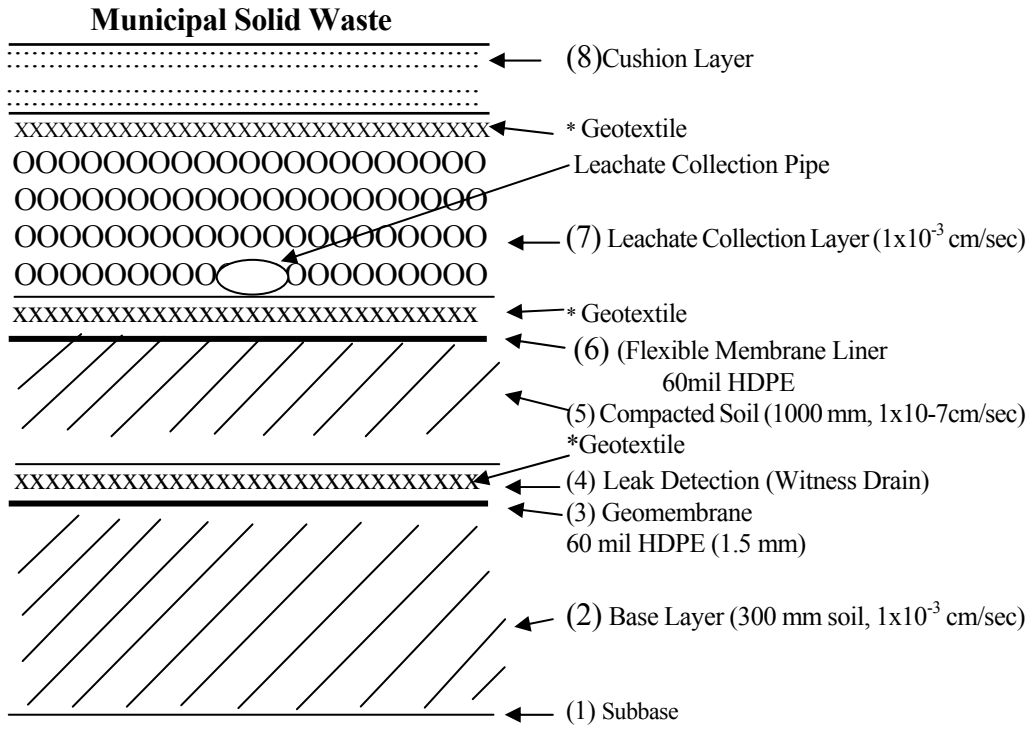
- ✓ A surveyed plot plan indicating the lined area of the landfill, including the location of permanent markers to visually indicate cell boundaries.
- ✓ A description of the layout, horizontal and vertical dimensions, elevations of the bottom of disposal cells, final contours to be achieved at the conclusion of filling, overall volumetric capacity (cubic metres) of the disposal site, and expected lifespan.

5.4 Typical Landfill Liner - **Figure 1** (a typical cross section of a landfill liner system).

MSW Containment Landfill liner systems shall be designed and built specifically for the site Materials used in liner construction must be compatible with leachate composition and contaminant capture. The following components are recommended:

(1) A **subbase** is the lowest point of the excavated area upon which the landfill liner system is to be located. The subbase will be native soil or ground of sufficient bearing capacity to support the material to be placed above it over the lifespan of the facility. Appropriate structural fill material may also be used meet the required bearing capacity.

(2) A **base layer** with a minimum of 300 mm of soil material, with a permeability of $1x10^{-3}$ cm/sec. The base layer shall be void of any bedrock or rock outcroppings for at least 300mm below the surface of the base layer.



* Geotextile filter materials shall be used as required to minimize the migration of fines from soil layers into drainage layers.
** Leachate collection pipe to be placed as required by design.

Figure 1 - Landfill Liner System

(3) A **bottom flexible membrane liner** (FML) of a minimum thickness 60 mil HDPE or approved equivalent directly above the compacted soil (base) layer.

(4) A **leak detection system** is to be installed to enable the detection and collection of a leak through the composite liner system. The seasonal high elevation of ground water should not be higher than one meter below the lowest elevation of the leak detection system

(5) A 1000 mm deep **compacted soil layer** should be placed in uniform, horizontal lifts of about 150 mm maximum loose thickness and constructed to ensure that the minimum hydraulic conductivity of the soil is $1x10^{-7}$ cm/sec or less.

- The soil liner should be protected during and after construction from damage due to frost, desiccation, over-hydration, differential movement and impact.

- The soil may be amended, if required, with an admixture such as bentonite clay in order to achieve the required hydraulic permeability, however, the hydraulic conductivity must be uniform throughout the entire thickness of the soil.

- The minimum hydraulic conductivity of the compacted soil, the compacted density of the soil required to obtain the design hydraulic conductivity, and optimum moisture content required to achieve the design hydraulic conductivity shall be stated.

(6) A flexible membrane liner (FML) manufactured of HDPE of a minimum 60 mil thickness or approved equivalent. This liner is to be installed directly below the intercept layer.

