



**Professional Engineers
Ontario**

Solid Waste Management Guideline

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Notice: The Professional Standards Committee has a policy of reviewing guidelines every five years to determine if the guideline is still viable and adequate. However, practice bulletins may be issued from time to time to clarify statements made herein or to add information useful to those professional engineers engaged in this area of practice. Users of this guideline who have questions, comments or suggestions for future amendments and revisions are invited to submit these to PEO using the standard form included in the following [Guideline Development and Maintenance Processes documents](#).

A man with grey hair and a goatee, wearing a blue work jacket and a high-visibility yellow safety vest with orange and white reflective stripes, is shown in profile. He is wearing white work gloves and is focused on handling a piece of waste material on a conveyor belt. The background is slightly blurred, showing other workers in similar attire.

ABSTRACT

The purpose of this guideline is to assist those providing or retaining engineering services relating to the planning, design, construction, commissioning, operation, monitoring, and/or closure of solid waste management systems.

The provision of these services is multi-disciplinary in nature and involves not only a broad cross-section of engineering disciplines, but a wide variety of non-engineering disciplines, including the natural and social sciences, legal counsel, public, stakeholder and Indigenous community/group consultation/engagement.

It is crucial to the successful implementation of any solid waste management project that an integrated team possessing the necessary specialized expertise be assembled.

PURPOSE OF PEO GUIDELINES

Professional Engineers Ontario (PEO) produces guidelines to educate licensees and the public on best practices.

For more information on PEO's guideline and development process, including PEO's standard form for proposing revisions to guidelines, please refer to the [Guideline Development and Maintenance Processes](#) document.

To view other PEO guidelines, please visit the [Practice Advice Resources and Guidelines](#) section of the PEO website.

PREFACE

In 2013, the Professional Standards Committee (PSC) prepared terms of reference for a subcommittee instructing them to review the existing guideline, *Professional Engineers Providing Services in Solid Waste Management* (1993); and, in consideration of changes to legislation affecting the industry and professional engineering, revise that document to better reflect current practices. This guideline is to be used by professional engineers who are involved in solid waste management projects and/or those retaining professional engineering services in solid waste management.

In all cases, however, the engineer must still review and comply with legislative, regulatory and approval requirements applicable to the project.

As part of this process, policies of other professional bodies in the Province of Ontario and engineering licensing organizations in other jurisdictions were reviewed.

Important Notes:

References in this guideline to the term "engineers" apply equally to professional engineers, temporary licence holders, provisional licence holders and limited licence holders.

For the purposes of this guideline, the term the "public interest" refers to the safeguarding of life, health, property, economic interests, the public welfare and the environment.

The recommendations contained in this guideline are not intended to be exhaustive. It is the engineer's responsibility to ensure that appropriate and up-to-date reference documents are properly consulted when performing engineering work related to solid waste management systems.

Current legislation and regulations prevail in the event of any discrepancies between this guideline and the legislation and regulations.

Solid waste management systems typically require approvals under Part V of the *Environmental Protection Act* but may also be subject to other approvals (e.g. air, odour control, noise, sewage and/or water).

PURPOSE AND SCOPE OF THIS GUIDELINE

This document provides guidance to those providing or retaining engineering services relating to the planning, design, construction, commissioning, operation, monitoring, and/or closure of solid waste management systems. It is primarily related to solid non-hazardous waste, but can be applied in whole or in part to waste management systems for other wastes as well. Solid non-hazardous waste describes refuse generated from domestic, industrial, commercial or institutional sources. In general use (and for the purpose of this guideline), it excludes wastes that are hazardous, radioactive or liquid. For the purpose of this guideline, solid waste includes dewatered solids (for example, dry bio-solids from wastewater facilities), but not liquid or sludge. This document does not address the collection and hauling of waste.

The provision of these services is multi-disciplinary in nature and involves not only a broad cross-section of engineering disciplines, but a wide variety of non-engineering disciplines, including the natural and social sciences, legal counsel, public, stakeholder and Indigenous community/group consultation/engagement. It is crucial to the successful implementation of any solid waste management project that an integrated team possessing the necessary specialized expertise be assembled. While the overall process or the individual elements of planning, designing, constructing, commissioning, operating, monitoring and/or closing of a solid waste management system may not be led by an engineer, engineers will play key roles in related activities. It is in this spirit that this guideline has been prepared.

The recommendations provided in this guideline are considered by PEO to be commensurate with the professional responsibilities of engineers. This guideline should be used in conjunction (as appropriate) with the guidelines *Use of Professional Engineer's Seal*, *Professional Engineers Reviewing Work Prepared by Another Professional Engineer* and *The Professional Engineer as an Expert Witness*, as well as the legislation and guidance documents that are prepared by approval authorities.



This guideline relates primarily related to solid non-hazardous waste, but can be applied in whole or in part to waste management systems for other wastes as well. Solid non-hazardous waste describes refuse generated from domestic, industrial, commercial or institutional sources.

BACKGROUND

4.1 Relationship between Engineering and Solid Waste Management

Engineers involved in projects related to solid waste management systems identify technically feasible, cost-effective solutions that minimize environmental and human health impacts and consider socio-economic impacts of affected communities.

To determine the most appropriate solution, engineers follow a process that begins with defining the solid waste management challenge to be resolved and identifying regulatory and other compliance requirements. They then evaluate the technical feasibility, costs, and potential environmental, human health and socio-economic impacts of appropriate options to assist decision-makers in determining the preferred alternative.

4.2 Responsibilities

O. Reg. 941/90 under the *Professional Engineers Act* cites the requirements with which engineers practising in Ontario must comply. These requirements provide all stakeholders with the assurance that proposals for solid waste management systems put forward by engineers are based on sound technical, environmental and economic data.¹

Notwithstanding any responsibilities engineers have in accordance with the *Professional Engineers Act*, engineers involved in solid waste management engineering must be familiar with federal, provincial and municipal legislation, regulations, policies, materials and guidelines that apply to their own particular discipline or area of expertise. The permit process, approvals requirements and compliance issues for a particular solid waste management system will vary depending on the site and type of facility. It is important that engineers and their team be cognizant and knowledgeable of all requirements in this respect, including changes and revisions as they occur.

4.3 Challenges

Discussions about solid waste management projects can be contentious and decisions may be influenced by political and community viewpoints and stakeholder dissent. Dissent can be due to a lack of accurate information about fiscally viable, environmentally-appropriate solutions, or by focusing too soon on a course of action without fully investigating all reasonable options¹ and effective and transparent public, stakeholder and Indigenous community/group consultation/engagement. To help overcome these constraints, stakeholders should be engaged and educated on the merits of the science and engineering underpinning a proposed solid waste management system.

4.4 Key Legislation

In Ontario, solid waste management is primarily governed by the *Environmental Protection Act* (EPA) and the *Environmental Assessment Act* (EAA). The EPA provides for the protection and conservation of the natural environment (air, land and water or any combination thereof), with Part V of the EPA dealing specifically with waste management. In addition, there are a number of regulations made under the EPA that deal specifically with waste. For example, O. Reg. 347—*General Waste Management* defines various types of wastes; places requirements on generators, carriers and receivers of wastes; and sets approvals, requirements and exemptions for specific wastes, waste disposal sites and waste

management systems (e.g. agricultural waste, and individual collection systems are exempt from Part V of the EPA and O. Reg. 347). Additionally, depending on the management and end-uses of certain wastes, the *Nutrient Management Act*, 2002 may apply.