(7) A leachate collection layer (minimum of 300mm or as required by construction design); Geotextile filter materials shall be used as required to minimize the migration of fines from soil layers into drainage layers." The leachate collection layer should have a hydraulic conductivity of $1x10^{-3}$ cm/sec or greater."

(8) A cushion layer of 375 mm of sand, gravel or native soil between the leachate collection layer and the waste. Waste material, free of large or long objects which could cause stress to the liner, should be placed above the cushion layer. The cushion layer fill should be capable of separating the waste material from the leachate collection layer.

5.5 Leachate Management (collection and treatment)

A leachate management system consists of leachate collection and a treatment system to remove contaminants prior to discharge to the receiving environment.

The analysis of any alternative leachate management systems proposed must include contaminant transport modelling and an analysis of the leachate compatibility with the liner and/or other system components.

The leachate collection system shall be capable of maintaining a maximum head of 300 mm above the liner excluding the leachate sumps, during routine operations and be sloped to allow the leachate to drain.

Tanks, sumps, or other storage units associated with leachate collection and removal systems shall be equipped with high-level indicator alarms. Details of staff procedures to follow once an alarm is sounded, shall be included in the operations manual and contingency plan.
The leachate treatment system shall include suitable infrastructure to store, treat and discharge the leachate volumes anticipated from the site. Detailed design information and product specifications of geotextile filters, drainage layers, piping, manholes and lift station

components to be incorporated into the leachate management system are to be provided.

Leachate which would be harmful if discharged into the surrounding environment shall be treated to remove contaminants. The type of treatment system proposed, the quality of water, and details of the current and anticipated future uses of the receiving waterbody shall be provided Leachate treatment must meet the appropriate Canadian Environmental Quality Guidelines and applicable Provincial and Federal Legislation (*Environmental Control Water and Sewage Regulations, Fisheries Act)*. Discharge from on-site treatment systems shall be tested on a regular basis (as per the approved Leachate Monitoring Program) to assess system performance and the continued ability to meet the required criteria limits (listed in separate Appendix C on Environmental Baseline and Monitoring).

The proponent shall ensure that leachate is not acutely lethal as determined by the Environment Canada Rainbow Trout Acute Lethality Test (Reference Method EPS-1/RM-1/RM/13, July, 1990).

Design requirements for landfill leachate collection and removal systems
(a) shall be hydraulically separate from the facility's storm water system; (b) function year round; (c) function effectively throughout the lifespan of the landfill; (d) be equipped to record instantaneous and total flows; (e) have storage capacity to accommodate a 100 year storm event for the drainage basin (f) be chemically compatible with the waste and leachate characteristics; (g) provide access for inspection, monitoring flow and head; controlling flow and cleaning; (h) function effectively under dynamic and static loading events for all development phases (i) use geosynthetic fabrics specified for leachate generation/ flow into post-closure phase (j) designed to prevent the passage of fines into and any blockage of piping systems

5.6 Leachate recirculation

Leachate recirculation from storage ponds into the waste disposal area may be conducted to speed up waste stabilization. The design of the recirculation system, including the forcemains and infiltration gallery specifications are to be provided.

Recirculation of leachate only for emergency operations, shall be in accordance with the provisions of a contingency plan approved by the Department. Leachate collected as a result of a liner failure should be treated and disposed of in accordance with applicable discharge criteria and is not to be recirculated to the waste disposal area.

5.7 Groundwater management

A minimum 1m separation is required between the high water table and the lowest point of the landfill liner. Alternatively the hydraulic gradient would be controlled through installation of an appropriate drainage and pumping system. Groundwater lowering systems must provide for positive drainage of the groundwater away from the landfill area.

5.8 Landfill Gas Control and Management

Landfill gas control systems can be either passive allowing natural diffusion, or active through creation of a pressure gradient using exhaust fans. The systems shall include a method of collecting the gas, monitoring the amount of gas generated, and using it for a beneficial purpose (e.g. fuel), if possible. Landfills must be assessed for the viability of energy recovery from gas production. The proponent must demonstrate that discharging to the atmosphere, or flaring the gas is the only practical option. All emissions must meet the *Air Pollution Control Regulations, NRL 39/04.*

5.9 Surface Water Management and Control

Surface water management shall incorporate controls for:

- erosion, siltation and flooding;
- diversion of storm water and run-on to working areas;
- run-off from the facility; and
- sediment removal from storm water prior to discharge.

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Storm water management systems shall be designed to handle a 100 year storm event for a duration appropriate to the size of the drainage basin. Sedimentation pond construction specifications shall be provided in the application.

Surface water management systems should be hydraulically separate from the facility's leachate management systems.

If environmental compliance monitoring indicates problems, then corrective action must be taken immediately. Refer to the Appendix C for an example of a typical surface and groundwater monitoring program.

5.10 Landfill design - Construction and Operations

The design of a landfill as part of a MSW management system must take into consideration the ongoing construction and operations requirements over the projected life of the facility. This may include (provisions for) investment in energy efficient features and infrastructure or technology that will maximize long term operational and energy efficiency, and environmental protection.