Current EPA definitions of “waste disposal site” and “waste management system” are provided in Section 5 of this guideline.

Part V of the EPA requires applicants to obtain an Environmental Compliance Approval (ECA) for waste management from the Ministry of the Environment and Climate Change (MOECC) to use, operate, establish, alter, enlarge or extend a waste disposal site or a waste management system. Information necessary to support an application for an ECA usually requires engineering documentation. The decision on whether to issue an ECA is the responsibility of the director, appointed under the EPA by the Minister of the MOECC. Although not explicit in the regulations, for certain waste disposal sites, the director may require public, stakeholder and Indigenous community/group consultation/engagement under Part V of the EPA.

Part V of the EPA also provides authority for the director to request a public hearing before the Environmental Review Tribunal (ERT) for a proposal (and engineers could be required to testify at such hearings). If a hearing is held, the director will implement the ERT decision or any party to the hearing may appeal the ERT decision based on:

- (a) a question of law, to the Divisional Court; and
- (b) a question other than a question of law, to the Minister of the MOECC.

¹The source of some of the information in this section is from the “October 2007 Solid Waste Management Position Paper” prepared by the Ontario Society of Professional Engineers (OSPE).

Certain waste management projects require approval under the EAA, as well as the EPA. The EAA provides for the protection, conservation and wise management of the environment. The EAA definition of “environment” is broad and is provided in Section 5 of this guideline.

A project to which the EAA applies is termed an “undertaking.” The definition of “undertaking” under the EAA is provided in Section 5 of this guideline. For an undertaking that is subject to an individual environmental assessment, the Minister of the MOECC decides, with the approval of the Lieutenant Governor in Council, whether or not to approve it. The Minister may also refer a matter that relates to an application for approval of an individual environmental assessment to the ERT, or another tribunal or entity, for a hearing and decision.

Five principles that are key to successful planning and approval under the EAA are:

1. consult with potentially affected and other interested parties;
2. consider a reasonable range of alternatives;
3. consider all aspects of the environment;
4. systematically evaluate environmental effects; and
5. provide clear and complete documentation.

An individual environmental assessment is not required for all undertakings. Streamlined environmental assessment processes are available for some routine projects that have predictable and manageable environmental effects. Proponents of these types of projects follow a self-assessment and decision-making process. Approval is not directly granted for each project. Streamlined self-assessment processes have been established through Class Environmental Assessments, the Electricity Projects Regulation, the Waste Management Projects Regulation and the Transit Projects Regulation.

Under the EAA, no other legal authorizations (such as approvals, licences, and permits) that are required to proceed with the undertaking can be issued until the proponent receives approval under the EAA. As a result, EAA and EPA processes are generally carried out sequentially.

A consolidated hearing can be held if multiple hearings are required before different tribunals on matters related to the same project. The proponent of an undertaking to which the *Consolidated Hearings Act* applies may request a consolidated hearing in order to have a Joint Board consider all of its approvals under the Listed Acts, as defined in Reg. 173 (Hearings) under the *Consolidated Hearings Act*, and to make a decision.

Five principles that are key to successful planning and approval under the EAA are:

1. consult with potentially affected and other interested parties;
2. consider a reasonable range of alternatives;
3. consider all aspects of the environment;
4. systematically evaluate environmental effects; and
5. provide clear and complete documentation.

The amount to which these items are required to be considered and documented vary based on the process (e.g. individual EA, Class EA, Environmental Screening process).

Other approvals may be required, including ECA approvals for discharges to air, land and water. Other legislation relevant to solid waste management includes, but is not limited to, key acts, regulations and guidelines outlined in Appendix 1.

SOLID WASTE MANAGEMENT—FUNCTIONAL ELEMENTS AND COMPONENTS

The practice of professional engineering related to solid waste management often involves a complex legal, technical and social environment.

The following section describes the various elements of solid waste management, and the role and reasonable expectations of engineering practitioners engaged in solid waste management projects.

5.1 Functional Elements

The functional elements of a solid waste management system are shown in Figure 1.

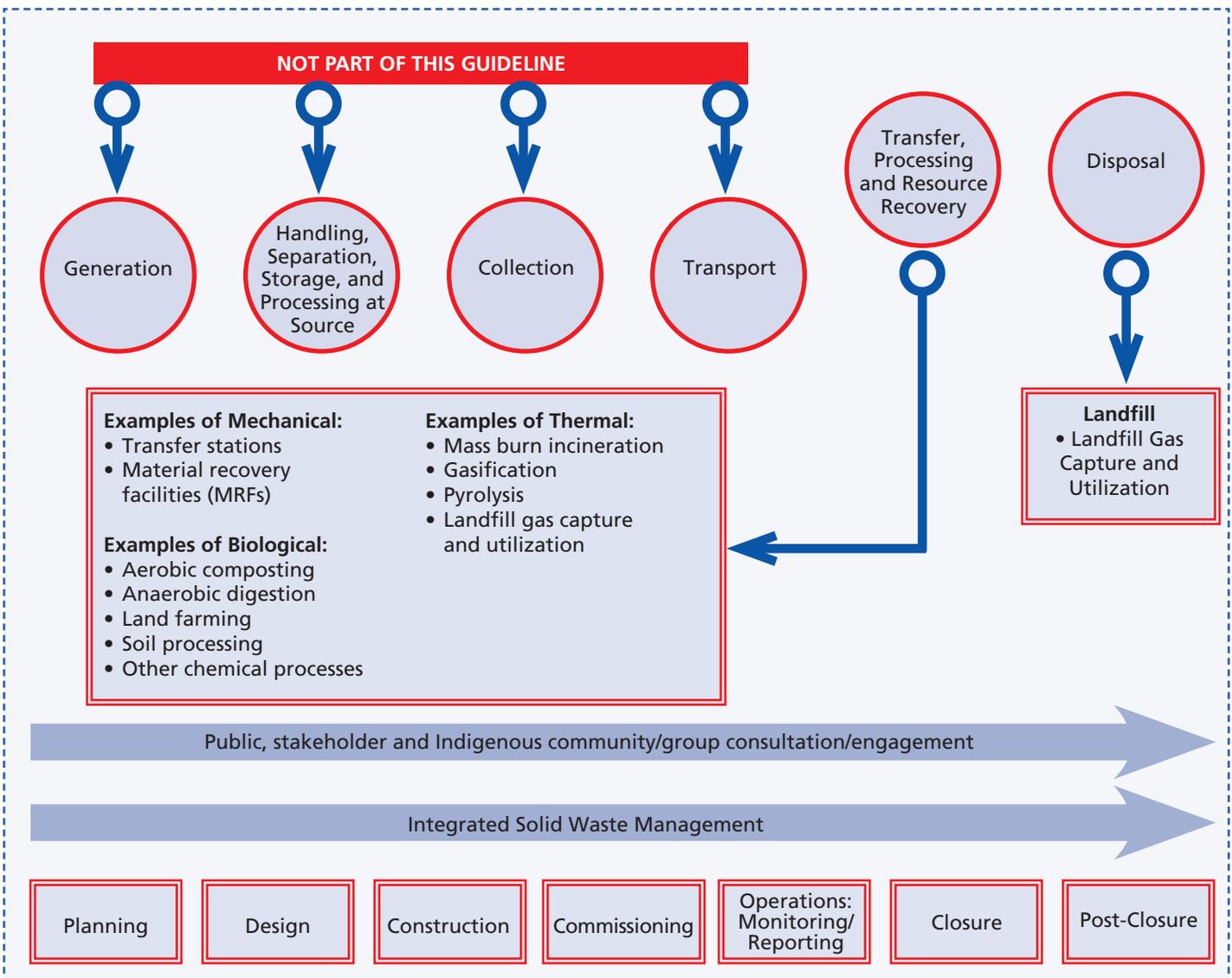


Figure 1: Functional Elements of a Typical Integrated Solid Waste Management System

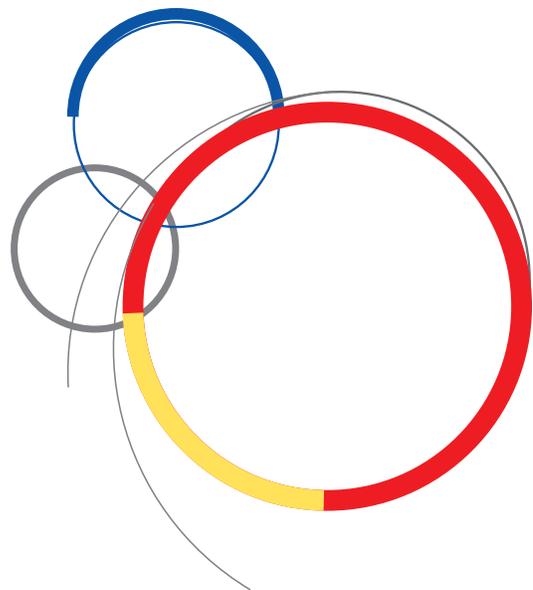
Stage	Typical Reports/Documents	Potential Approvals
Planning	<ul style="list-style-type: none"> • Municipal Master Plan Report • Feasibility Study • Terms of Reference (ToR) for Individual • Environmental Assessment Report (EA) • Project Description Report 	<ul style="list-style-type: none"> • EA Terms of Reference (ToR) • Approved EA • <i>Green Energy Act</i> (GEA) or Renewable Energy Approval • Zoning bylaws
Design	<ul style="list-style-type: none"> • Preliminary/Conceptual Design Report • Design Brief • Base Design Features Report • Design and Operations (D&O) Report • Detailed Design • Contract Drawings and Specifications • Applicable Studies (e.g. hydrogeological, geological) 	<ul style="list-style-type: none"> • Environmental Compliance Approval (ECA) • Environmental Activity and Sector Registry (EASR) • Site Plan Approval • Conservation Authority Approval • Niagara Escarpment Commission (NEC) • Applicable municipal, provincial and/or federal approvals • Permit to Take Water • Renewable Energy Approval (REA)
Construction	<ul style="list-style-type: none"> • Construction Quality Assurance/Quality Control plan (QA/QC) • As-built and Record Documents 	<ul style="list-style-type: none"> • Building Permit
Commissioning	<ul style="list-style-type: none"> • Operation and Maintenance (O&M) Manuals • Post-Construction Summary Report • Applicable Inspections 	<ul style="list-style-type: none"> • Technical Standards & Safety Authority (TSSA) • Electrical Safety Authority (ESA)
Operations (Monitoring, Inspection and Reporting)	<ul style="list-style-type: none"> • Annual Monitoring Report • Annual Operation Report • National Pollutant Release Inventory (NPRI) • Federal & Provincial Greenhouse Gas (GHG) Reporting • Waste Diversion Ontario (WDO) Reporting 	<ul style="list-style-type: none"> • Amendment to existing approval(s) as required
Closure	<ul style="list-style-type: none"> • Closure Plan 	<ul style="list-style-type: none"> • Approval of Closure Plan
Post-closure	<ul style="list-style-type: none"> • Care and Monitoring Reports–Landfill • Decommissioning Report 	<ul style="list-style-type: none"> • MOECC Review

Table 1: Typical Reports/Documents and Potential Approvals by Stage

The above table provides a more detailed overview of solid waste management engineering activities. The list is not intended to be exhaustive, but rather highlights typical reports, documents and approvals associated with the components on page 8.

The following subsections provide additional details related to the reports and approvals referenced in Table 1.

Proactive communication with stakeholders is important throughout the life of a project because of the potential for a high degree of public scrutiny associated with solid waste management projects.



5.2 Planning

Many solid waste management projects require a planning phase, which often includes public, stakeholder and Indigenous community/group consultation/engagement, in order to proceed. The projects may also be subject to municipal, provincial or federal planning level approvals.

This section outlines the general process required by O. Reg. 101/07 under the EAA regarding an individual EA or ESP. However, projects requiring planning approval under other existing legislation, such as Renewable Energy Approvals Regulation (O. Reg. 359/09) made under the EPA, must adhere to specific approaches outlined in the applicable legislation and associated regulations and guidelines.

Planning activities typically require multi-disciplinary teams. Team members are generally involved in three distinct activities: system design or development; assessing the impact of the proposed system on a defined environment; and consulting throughout the planning process with stakeholders, including the public and applicable government agencies. Public, stakeholder and Indigenous community/group consultation/engagement should begin as early as possible in the planning process so that concerns can be identified and addressed before final decisions and commitments are made on the selected approach or specific proposals. The planning process should be developed in consideration of the involvement and ongoing contributions of potentially affected and/or interested public, Indigenous community and any other stakeholders.

The basic stages in the planning phase, which are generally documented in a report, are:

- problem/issue definition;
- identification of alternatives;
- evaluation of alternatives;
- preferred alternative selection;
- detailed evaluation of preferred alternative;
- preferred alternative implementation; and
- public, stakeholder and Indigenous community/group consultation/engagement.

The elements of these seven stages are outlined below. The overarching process employed to arrive at a preferred alternative includes: identify alternatives; screen alternatives; consider impacts and mitigation to minimize risks and impacts; comparatively evaluate alternatives from a net effects perspective; and select a preferred alternative with consultation throughout this process.

1. Problem/issue definition

Details the problem to be resolved or the opportunity to be realized, and then documents and justifies the need for the resolution or opportunity in a broad context.

2. Identification of alternatives

Develops a comprehensive list of alternative approaches or technologies which may be able to meet the defined need; screens out

alternatives which, either on their own or in conjunction with others are not reasonable or cannot meet the need; and describes the remaining alternatives within a systems context to allow subsequent evaluation.