5.11 Landfill design - Decommissioning

The design of the MSW landfill site shall take into consideration the requirements of these plans and the proper closure and decommissioning of the site. Preliminary and detailed decommissioning plans will be required, please refer to Section 14.0 for further information.

6.0 CONSTRUCTION

The landfill and associated facility (ies) shall be constructed:

- according to the approved design;
- following approved Quality Assurance and Quality Control protocol; and
- consistent with sound environmental practices for construction activities.

Prior to the site opening, the proponent shall provide documentation, in the form of a Certificate of Completion, that the site has been constructed as proposed, that all environmental systems are in place and functional, and that the site is ready to receive waste.

The Certificate of Completion shall include:

- as-built drawings;
- quality control certifications for the liner installation; soil layers and other aspects of the landfill system as required (Refer to Appendix B)
- a Certificate of Completion report from the consulting engineer stating that the facility has been constructed as designed and outlining any deviations from the original design and the rationale for those deviations. The report shall include a description of facilities constructed along with photographic records;
- a facility operations and maintenance manual.

7.0 QUALITY CONTROL/ASSURANCE

Quality control/assurance (QC/QA) is defined as a planned system of inspections and activities that provide assurances that the design, manufacture and installation of systems and materials used in the construction and operation of the landfill meet the purposes for which the systems and materials are intended. Appendix B (separate document) provides an example of a Typical Quality Control/Assurance program.

The owner/operator shall provide a description of the quality control/assurance programs to be carried out on all aspects of the landfill system and materials as part of the application to obtain a Certificate of Approval to Construct and Operate a Waste Management System. For specific items, including, but not limited to, flexible membrane liners and low hydraulic conductivity soil components, quality control/assurance shall be carried out by an independent third party company to ensure that the materials are manufactured and installed

as specified and in accordance with manufacturer's guidelines and accepted practices.

8.0 RECEPTION OF MATERIAL

8.1 Receiving Areas

Details of material receiving and storage, including infrastructure for monitoring, storage and access is to be clearly described.

Roadways are to be surfaced, drained and maintained to bear vehicle traffic without rutting or excessive erosion.

8.2 Inspection and Monitoring

All new landfills shall have systems in place to both monitor and control the material accepted into the landfill. All vehicles delivering waste to the site shall be screened to ensure they are carrying acceptable materials.

All incoming loads shall be viewed by a trained operator/attendant during discharge from haulage vehicles, and any non-compliant materials shall be immediately segregated and removed from the site.

Details of non-compliant material brought to the facility shall be recorded, including the date, type and quantity of non-compliant material, the identity of the haulage vehicle, reported origin of the material, and contact information to enable further contact with the hauler or owner.

The Operations Manual for the site shall include the inspection protocol and a contingency plan to recover and remove unacceptable materials from the landfill facility.

8.3 Measurement of Waste

Landfills serving a population of 5,000 or more, or which receive more than 5,000 tonnes/year of material shall use measurement methods approved by the Department. For municipal landfills serving populations greater than 10,000 or which receive greater than 10,000 tonnes/year, and for all private landfills, weigh scales are required.

The federal government requires that weigh scales used to assess charges related to the weight of a commodity be accurate and sensitive to the range of weights being measured. A weigh scale accurate for measuring typical commercial waste vehicles and/or containers (loaded weight as well as tare weight) may not be accurate for measuring waste loads brought to the landfill in smaller vehicles such as pickup trucks and private automobiles. If fees are being contemplated for small loads, the accuracy of the scales for measuring these smaller weights should be confirmed with the federal department of Consumer and Corporate Affairs (Weights and Measures). Alternatively, charges for these loads could be based on typical load sizes according to type of vehicle rather than on a direct measure of weight.

8.4 Acceptable Waste

Types of materials accepted at the municipal solid waste landfill shall not be broader in scope than municipal solid waste as defined for the Waste Management Standards and compatible waste types as set out in the Certificate of Approval. The Certificate of Approval is issued by the Department and administered (and renewed) by the GSC. Questions on the acceptability of various waste types for landfill disposal are to be directed to the Regional GSC.

8.5 Unacceptable Waste

The following is a list of wastes for which disposal to landfill is prohibited. The appropriate disposal option shall be specifically approved / approved with restrictions by the Department. Some of these wastes categories may be approved for recycling, composting, or thermal treatment. A Certificate of Approval from the Department is also required for the handling and transportation of hazardous materials and low level radioactive materials to licensed final treatment or disposal facilities. With respect to all waste types, depending upon the origin and nature of the waste material, other Provincial, and Federal Legislation and Regulations, or Agreements and Guidelines may apply.

1) Bulk liquids of any kind, with the exception of used oil, where a registered and approved used oil storage tank system is in place.*

2) Bulk liquids and semi-solid sludges which contain free liquid including septage, black water, sewage treatment sludge, etc.; *

3) Special waste (please refer to definitions in Appendix D) shall normally be accepted ONLY at the Regional Waste Management Facility, and only upon written approval from the GSC. The handling and disposal guidelines, and technical recommendations of regulatory agencies, shall be adhered in all cases. Burial may be approved only if there is no viable alternative for treatment or final disposal, recycling, reprocessing or composting; and only if burial is an environmentally sound option for the waste in question. The viability of alternatives is to be determined by the Department. The specific on-site location of any burial shall be permanently marked and recorded to allow retrieval should corrective or further management of the waste be required at a future time. *

4) Organic and compostable waste, which may include various special waste types, shall be diverted wherever possible to an appropriate composting facility/operation.