3. Evaluation of alternatives

Criteria should be developed to assess the effects of the alternatives on the environment. The criteria should be linked to each component of the environment (such as the natural, social, economic and cultural environments), and a description of the effects of each of the alternatives on the environment is required. The criteria and evaluation should include consideration of public, stakeholder and Indigenous community/group consultation/engagement.

4. Preferred alternative selection

Based on the evaluation of alternatives, a preferred alternative is identified and accompanying documentation needs to support the robustness and transparency of the evaluation process.

5. Detailed evaluation of preferred alternative

Once a preferred alternative is identified, it may require more detailed investigation as the initial evaluation of alternatives may not provide sufficient detail for design purposes.

6. Preferred alternative implementation

Once the preferred solution has been determined, conceptual design, detailed design and construction of the system or facility is completed.

7. Consultation with public, stakeholder and Indigenous communities/groups

Consultation is a two-way communication/engagement process to involve interested persons or groups in the planning of a proposed undertaking and it should be implemented through all stages of the planning process discussed above.

5.2.1 Environmental approval—environmental assessment or screening

The following provides an overview of the provincial environmental approvals that may be required for a solid waste management project. It is recommended that pre-consultation with approval agencies be completed.

To provide a more standardized approach, the MOECC developed EA requirements for waste management projects that apply equally to both public and private sector proponents. The O. Reg. 101/07 and the *Guide to Environmental Assessment Requirements for Waste Management Projects* dated March 2007 (as amended) set out the standard approach to EA requirements. These documents should be referred to during the EA process.

O. Reg. 101/07 designates two types of activities related to waste management projects: establishment and change. Under O. Reg. 101/07, waste management projects are generally classified based on the:

The MOECC is also working on expanding activities and sectors that would qualify under the EASR. At the time of writing, the only EASR related to waste was for the collection and hauling of non-hazardous waste (which is not part of this guideline). However, in future there may be other components of a solid waste management project that may qualify under the EASR.

- type of waste to be managed;
- size and type of the proposed facility;
- ability of the planned facility to recover energy from the waste; and
- use of any other fuel in the treatment process for thermal treatment sites.

O. Reg. 101/07 identifies two types of EA processes:

1. Certain waste disposal projects require an individual EA under Part II of the EAA. This includes the development of terms of reference (ToR) and EA that must be approved by the Minister.
2. Some projects are exempt from the requirements of Part II of the EAA, provided the Environmental Screening Process (ESP) is followed. The ESP is a proponent-driven, self-assessment process and includes a minimum of four public, Indigenous communities/groups and government agency consultation periods. There are provisions in the ESP for the public to request and the MOECC to consider the elevation of a project from the ESP to an individual EA.

O. Reg. 101/07 also contains exemptions for certain projects from the EAA. An exemption from the EAA under O. Reg. 101/07 does not exempt the proponent from any other applicable approval requirements under any other legislation, such as the EPA.

5.3 Design

There are generally three stages to design (conceptual, preliminary and detailed), and they are further described below. As an aid to the design process, reference is made to various specific acts and regulations in the following sections of this document. The reader is cautioned that it remains the responsibility of the engineer to confirm the applicability of any regulation or statute—whether explicitly referenced in this document or not—at the time at which work is being, or to be, conducted.

5.3.1 Conceptual design

The conceptual design will be sufficient to demonstrate the feasibility of the proposed system or facility on a site-specific basis. It will include the proposed system capacity, the components necessary to ensure functionality (e.g. servicing requirements), environmental protection and conceptual-level cost estimates.

5.3.2 Preliminary design

The development of preliminary designs for a waste disposal facility often requires a multi-disciplinary team to consider the technical issues and impacts of the proposed facility at the proposed site and vicinity, and then develop a Design and Operations Report recommending measures to mitigate those impacts.

5.3.3 Detailed design

The detailed design will build on the conceptual and preliminary design and, in some cases, on experience gained in earlier phases of the project or on technological advances.

The detailed design will include the preparation of detailed plans and specifications as needed for approvals or permits and, subsequently, as suitable for tendering and construction purposes.

The detailed design drawings and specifications for facilities may involve contract drawings and specifications for site preparation only. A long-term operations plan may or may not be contracted out by the owner. Engineers are often required to develop a detailed operations manual and tender documents for the operation of facilities as part of the final design process.

The detailed design must satisfy the conditions of approval provided under any permits previously issued. Typically, such conditions are satisfied by the submission and approvals or approval of a final set of drawings and specifications to the appropriate regulator(s).

5.3.4 Environmental Compliance Approval and Environmental Activity and Sector Registry

The following provides an overview of the provincial environmental approvals that may be required for a solid waste management project. It is recommended that pre-consultation with approval agencies be completed.

Environmental Compliance Approvals (ECAs), issued under Part II.1 of the EPA, are required under:

- subsection 9(1) (i.e. air, noise, vibration, odour, etc.) of the EPA; or
- subsection 27(1) (i.e. waste disposal site, waste management system, etc.) of the EPA; or
- subsection 53(1) (i.e. sewage works, stormwater management) of the *Ontario Water Resources Act* (OWRA).

A single ECA application package can be submitted for multiple activities and projects in multiple media, (e.g. for air, waste and wastewater.) An ECA with Limited Operational Flexibility allows for certain modifications (e.g. operational, equipment, infrastructure) to be made to a site over time without having to seek amendments to the ECA for those “pre-approved” modifications.



The MOECC is also working on expanding activities and sectors that would qualify under the EASR. At the time of writing, the only EASR related to waste was for the collection and hauling of non-hazardous waste (which is not part of this guideline). However, in future there may be other components of a solid waste management project that may qualify under the EASR.

The Design and Operations (D&O) Report is the principal document where the details of a waste disposal site are presented. The report will include engineered systems necessary to mitigate environmental impacts from the site. The report will also describe site description; facility design and layout; facility operations; quality assurance; maintenance program; staff training requirements; potential nuisances and control program; contingency and emergency response plans; documentation (record keeping); environmental monitoring and controls; system redundancy/contingency measures; and site closure and post-closure monitoring and maintenance.

Financial assurance is typically required for private sector proponents to ensure that funds are available for closure and remediation (if necessary) of a site and, if appropriate, for long-term care and monitoring (e.g. landfill sites). For additional information on financial assurance, please refer to the MOECC's document, *F-15, Financial Assurance Guideline*.

Key considerations for determining the amount of financial assurance include:

- the equipment and facilities on the site;
- the total volume of waste on site;
- the nature of the waste/material on site; and
- the extent of soil contamination at the site.

An evaluation or update of financial assurance for a landfill site covers closure and post-closure care, and contingency plans, throughout the contaminating lifespan of the site.

- Closure cost—should cover as a minimum the cost of site closure works.

The *Guide to Applying for an Environmental Compliance Approval*, dated December 2012, should be referred to during the preparation of an ECA application package. The MOECC requires the proponent to submit a complete ECA application for approval of a waste disposal site. Applications for ECA Regulation, O. Reg. 255/11 made under the EPA (ECA Application Regulation), set out prescribed requirements for a complete ECA application. The minimum ECA application requirements set out in the ECA Application Regulation include, but are not limited to, the following:

- submission of correct application form, fees payment and all the applicable information requested;
- providing a summary of project description;
- providing a detailed project and process description;
- providing information about ownership, land use and municipal zoning;
- providing a site plan and other applicable maps, plans and drawings; and
- providing a financial assurance calculation and rationale, if required.