5) Industrial/ commercial/institutional waste sources shall only be accepted with pre-approval from the GSC and the Regional Service Board.

6) Biomedical waste (please refer to definitions in Appendix D) shall NOT be accepted.

7) International waste (please refer to definitions in Appendix D), for the purposes of this approval, is to be considered as “special waste”. *

8) Specified risk material (please refer to definitions in Appendix D), for the purposes of this approval, is to be considered as “special waste”, and may ONLY be disposed at the Regional Landfill. However, a permit is required from the Canadian Food Inspection Agency under the Health of Animals Act prior to moving this material from its point of origin.*

9) The storage and disposal of program tires is banned at all waste management facilities and waste disposal sites throughout the province with the exception of off the road vehicle tires (OTRs). Off the road tires can be defined as tires used on rolling stock equipment used in the agricultural, forestry, industrial/construction and mining industries.

Acceptance of "program" tires as included in the Used Tire Recycling Program at a waste management facility, for temporary storage and subsequent collection by an approved tire recycling facility, would require a written request for an approval and/or an amendment to the Certificate of Approval. *

10) Vehicles wrecks and scrap metal shall be directed to a recognized metal salvage and recycling operations where this option is available, or the designated on-site Recyclable Metals Storage depot. White metal wastes such as freezers, refrigerators and stoves may also be appropriately stockpiled in the Recyclable Metals Storage area, pending at least semi annual transport to a recycling operation. *

11) Equipment containing regulated substances (refrigeration, air conditioning and fire extinguishing equipment) shall not be disposed of at a waste disposal site without first having the regulated substance recovered by a person approved under the Halocarbon Regulations and shall be labeled "Halocarbon Free".

12) Fuel storage tanks (commercial or residential) shall not be accepted at a waste disposal site without confirmation that the tanks have been purged of product, tank bottom sludge and vapour. The tank must also be cut in half or sufficient openings cut in the tank to prevent the accumulation of vapour and to accommodate visual inspection. If municipalities, transfer stations or regions would like to develop a fuel storage tank management program, the Department shall be contacted to amend or issue an approval.*

13) Hazardous waste dangerous goods and regulated hazardous waste and (please refer to definitions in the separate Appendix D). A designated holding and inspection area to facilitate proper handling of wastes which are suspected to contain hazardous materials is required. Where there exists any doubt regarding the properties of a given waste, consultation with the GSC is required prior to disposal Municipal and industrial landfills in this province are not permitted to accept hazardous waste materials other than Household Hazardous Waste for storage at approved depots.

14) The storage of Household Hazardous Waste (HHW), must be approved by the Department. (please refer to definitions in separate Appendix D). These HHW depots or areas shall be an enclosed structure, fenced, locked, and underlain by an impermeable surface, have adequate ventilation and a means to contain any spills before reaching the receiving environment.*

15) Low level radioactive material (NORMS <70 becquerels/g total specific activity) shall not be accepted at waste management facilities. An exception may be made for the collection and storage of small quantities of smoke detectors at household hazardous waste depots.

16) Radioactive material (>70 becquerals/g) is separately regulated by the Canadian Nuclear Safety Commission, and shall not be accepted.

17) Any mixture or combination of the above restricted waste is also restricted or prohibited.

* These waste types require special provisions for treatment and/ or disposal for which approval must be requested from the Department.

8.6 Construction and Demolition (C&D) Debris
C & D debris shall be directed to the appropriate location for reuse and recycling where this is possible or to the C & D landfill for final disposal. In some cases clean wood waste and landscaping debris may be directed to composting. Please refer to the Environmental Standards for Construction and Demolition Debris Landfills.

8.7 Electronic Waste
Electronic waste shall be collected in a secure storage area for regular removal to a recycling option where a program exists.

8.8 Recyclable Metals
Recyclable metals may be stored at a designated location on-site in an organized, environmentally sound and safe manner as approved in the site specific Certificate of Approval . All environmentally hazardous materials shall be removed and appropriately contained/stored prior to stockpiling the metal. Access to this area shall be controlled by gating/ fencing and monitored.

8.9 On-Site Processing
Details of processing facilities for volume reduction or materials recovery , where applicable, are to be provided including the general type, size, and location of equipment, sorting pads, and facilities.

9.0 LANDFILL OPERATIONS

9.1 Equipment
Heavy equipment such as bulldozers, compactors, loaders, trucks and the equipment used on the site shall be of a suitable type and size to meet site design and operating requirements.

9.2 Waste Compaction and Daily Cover
Waste shall be properly placed and compacted as it is received and covered on a daily basis with a minimum of 150 mm of soil, or approved alternate cover material (ACM), such that there is no exposed waste. When weather conditions restrict site activity, the waste shall be placed and then compacted and covered as soon as possible.

9.3 Intermediate Cover
On portions of the site where disposal has occurred, but will not take place again within the next six months, intermediate cover, additional to daily cover, is required. The intermediate cover shall be placed as soon as possible, at least within 30 days, after the end of use of the area, or as soon as weather conditions allow.
The recommended intermediate cover is 450 mm of soil or alternatively a geosynthetic

cover material with a minimum thickness of 20 mils. The soil shall be tilled, placed and compacted in at least two lifts, graded to promote runoff and limit infiltration, and either mulched or seeded to prevent erosion. If a geosynthetic cover is used, it shall be properly designed, installed and maintained.

Prior to the area being used for disposal again the intermediate cover shall be removed before any further landfilling can occur.

9.4 Final Cover

Once an area or landfill cell has reached final grade, the final cover shall be installed. The final cover shall be constructed and documented in accordance with the approved plans and specifications, including all liners and vegetative layers. These requirements are as follows:

Final cover shall be placed above the waste in finished areas of the site to:

- cover the waste uniformly and provide acceptable aesthetics;
- control and reduce the infiltration of precipitation and/or surface water into the waste;
- limit erosion by wind and water;
- control release and prevent landfill gas from escaping at other than design points;
- accommodate settling, freeze thaw cycles and consolidation of the waste material to avoid ponding of water on the surface;

The proposed multi-layered final cover design shall be approved by engineers with the Department of Municipal Affairs and the Department of Environment and Conservation, and would include:

(a) A **grading pad** thick enough to uniformly cover the surface of the waste. It is recommended that the grading pad be a minimum of 300mm thick and consist of structural fill material capable of supporting the material above. The grading pad must allow for the lateral movement of gases.

(b) A **barrier layer** of either a Flexible Membrane Liner (FML) manufactured of a low density polyethylene (LDPE) of a minimum 40 mil thickness or equivalent; or a minimum of 750 mm of soil with a hydraulic conductivity of 1×10^{-6} cm/sec or less.

- The soil may be amended, if required, with an admixture such as bentonite clay in order to achieve the required hydraulic permeability, however, the hydraulic conductivity must be uniform throughout.
- The soil should be protected during and after construction from damage due to frost, desiccation, over-hydration, differential movement and physical impact. It should be constructed in layers such that it can achieve uniform compaction throughout its entire thickness.

(c) A **filter layer** of geotextile or aggregate, if required, to prevent the migration of fines into the grading layer and clogging the pore spaces.

(d) A **drainage layer** a minimum of 300 mm in depth with hydraulic conductivity in the range of 10^{-3} and consisting of an appropriate granular or soil material. The drainage layer should provide for the removal of infiltrated water from the vegetative layer and protect the low hydraulic conductivity soil liner from damage due to desiccation, over-hydration, and impact.

(e) A **vegetative layer** of a suitable depth to promote growth of vegetation in order to limit erosion. The vegetative layer should serve to stabilize the final cover system from the forces of wind and water erosion and to provide a low-maintenance surface.

NOTE: As stated in Section 2.0, alternatives demonstrated to provide an equivalent or better level of environmental protection may be considered for approval

9.5 Odour Control

Details on the proposed schedule and options for waste arrival, reception and covering to reduce odour impacts to adjacent property and on-site, shall be provided to the Department.

9.6 Litter Control and Housekeeping

Good housekeeping practices including contingencies for waste spillage and regular litter removal are essential for safe and environmentally sound landfill operation. Details shall be provided to the Department in the Operations and Maintenance Manual/Plan.

10.0 OPERATIONS PLANS

10.1 A facility Operations Manual is required for all waste management facilities and systems.

The following shall be addressed in detail and as applicable:

- **a.** Site security, manpower, supervision, access and signage
- **b.** Unacceptable/prohibited activities e.g. no open burning or smoking on-site
- **c.** Control of nuisance factors including vectors, rodents, scavenging, illegal dumping, malodour, dust and litter
- **d.** Inspection of waste prior to landfilling
- **e.** Acceptable and unacceptable waste material/waste streams
- **f.** Contingency and Environmental Emergency plans
- **g.** Environmental monitoring program
- **h.** Landfill and associated facility day-to-day operations protocol
- **i.** Site and equipment maintenance schedule / regime
- **j.** Staff/operator training
- **k.** Record keeping and Reporting
- **l.** Contact information for owner/operator and site managers / supervisors
- **m.** On-going Quality Control / Quality Assurance protocol (Plan, do, check, repair/revise/repeat where appropriate).

n. A copy of the facility Certificate of Approval

The Operation Manual shall be prepared by the owner/operator and approved by the Department.

The operation of the facility shall be in compliance with the provisions of the Certificate of Approval and a copy of the Operations Manual is to be kept on site and readily available to staff and regulators.

10.2 Environmental Emergency Health and Safety Contingency Plans

The owner / operator shall have an up-to-date contingency plan in place to effectively handle all reasonably foreseeable emergencies such as, fire, odour, flood, power outage, spill, delivery of hazardous waste, explosion, leachate leakage or any other environmental emergency or other issue which could cause a disruption to proper facility operation and/or damage to the surroundings. The plan shall describe appropriate mitigation measures required to prevent damage to the landfill and the environment.