The proponent is required to sign the application certifying its completeness and that the information submitted is accurate. An incomplete ECA application can be returned by the MOECC without considering whether to issue or refuse an ECA. Some waste management activities are eligible for registration of their activities through the MOECC Environmental Activity and Sector Registry (EASR) prescribed by the regulations under subsection 20.21 of Part II.2 of the EPA.

Key considerations for determining the amount of financial assurance include:

- the equipment and facilities on the site;
- the total volume of waste on site;
- the nature of the waste/material on site; and
- the extent of soil contamination at the site.

- Post-closure cost—should cover as a minimum, the cost of post-closure care, monitoring and reporting.
- Project management fees.
- Contingency—an additional amount is required for contingencies such as leachate and landfill gas management and removal and cost of hiring a third party to oversee clean up of the site.

O. Reg. 232/98 (Landfilling Sites Regulation) made under the EPA specifies certain financial assurance requirements for landfill sites, and MOECC's F-15, *Financial Assurance Guideline* provides information for estimating financial assurance.

5.3.5 Renewable energy projects

Renewable energy projects that will use biomass (defined in Definitions and Exemptions Regulation (O. Reg. 160/99) made under the *Electricity Act*, 1998) for electricity production) are subject to the Renewable Energy Approvals (REA) Regulation (O. Reg. 359/09) made under the EPA. Depending on the nature of the projects, anaerobic digestion facilities and thermal treatment facilities could be subject to: O. Reg. 359/09, O. Reg. 347, O. Reg. 267/03, O. Reg. 101/07 or O. Reg. 116/01 (Electricity Projects Regulation). Engineers providing guidance or involved with the development of renewable energy projects or energy from waste projects should know which regulations apply to any waste-based electricity project.

5.4 Construction

There are special issues that are of particular relevance to solid waste management facility construction.

- Other permits and licences may contain conditions relating to certain aspects of the facility's construction. The engineer responsible for construction oversight must be aware of all such conditions and other permit requirements, in addition to requirements in the ECA.
- In addition to the detailed material testing reports and other records maintained during construction that are typical of engineering works, the contract administrator/construction inspector or an independent auditor may be required to complete a post-construction report for submission to the MOECC to demonstrate that the facility (e.g. landfill site) was constructed in accordance with the approved design. This may include records for special features, such as landfill liners or pollution control systems.
- As part of the D&O report, specific requirements may be set out relating to monitoring and minimizing potential construction impacts from nuisance/discharge/emission. These may be related to both on-site and off-site impacts. Engineers should be aware of these requirements and ensure compliance.

5.5 Commissioning

The extent of commissioning activities will vary depending upon the nature of the project and the associated facilities. Certain facilities may require commissioning activities for process equipment

including mechanical, electrical, instrumentation and control systems. Typical commissioning activities may include, but are not limited to:

- post-construction report for landfills;
- Site Preparation Report (including drawings) for landfills (as defined in O. Reg. 232/98);
- noise audits for renewable energy facilities;
- ECA approvals for air, odour control or waste water;
- site acceptance tests; and
- Pre-start Health and Safety Review.

5.6 Operations

The operation of a solid waste management facility comprises a number of components of which engineers should be cognizant in the preparation of an Operations Manual. Such components may also be identified within the ECA.

ECA holders are required to ensure they comply with all the terms and conditions of their ECAs as well as other applicable regulations, policies and guidelines including the impact of the solid waste management facility on the neighboring natural and social environments. The same would also apply to any person carrying out work or operating such a facility.

5.6.1 Operations Manual

The Operations Manual should address the control and administration of activities within the solid waste management facility (including equipment, personnel, waste, data/information processing, financial documents, and users/clients) and the reporting of the performance and efficiencies of these activities. ECAs will typically require that an Operations Manual be prepared for a project, and may identify specific requirements that need to be followed. An Operations Manual might include:

- staffing;
- performance measures;
- abatement activities;
- mode of operation(s);
- health and safety;
- operating reports/activity diaries/daily logs/progress/field reports;
- records/files;
- equipment;
- facility security;
- inspection and maintenance of facility/operations/equipment;
- control of users;
- waste load recording;
- transaction ticket form/mode of fees/billing procedures;
- budgeting/cost control;
- contracted services;
- public involvement;
- emergency and complaint response procedure; and
- staff training.

5.6.2 Monitoring and reporting

During operations, the monitoring, recording and reporting of the performance of the solid waste management facility and environmental controls are required to satisfy the requirements of various agencies and regulators with respect to performance and compliance, in addition to ensuring the receipt of funding (from Waste Diversion Ontario, for example). This information may then be used to improve performance and for long-range planning of solid waste management facilities. It may also be used to help identify new processes and markets.

Typical reports include annual reports to the MOECC with individual sections dedicated to a discussion of environmental controls including groundwater, surface water, air and gas collection systems, and federal National Pollutant Release Inventory (NPRI) and greenhouse gas (GHG) reporting.

Annual reporting to the MOECC is either completed by a site operator and/or by a Qualified Person, depending on the type of report.

Practitioners should consult the MOECC guideline *Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water*.

5.7 Closure

Solid waste management facilities may require Closure Plans at the end of their service life. For a landfill, this is typically completed at least two (2) years prior to the anticipated date of closure of the waste management site, or the date 90 per cent of the total waste disposal volume is reached, whichever occurs first (refer to *Landfill Standards: A Guideline On The Regulatory And Approval Requirements For New Or Expanding Landfilling sites for O.Reg 232/98*). For other facilities, such as waste processing, transfer, composting sites, etc., this may be completed four to six months prior to closure.

A closed landfill site will require long-term care and monitoring, while other waste management facilities may just require appropriate decommissioning upon site closure.

For landfills, the Owner/Operator should prepare a detailed Site Closure Plan in conformance with the conditions of the ECA and other applicable approvals, pertaining to the termination of the landfilling operations, post-closure inspection, maintenance, monitoring, reporting and end-use plan for the site. This should be submitted to the director of the MOECC for approval with copies to the local District Office of MOECC, the appropriate stakeholders and the established Public Liaison Committee (if applicable).