The attendant on site shall be equipped with an effective, reliable and rapid means of communication with fire, police, and medical and environmental emergency responders.

An appropriate fire control program shall be in place. The program shall be developed in consultation with the local Fire Department. Fire safety plans, including the comments of the first responder fire department as to the adequacy of the plan, are to be provided. The Department of Natural Resources shall be contacted regarding forest fire risk.

11.0 RECORDS AND REPORTING REQUIREMENTS

11.1 The Certificate of Completion report including as- built drawings and quality control/ assurance records during construction shall be retained for future reference if needed.

11.2 Operations and maintenance / routine inspections

A standard form for recording completion of operational tasks and maintenance on a daily, weekly, or as appropriate basis; and routine inspection reports shall be maintained as part of operations records. These records shall be made available to regulatory agencies upon request.

11.3 Complaints

Records of complaints regarding nuisance, operational, or environmental or other issues shall be kept and include a description of the complaint, the contact information for the complainant, and an explanation of the action taken / how the complaint was responded.

11.4 Staff training

Certification and training records are required to ensure that staff are appropriately trained for the assigned work and training is current as per applicable legislation and guidelines and recommended industry practices.

11.5 Contingency Plan implementation / emergency response and safety equipment inventory
Records of all incidents of contingency plan implementation shall be kept on file. The contingency plan shall be updated annually or as required and an up to date inventory of emergency response and safety equipment shall be maintained.

11.6 Environmental monitoring reports are to be submitted on an appropriate basis to establish the effectiveness of the leachate collection system and ensure no adverse impact to surface and groundwater quality due to landfill operations. The Departments reporting requirements may be more intensive during the first year of operation and if problems occur or are suspected. But exceedance of criteria limits for leachate, surface or groundwater quality parameters, as set out in the approval shall to be reported immediately to the Department.

11.7 The Annual Report will summarize landfill activity over the past year, present an evaluation of environmental monitoring data, and highlight any proposed changes to operations or monitoring.
Information contained in the annual report would include:

- changes to facility or systems operations;
- problems or complaints and the resolution;
- a waste flow summary i.e. type, origin and quantities received and buried on site;
- an estimate of remaining landfill capacity;
- description of any environmental incidents / contingency plan implementation;
- the inspection reports and summary of findings/recommendations;
- updates to operations plans, contingency plans, and decommissioning plans;
- a summary and evaluation of environmental monitoring data and landfill performance:
    - pre- and post-treatment leachate monitoring data including total, peak and average flows; leachate quality and an interpretation of leachate management effectiveness;
    - gas production monitoring data and interpretation; including total production, peak and average for landfills with landfill gas management systems;
    - groundwater and surface water quality monitoring data and interpretation.

11.8 Decommissioning and Post-decommissioning
A decommissioning summary report describing the site condition at closure, including problems on the site or off-site impacts. and any concerns relating to leachate, groundwater and surface water and gas generation is to be provided.

Annual reports shall be submitted to the Department of Environment updating the post-decommissioning maintenance and monitoring and activities, summarizing the results of all inspections. Any problems noted shall be described along with the corrective actions taken.

12.0 SITE SAFETY AND SECURITY

12.1 Site Access
Suitable public waste drop off areas shall be provided. Access shall be restricted to hours of operation, when operating personnel are present. Information regarding conditions of access and restrictions are to be posted at the site entrance.

Access to the site shall be controlled by the use of barriers, fencing and gates. The type and extent of fencing will depend on the existing natural vegetation and topographic features and is to be approved by the Department. All access points are to have locking gates.

All roads on site shall be properly maintained to minimize the potential for dust, mud or wastes from the facility being carried onto access, public or private roads.

12.2 Signage

Legible and appropriate signage at the site entrance(s) shall state the name and purpose of the facility, a list of materials acceptable for disposal, hours of operation, emergency contacts and general contact information. Legible and appropriate signage shall be used to direct vehicles to the solid waste unloading areas such that small vehicles do not have direct access to the landfill working face. Specifications regarding the signage, fencing and gates are to be provided to the Department.

12.3 Prohibited activities

Open burning and scavenging are strictly prohibited at MSW landfills**.**

There shall be no smoking at any waste management facility, with the exception of a location designated for the use of employees who smoke. Smoking is a fire hazard in areas where there may be combustible materials, including concentrations of airborne dust and gases.

12.4 Staff Training and Certification

Key personnel shall be trained in proper landfill operation and be certified through the Solid Waste Association of North America (SWANA) landfill operator training certification program or accepted equivalent.

In many cases contractors and the general public cannot identify hazardous or an "unacceptable" waste. On-site operators must therefore be trained to identify hazardous or "unacceptable" materials, as hazard identification and management is the responsibility of the MSW Landfill site operator. The training requirements and schedule shall be included in the operations manual. The appropriate level of training/certification will help ensure MSW materials are disposed of properly and that hazardous and unacceptable materials are disposed appropriately and safely.

12.5 Employee and Administrative Facilities

Appropriate employee and administration facilities are to be provided, to satisfy occupational health and safety regulations and provide for worker comfort. Secure storage space is also required for administrative records, personal protective equipment, tools, and combustible materials.