The Site Closure Plan should include the following sections as a minimum:

- **Introduction**—The introduction should provide highlights of the site ownership; location; approved area and capacity; design principles of the site; regulatory legislation; and a brief summary of the facility operation, including the type of waste received and other solid waste management operations carried out at the site, as well as the conceptual plan proposed for use of the site after the site is closed and rehabilitated (if required).
- **Site Closure Works**—This section describes activities to maintain the site in a manner that is aesthetically pleasing and ensures long-term protection of the environment. The site closure activities should include the following:
 - a. a plan (i.e., engineering drawing), commonly called “Site Grading Plan” showing site appearance after closure, including drainage, control, treatment and monitoring features, landscape, final cover details, etc.;
 - b. description of final cover design details, specifications and tendering and construction procedures (if applicable);
 - c. description of the control and management of leachate, surface water, groundwater and landfill gas; and
 - d. descriptions of the procedures for closure of the site, including:
 - i. advance notification to the public of the landfill closure;
 - ii. posting of a sign at the site entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements;
 - iii. construction of the final cover, site access roads and landscaping;
 - iv. site security fencing and lockable gates;
 - v. removal of unwanted landfill-related structures, buildings and facilities;
 - vi. final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and
 - vii. complaint contact and response procedures.
- **Inspection and Maintenance**—Description of the procedures and schedules for post-closure care of the site, including:
 - a. operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and
 - b. inspection and maintenance programs for the final cover, site security fence and gates, and access roads.
- **Compliance Monitoring Programs**—Description of monitoring programs for groundwater/leachate, surface water and landfill gas to assess compliance with applicable legislation, ECA and to evaluate the performance of the landfill site as designed.
- **Trigger Mechanism and Contingency Plan**—including:
 - a. description of trigger monitoring programs for groundwater/leachate, surface water and landfill gas, including trigger mechanism and locations to assess the need for implementation of contingency action; and
 - b. description of contingency plan to be implemented.
- **End-use Plan**—A description and design of the proposed end-use of the site, including design brief and details shown on plans as appropriate.

- **Financial Assurance** (if applicable)—An update of the cost estimate for financial assurance and the amount which has been provided to the director of the MOECC.

5.8 Post-Closure

Since the implications of the contaminating life of landfilled waste could extend to hundreds of years, post-closure care, monitoring and maintenance is an essential part of landfill site operations. The post-closure care requirements should be itemized and costed during design, and the financial planning should be initiated upon approval of the facility for such things as:

- access;
- vegetation/landscaping;
- erosion/settlement;
- storm drainage control;
- leachate management;
- gas management;
- annual monitoring; and
- remedial contingencies.

Post-closure reports for landfills are generally required for:

- record keeping and reporting on post-closure inspection/maintenance, results of monitoring programs and an interpretation of the results;
- an assessment of the adequacy of, and need to implement, the contingency plans for groundwater/leachate, surface water and landfill gas; and
- an updated estimate of the contaminating life span of the site, based on the results of the monitoring programs to date.

In accordance with Section 46 of the EPA, approval by the Minister of the MOECC is required if development is proposed on a closed landfill site less than 25 years from closing.

5.9 Special Services

Due to the controls needed to safeguard the natural environment, the complexity of technology used and the strict regulatory requirements, some of the following special services may be required, including but not limited to:

5.9.1 Testimony

The approvals process may involve hearings and the testimony of engineers at these hearings. Testimony may also be required at hearings, courts of law, discoveries, through interrogatories, and before committees. Such testimony should be confined to expert testimonials that are within an engineer's realm of expertise and experience. It could also involve directly consulting with counsel before, during and after hearings and involvement during discoveries and interrogatories. The purpose of expert testimony is to provide unbiased truthful information to assist the judge, board or inquest jury to reach a sound decision.

For more information on providing expert witness, please refer to the PEO guideline *The Professional Engineer as an Expert Witness*.

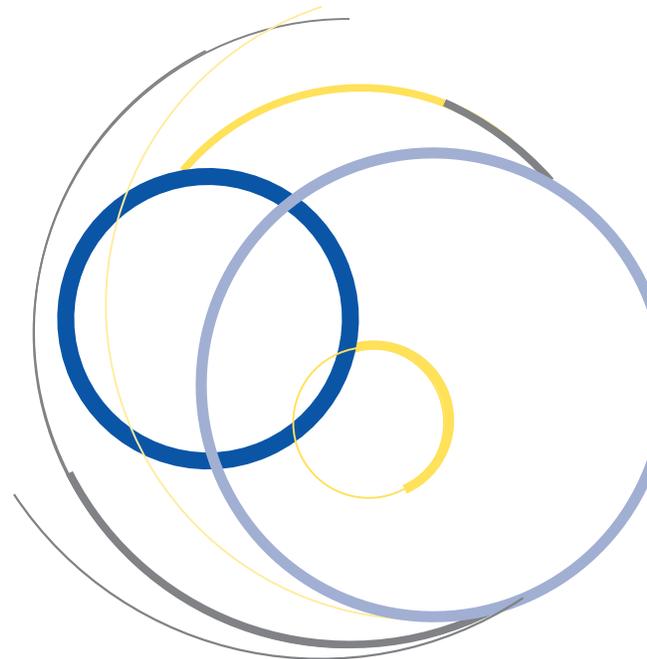
5.9.2 Advisory services

Engineers may be retained to provide advisory services to parties opposed to a proposed facility or system. Engineers must be aware of their responsibilities under the Code of Ethics with respect to the review of another engineer's work. Advice on alternative proposals for other stakeholders should be included in this section.

For more information on engineers providing technical review of another engineer's work, please refer to the PEO guideline *Professional Engineers Reviewing Work Prepared by Another Professional Engineer*.

5.9.3 Closed landfills/Dumps

There are numerous sites in the province where historic waste disposal activities have taken place, however no Closure Plan is available or on-going monitoring conducted. These sites may be located close to land proposed for development, such as residential or commercial buildings or for new groundwater supply wells. In these instances, the engineer may be required to work with proponents, stakeholders and regulators to develop a plan to assess the potential impacts from a known historic waste disposal site, and identify monitoring and/or remedial measures as necessary.



BEST PRACTICES

6.1 What Needs to be Sealed?

Engineers must seal all final documents that are within the practice of professional engineering, provided as part of a service to the public. For more information on what needs to be sealed, please refer to the PEO guideline *Use of the Professional Engineer's Seal*.

6.2 Waste Management Hierarchy and the Proposed New Waste Framework

An engineering practitioner may engage in a hierarchy of activities relevant to solid waste management. The province's *Waste Diversion Act* (2002) promotes a hierarchy of waste reduction, reuse and recycling (the three Rs); and prohibits programs from promoting the burning, landfilling, or land application of designated material. It should be noted that the use of waste as a fuel or energy source, or to create materials used as fuel or energy sources, is not included in the definition of the three Rs in Ontario. Other variations of this hierarchy, which has also been adopted as a best practice by many jurisdictions, can be stated as follows:

1. Reduce—Prevent waste generation where possible;
2. Reuse waste for other purposes;
3. Recycle waste through the creation of other useful products;
4. Thermally treat, change the form, and reduce the volume of the combustible fraction of the waste stream and recover the energy while safely disposing of or using the by-products of combustion; and
5. Landfill waste in an engineered landfill in a suitable location and collect and utilize methane and other gases as a source of energy.

The province has proposed a new framework for waste which includes new legislation and a strategy. The proposed legislation, called the *Waste Free Ontario Act*, is currently being considered by the legislature. If passed, it would replace the *Waste Diversion Act*, 2002 and would establish an outcomes-based producer responsibility regime for their products and packaging.

The draft strategy “Draft Strategy for a Waste-Free Ontario: Building the Circular Economy” works with the proposed legislation to provide a roadmap for the province to transform its existing waste diversion framework and move toward a circular economy. The strategy proposes a vision, goals, key actions and performance measures. The final strategy will be released once all public, stakeholder and Indigenous community/group consultation/engagement and reviews have been completed. The following vision and goals are proposed in the strategy:

Vision:

- A circular economy where we have zero waste and zero greenhouse gas emissions from the waste sector and where all resources, organic or non-organic, are used and reused productively, maximizing their potential and reintegrating recovered materials back into the economy.

Goals:

- Zero waste in the province.
- Zero greenhouse gas emission from the waste sector.

Interested parties should visit the government website to review the proposed legislation and strategy and to check for any final versions.

6.3 Climate Change and Extreme Weather Considerations

Projects should consider climate change and extreme weather conditions. The following list provides an overview of some key ideas around this topic, but are not limited to:

- engineers should integrate an understanding of changing climate and weather into the normal day-to-day planning, design, procurement, operation, commissioning and maintenance activities for which they are professionally responsible;
- engineers should work with climate and meteorological specialists/experts to ensure that interpretations of climatic and weather considerations used in professional practice reasonably reflect the most current scientific consensus regarding the climate and/or weather information;
- engineers should consider the impact of changing weather and climate conditions over the entire service life of an engineered system;
- engineers should be aware of the legal liability associated with reliance on historic climatic and weather information within their professional practice;
- engineers should use current accepted practice for return periods on storms and flooding:
 - o designs should consider limitations of a predictive model using existing historical data (i.e. Hindcast Data) when forecasting maximum design events and extreme occurrences; and

Projects should consider climate change and extreme weather conditions.

- engineers should consider long-term terrain changes in areas subject to influence from such trends (i.e. changes in permafrost).

6.4 Duty to Report (unsafe situations)

The duty to report is an essential component of an engineer’s commitment to professionalism. In fact, most engineers are fulfilling this duty daily when they identify designs, processes and procedures that are unsafe, unhealthy or uneconomical (which is detrimental to the public welfare), and then act to correct these problems. Indeed, no engineer should disparage or renege on his or her duty to report.

Engineers have obligations both to their clients/employers and to the public. Sometimes these obligations will conflict. On one hand, the engineer is obligated not to disclose confidential information of the client/employer and must avoid the use of such information to the disadvantage of the client/employer. On the other hand, PEO’s Code of Professional Conduct states that failure to report a situation that an engineer believes may endanger the safety or welfare of the public would constitute professional misconduct on the part of the engineer (section 72(2)(c), O. Reg. 941/90). There should be no doubt, however, as to how the engineer must act: The engineer “shall regard the practitioner’s duty to public welfare as paramount” (section 77(2).i, O. Reg. 941/90). Although the engineer’s ultimate responsibility is clear, there is no universally applicable procedure to be used for discharging this responsibility.

For more information on an engineer’s duty to report, please refer to the PEO guideline *Professional Engineering Practice*.

6.5 Duty to Inform

If the practitioners are overruled by a non-technical authority where the engineer is responsible for the technical adequacy of the engineering work, the practitioners have obligations to clearly present to their employers the consequences from a deviation proposed in work (section 72(2).f, O. Reg. 941/90). Essentially, this is the duty to inform a non-technical person about the consequences of an action.

6.6 Conflict of Interest

O. Reg. 941/90 made under the *Professional Engineers Act* clearly describes the circumstances that create a conflict of interest. In section 72(2)(i), it states that “failure to make prompt, voluntary and complete disclosure of an interest, direct or indirect, that might in any way be, or be construed as, prejudicial to the professional judgment of the practitioner in rendering service to the public, to an employer or to a client” shall constitute professional misconduct. To know when disclosure is appropriate, a clear understanding of what causes a conflict of interest is needed.

For more information on conflict of interest, please refer to the PEO guideline *Professional Engineering Practice*.

The duty to report is an essential component of an engineer’s commitment to professionalism. In fact, most engineers are fulfilling this duty daily when they identify designs, processes and procedures that are unsafe, unhealthy or uneconomical (which is detrimental to the public welfare), and then act to correct these problems. Indeed, no engineer should disparage or renege on his or her duty to report.



DEFINITIONS AND ACRONYMS

The following definitions apply for the purposes of this guideline and may not be generally applicable in other situations.

Competent Environmental Professional

Refer to Qualified Person definition below.

Dump

A non-engineered landfill.

Engineers

References in this guideline to the term engineers apply equally to professional engineers, temporary licence holders, provisional licence holders and limited licence holders.

Environment (from EAA)

- a) air, land or water;
- b) plant and animal life, including human life;
- c) the social, economic and cultural conditions that influence the life of humans or a community;
- d) any building, structure, machine or other device or thing made by humans;
- e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or
- f) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

Limited Operational Flexibility Environmental Compliance Approval

Allows for certain modifications (e.g. operational, equipment, infrastructure) to be made to a site over time without having to seek amendments to the ECA for those “pre-approved” modifications.

Municipal waste (from O. Reg. 347):

- a) any waste, whether or not it is owned, controlled or managed by a municipality, except:
 - i. hazardous waste;
 - ii. liquid industrial waste; or
 - iii. gaseous waste; and
- b) solid fuel, whether or not it is waste, that is derived in whole or in part from the waste included in clause (a).

Qualified Person

O. Reg 153/04 defines Qualified Persons who conduct or supervise environmental site assessments to include members of Professional Engineers Ontario (PEO) and the members of the Association of Professional Geoscientists of Ontario (APGO). The qualified person shall meet one of the following:

- the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or

- the person holds a certificate of registration under the *Professional Geoscientists Act*, 2000 and is a practising member, temporary member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2.

We note that an ECA may also define a Qualified Person for a project.

Solid waste

Generally, follows the definition of “Municipal Waste”. For this guideline, dry biosolids are included, but not liquid biosolids.

Solid waste management facility

Transfer station; materials recovery facility (MRF), organics processing (e.g. aerobic or anaerobic) facility; thermal treatment facility; landfill, etc.

Solid waste management system

All facilities, programs, equipment and operations for the complete management of waste, including generation, handling, separation, storage, processing at source, collection, transport, transfer, processing, resource recovery and disposal.

Waste (from EPA)

Includes ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and such other materials that are designated in the regulation.

Waste management engineering

Involves planning, design, construction, operation, monitoring, closure and decommissioning of a waste management system, or one or more components of a waste management system.

Waste disposal site (from EPA)

- a) any land upon, into, in or through which, or building or structure in which, waste is deposited, disposed of, handled, stored, transferred, treated or processed; and
- b) any operation carried out, or machinery or equipment used in connection with, the depositing, disposal, handling, storage, transfer, treatment or processing referred to in clause (a).

“Waste disposal site” has the same meaning as in section 25; (“lieu d’élimination des déchets”)

Waste management system (from EPA)

Any facilities or equipment used in, and any operations carried out for, the management of waste; including the collection, handling, transportation, storage, processing or disposal of waste, and may include one or more waste disposal sites.