12.6 Site Safety and Personal Protective Equipment

The site shall be attended by an appropriate number of on-site trained personal at all times while open for operation. The site shall be closed and locked outside hours of operation.

All personnel shall be familiar with the Operations and Maintenance manual/ plan, and the Environmental Health and Safety Contingency Plan, with emphasis on the part of the facility where they are stationed. All personnel shall be equipped with Personal Protective Equipment appropriate to their level of training and assigned tasks. Safety and Emergency Response training shall be current and reinforced with regular exercises.

Emergency response equipment and exits shall be conveniently located and clearly marked. In the event of an electrical outage, alarms, communications systems and and security lighting shall be sourced with back up power.

13.0 ENVIRONMENTAL MONITORING

A site specific Environmental monitoring program is to be developed for all MSW Landfill sites. The owner/ operator shall prepare and propose a program which satisfactorily addresses surface/storm water and groundwater monitoring, leachate, and landfill gas. Further information on a Typical Surface/ Groundwater Monitoring Program is provided in Appendix C. Environmental Monitoring Programs are to be developed in consultation with, and approved by the Department.

The Department may adjust the list of parameters and/or monitoring schedule on a site specific or as-needed basis. The annual report shall outline the results of the environmental monitoring programs and provide an assessment of the environmental impact of landfill operations. If monitoring indicates that there are negative environmental impacts as a result of the operation, then corrective measures must be put in place and the Department notified immediately. The report shall be prepared by a suitably Qualified Professional.

13.1 Surface / Storm Water Management

Surface/Storm water management and control systems shall be provided to:

- divert storm water and run-on to working areas;
- collect and control run-off waters from the site to remove sediment prior to discharge;
- reduce potential for erosion in order to protect the integrity of the intermediate and final cover; and
- construct disposal cells in a way to minimize the collection of water

Storm water management systems shall be designed to handle a 100 year storm event for a duration appropriate to the size of the drainage basin. Sedimentation pond construction specifications shall be provided to the Department.

Surface water management systems should be hydraulically separate from the facility's leachate management systems.

Discharge from a sedimentation pond shall meet the *Environmental Control Water and Sewage Regulation, 2003* as listed in the separate Appendix C. For parameters of concern that are not addressed by the regulations, the appropriate CCME Water Quality Guidelines

will apply. If compliance monitoring and sampling indicates problems, then corrective action must be taken immediately.

13.2 Leachate Management Program

Leachate collection and treatment systems shall be properly managed and maintained throughout the life of the site. All leachate shall be tested prior to discharge and treated to remove contaminants.

The discharge standards for all liquid effluent will be related to the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines for the protection of these defined water uses and the *Environmental Control Water and Sewage Regulation, 2003*. Additionally, liquid effluents shall not be acutely lethal as determined by the suite of biological Test Methods developed by Environment Canada for this purpose.

The parameters to be analyzed and frequency of sampling shall be determined by a suitably Qualified Professional in consultation with the Department, and outlined in the Environmental Monitoring Plan.

Contingency plans in the event of problems with any part of the system shall be in place to mitigate environmental damage as part of regular maintenance programs.

13.3 Landfill Gas Monitoring Program

Landfill gas production shall be managed to control the discharge of potentially dangerous gases into the atmosphere. At no time should combustible gas concentrations be allowed to exceed or be predicted to exceed the lower explosive limit in soils at the property boundary or 25% of the lower explosive limit at or in on-site or off-site structures. Information on chemical hazards are available in the National Institute of Occupational Safety and Health (NIOSH) publications, and are part of Hazardous Material Response Safety Training. Venting or gas collection systems shall be installed to control and monitor the gas production in the landfill.

All new landfills shall be assessed for the viability of energy recovery from gas production. The results and interpretation of this assessment are to be submitted when applying for a Certificate of Approval. Landfill gas management systems and the viability of landfill gas recapture, will be evaluated on a case by case basis.

13.4 Surface Water Quality Monitoring

A regular program of surface water monitoring shall include:

- a program for measuring surface water quality upstream of the site;
- a program for detection and measurement of leachate contaminants in the surface water;
- a suitably designed QC/QA program.

The surface water monitoring program shall include a combination of visual inspection for leachate seeps, along with surface water sampling. Refer to separate Appendix C for a typical surface and groundwater monitoring program.

13.5 Groundwater Monitoring Program

A groundwater monitoring program designed by a suitably Qualified Professional, is to be site specific and shall include an appropriate number and configuration of monitoring wells around the perimeter of the site, both up and down gradient, to allow accurate evaluation of the impact of the operation and assessment of any migration pathway.

The groundwater monitoring program will include:

- a program for baseline groundwater chemistry;
- a program for detection of leachate in the groundwater;
- a program to measure the extent and magnitude of leachate contamination, should it occur;
- measuring groundwater levels and general hydrogeological conditions on the site; and
- a suitably designed QC/QA program.