“Waste Management System” has the same meaning as in section 25. (“système de gestion des déchets”) 2010, c. 16, Sched. 7, s. 2 (15)

Undertaking (from EAA)

- a) An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by a public body or public bodies or by a municipality or municipalities;
- b) A major commercial or business enterprise or activity or a proposal, plan or program in respect of a major commercial or business enterprise or activity of a person or persons other than a person or persons referred to in clause (a) that is designated by the regulations; or
- c) An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity of a person or persons, other than a person or persons referred to in clause (a), if an agreement is entered into under section 3.0.1 in respect of the enterprise, activity, proposal, plan or program (“enterprise”).

Director

A director appointed under section 5. R.S.O. 1990, c. E.19, s. 1 (2).

Acronyms

D&O Report—Design & Operations Report

EA—Environmental Assessment

EAA—Environmental Assessment Act

EASR—Environmental Activity and Sector Registry

ECA—Environmental Compliance Approval

EPA—Environmental Protection Act

ERT—Environmental Review Tribunal

ESP—Environmental Screening Process

MOECC—Ministry of the Environment and Climate Change

O&M—Operations & Maintenance

PEO—Professional Engineers of Ontario

QA/QC—Quality assurance/quality control

QP—Qualified Person

REA—Renewable Energy Approval

ToR—Terms of Reference

TSSA—Technical Standards & Safety Authority

WDO—Waste Diversion Ontario

APPENDIX 1

The following is a list of regulations, acts and guidance documents in force at the time of publication of this guideline which may be useful or helpful to the engineer. It is the engineer's responsibility to ensure that appropriate and up-to-date reference documents are properly consulted when performing engineering work related to solid waste management facilities. Other approvals may be required, including approvals for all discharges to air, land and water.

EPA Regulations

- O. Reg. 33/08 (Stewardship Ontario)
- O. Reg. 101/94 (municipal blue box, composting and recycling sites)
- O. Reg. 102/94 (Waste Audits and Waste Reduction Work Plans)
- O. Reg. 103/94 (source separation programs)
- O. Reg. 104/94 (Packaging Audits and Packaging Reduction Work Plans)
- O. Reg. 153/04 (Records of Site Condition)
- O. Reg. 169/03 (Ontario Drinking Water Quality Standards)
- O. Reg. 232/98 (Landfilling Sites)
- O. Reg. 255/11 (Applications for Environmental Compliance Approvals)
- O. Reg. 267/03 (compost)
- O. Reg. 340 (Containers)
- O. Reg. 344 (Disposable Containers for Milk)
- O. Reg. 345 (Disposable Paper Containers for Milk)
- O. Reg. 347 (General—Waste Management)
- O. Reg. 363/98 (Fees—Certificate of Approval)
- O. Reg. 419/05 (Air Pollution-Local Air Quality)
- O. Reg. 454/96 (Ontario Lakes and Rivers Improvement)
- O. Reg. 79/15 (Alternative Low-Carbon Fuels)
- O. Reg. 359/09 (Renewable Energy Approvals)

EAA Regulations

- O. Reg. 101/07 (Waste Management Projects)
- O. Reg. 101/98 (EA requirements for Waste Management Systems)
- O. Reg. 116/01 (Electricity Projects)

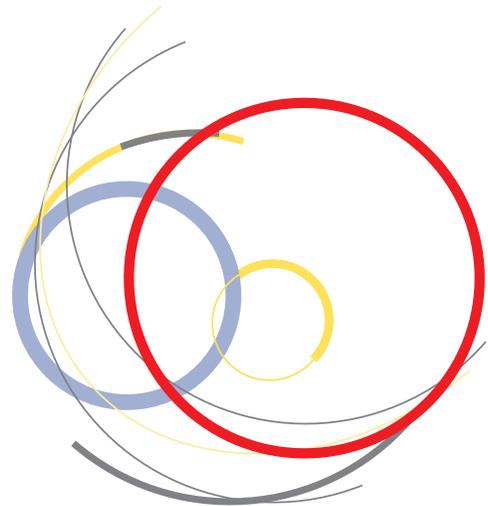
Federal Acts

- *Air Transport Act*
- *Canadian Environmental Assessment Act (CEAA)*
- *Canadian Environmental Protection Act (CEPA)*
- *Environmental Contaminants Act*
- *Fertilizers Act*
- *Fisheries Act*
- *Nuclear Fuel Waste Act C27*
- *Transportation of Dangerous Goods Act*

Other Provincial Acts:

- *Adam's Mine Lake Act*
- *Aggregate Resources Act*
- *Consolidated Hearings Act*
- *Conservation Authorities Act*
- *Electricity Act, 1998*
- *Endangered Species Act, 2007*
- *Environmental Bill of Rights, 1993*

- *Environmental Review Tribunal Act, 2000*
- *Expropriations Act*
- *Food Safety and Quality Act, 2001*
- *Greenbelt Act, 2005*
- *Green Energy Act, 2009*
- *Health Promotion and Protection Act*
- *Municipal Act*
- *Niagara Escarpment Planning and Development Act*
- *Nutrient Management Act, 2002*
- *Oak Ridges Moraine Conservation Act, 2001*
- *Occupational Health and Safety Act*
- *Ontario Drainage Act RSO1990-cD17*
- *Ontario Water Resources Act*
- *Pesticides Act*
- *Planning Act*
- *Repair and Storage Liens Act RSO1990.R25*
- *Safe Drinking Water Act*
- *Technical Standards and Safety Act, 2000*
- *Tile Drainage Act*
- *Waste Diversion Act, 2002*
- *Wetlands Conservation Act RSO1990 cC27*
- *Consolidated Hearings Act*



Guidelines/Best Management Practices:

- Guideline A-7: Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal Treatment
- A Guide to Waste Audits and Waste Reduction Work Plans for Construction & Demolition Projects, As Required under O. Reg. 102/94
- A Guide To Waste Audits And Waste Reduction Work Plans For The Industrial, Commercial And Institutional Sectors As Required Under O. Reg. 102/94
- MOECC Guide to applying for an Environmental Compliance Approval
- Guideline for the Production of Compost in Ontario
- A guideline on the regulatory and approval requirements for landfill gas
- Guide to Environmental Assessment Requirements for Waste Management Projects (2007)
- Reasonable Use Guideline for Surface and Groundwater
- Guideline B-7: Incorporation of the Reasonable Use Concept into MOEE Groundwater Management
- Monitoring and Reporting for waste disposal sites Groundwater and Surface Water
- MOE Management of Excess Soil—A Guide for Best Management Practices
- Policy Statement on Waste Management Planning (2007)
- Landfill Standards: A Guideline On The Regulatory And Approval Requirements For New Or Expanding Landfilling Sites
- Guideline F-15: Financial Assurance Guideline
- Guide to Environmental Assessment Requirements for Electricity Projects
- International Waste Directive—Requirements for Approval of Transport Routes and Landfill Sites for the Disposal of International Waste (Landfill Disposal)
- Consultation in Ontario's Environmental Assessment Process
- Environmental approvals: hearings and public consultation







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