Monitoring wells shall be installed to a depth which will span the anticipated high and low water table levels and be appropriately sized to allow proper well development, purging and sampling. Monitoring wells will also be used for the measurement of water levels, the determination of horizontal and vertical gradients and the determination of flow directions and groundwater velocities. Refer to separate Appendix C for an example of a typical surface and groundwater monitoring program.

The groundwater monitoring system should consist of the following:

(1) groundwater monitoring wells installed hydraulically above and below the gradient direction of the landfill;
(2) locations of the monitoring wells sufficiently close to the active disposal area to allow early detection of contamination and implementation of mitigation measures;
(3) specifications for well drilling methods, casing, screens, filter packs, annular space seals, ground surface seals, grout, caps, development and purging which are to be provided; and
(4) monitoring wells are to be retained throughout the lifespan of the facility.

Evaluation Criteria

Surface water and groundwater monitoring results will be compared to the appropriate Canadian Water Quality Guidelines and will be applied on a site specific basis depending on the surface water and groundwater use in the area.

Discharge water must also comply with the *Environmental Control Water and Sewage Regulations*, 2003.

The person conducting the groundwater monitoring program must be a suitably Qualified Professional.

The Department of Environment and Conservation Policy PD:PP2001-01: *Use of Accredited and Certified Laboratories* applies. (separate document)

13.6 Air Quality, Dust and Noise

Details of the anticipated on -site control for dust, noise are to be provided to the Department. If problems develop a monitoring program may be required.

13.7 Vector Control

Details of control measures for vectors, which may include flies, rodents, birds and nuisance animals, are to be provided to the Department. Monitoring programs may be required if problems develop or persist.

14.0 DECOMMISSIONING

The design of the MSW landfill site shall take into consideration the requirements of these plans and the proper closure and decommissioning of the site.

14.1 Preliminary Decommissioning Plan

A Preliminary Decommissioning Plan based on the estimated landfill life is required to obtain a Certificate of Approval for the Construction and Operation of a MSW Landfill site.

(a) A description of the waste(s) composition, placement, volume and tonnage that will remain in the landfill; and scaled drawings showing maximum final height of disposal cells;
(b) Environmental monitoring systems for leachate, groundwater and surface water;
(c) Final cover installation and monitoring for stability, erosion and settlement;
(d) Landfill gas control and management;
(e) Operation plans for pollution abatement engineering works such as leachate collection and treatment systems;
(f) A closure activities schedule;
(g) Current and projected cost estimates to complete decommissioning, and the corresponding details regarding acceptable financial assurance (bond, surety or cash deposit);
(h) Proposed post-closure use of the property; and
(i) any other information required by the Department.

Note that an updated decommissioning plan must be submitted to the Department whenever significant changes are made to the MSWL site.

14.2 Notification of final closure/decommissioning

The owner/operator shall notify the community, site users and the Department in writing of the pending shutdown of the site at least 180 days in advance of the site ceasing operation and provide an estimate of the engineering costs to complete the decommissioning.

The detailed decommissioning plan for the site must be approved by the Department.

The owner/operator shall notify the Department when the site decommissioning activities begin and again when decommissioning is complete.

Appropriate signage shall be placed at the site entrance to notify site users of the pending decommissioning of the site, along with the date of shutdown and details on where waste shall be taken once the site closes.

14.3 Detailed Decommissioning Plan

The final decommissioning plan is to be approved by the Department at least 6 months prior to final closure of the waste management facility / waste disposal site. Based on the assumption that an approved, contained MSWL has been operated, maintained and progressively decommissioned over the landfill life, site cleanup, preparation and remedial work should be completed in a very timely manner.

Information to be provided/ updated includes:

- Notification requirements and alternate disposal site locations;
- Description, schedule and costs associated with decommissioning activities;
- Final cover design and installation details, and any additional work required;
- Contingency plans for fire, illegal dumping and nuisance control post-decommissioning;
- Post-decommissioning monitoring and maintenance, including environmental monitoring requirements.

As part of the decommissioning plan the proponent shall provide as built drawings for all facilities, components and installations, including an accurate plot plan, geographic positioning system coordinates and permanent location markers.

Environmental management systems and the monitoring regime for the final cover system; surface and ground water quality; landfill gas control and leachate management should be clearly described.

This detailed plan will likely elaborate on the preliminary decommissioning plan submitted with the original application for site approval.

14.4 Post-Decommissioning

Monitoring and maintaining the waste containment systems and monitoring groundwater is continued following decommissioning to ensure that waste is not escaping and polluting the surrounding environment. The average period is 30 years from site closure, but this may be

varied depending upon the site condition and issues. The owner / operator of the MSW landfill at the time of closure, is required to develop a plan to maintain the decommissioned site and continue environmental monitoring during the post-closure period. The plan shall address any recommendations and outstanding issued identified in the decommissioning summary report and shall be approved by the Department. Specific post-closure care requirements consist of maintaining the integrity and effectiveness of the:

- Final cover system
- Leachate collection system
- Surface and groundwater monitoring programs/systems
- Methane gas monitoring system
- Environmental emergency health and safety contingency plans may also be required.

14.5 Future use of the site should be consistent with recommendations of the decommissioning report and approved by the Department.

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