

GUIDELINE

**Professional Engineers
Providing Services in Solid
Waste Management**

1993

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1. INTRODUCTION

1.1 Purpose

This document is a guideline for providing engineering services relating to the planning, design, implementation, phasing, retrofit, revision 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.

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 as well, including the natural and social sciences, legal counsel and public consultation. It is crucial to the successful implementation of any waste management facility that an integrated team possessing the necessary specialized expertise be assembled. The overall process of planning, designing, implementing and/or closing of a waste management facility may be led by an engineer; nevertheless, engineers will undoubtedly play key roles in any design- and construction-related activities. It is in this spirit that this guideline has been prepared.

1.2 Definitions

For the purpose of this guideline:

“Waste” means a solid, non-hazardous material for which the generator no longer has any use.

“Waste management system” means all facilities, programs, equipment and operations for the complete management of waste, including collection, handling, transportation, storage, processing, disposal and monitoring.

“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.

1.3 Legislation

In Ontario, waste management is primarily governed by Part V of 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). Its regulations deal specifically with waste management. Certain wastes, waste disposal sites and waste management systems are exempt from EPA requirements (mine waste, for example).

Part V of the EPA requires applicants to obtain formal approval from the Ministry of the Environment and Energy (MOEE) through a Provisional Certificate of Approval to establish or alter a waste disposal site or a waste management system, as defined under the EPA. Supporting documentation to an application for a Provisional Certificate of Approval usually contains engineering documentation. The decision on whether to issue a certificate is the responsibility of the director, appointed under the EPA by the MOEE. Although not in the regulations, public consultation is generally required for Part V approvals.

Part V of the EPA also specifies when a public hearing before the Environmental Assessment Board is required for a proposal, engineers are often required to testify at such a hearing. If a hearing is held, the director will issue the Provisional Certificate of Approval in accordance with the decision of the board.

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” includes air, land and water, plant, animal and human life, as well as the social, economic and cultural conditions that influence human life, and their interrelationships. A project to which the EAA applies is termed an undertaking. Approval of an undertaking is given by the Minister of the Environment and Energy or an applicable hearing board. The EAA stipulates that a Certificate of Approval under Part V of the EPA, or any other necessary approval, licence, or permit, will not be issued prior to the proponent submitting an environmental assessment and obtaining EAA approval. EAA and EPA processes are generally carried out concurrently and approvals sought under the *Consolidated Hearings Act*.

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

- u consultation with affected parties;
- u consideration of reasonable alternatives;
- u consideration of all aspects of the environment;
- u systematic evaluation of net environmental effects, and
- u provision of clear and complete documentation.

Other approvals may be required, including approvals for all discharges to air, land and water.

Other legislation relevant to waste management includes, but is not limited to:

Provincial:

- u Waste Management Act
- u Ontario Water Resources Act
- u Municipal Act
- u Planning Act
- u Expropriations Act
- u Consolidated Hearings Act
- u Conservation Authorities Act
- u Aggregate Resources Act
- u Pesticides Act
- u Occupational Health and Safety Act
- u Health Promotion and Protection Act
- u Niagara Escarpment Planning and Development Act

Federal:

- u Canadian Environmental Protection Act (CEPA)
- u Canadian Environmental Assessment Act (CEAA)
- u Environmental Contaminants Act
- u Fisheries Act
- u Air Transport Act
- u Transportation of Dangerous Goods Act

1.4 Responsibilities

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

2. WASTE MANAGEMENT SERVICES

2.1 System/Facility Planning

2.1.1 General

All or most waste management projects will require a planning phase for their development or implementation to proceed in a logical fashion. Some projects associated with development and approval of a waste management system may only require this phase.

Waste management systems may comprise many different types of facilities. Development of these may be subject to provincial or federal planning level approvals (i.e., EAA and CEAA). Both processes follow rational planning principles. This section outlines the general process required by the EAA.

2.1.2 Formal Planning Process

Projects requiring planning approval under existing legislation must adhere to specific approaches outlined in the legislation and associated regulations and guidelines.

These processes inevitably require multi-disciplinary teams. Team members are generally involved in three distinct activities: facility design or system development; assessing the impact of the proposed facility or system on a broadly defined environment, and consulting throughout the planning process with the public and interested government agencies. Public consultation should begin as early as possible in the planning process so that concerns can be identified and addressed before irreversible decisions and commitments are made on the chosen approach or specific proposals. The planning process should be constructed around the involvement and ongoing contributions of affected parties.

The basic stages in the planning process are:

- u problem definition;
- u solutions identification;
- u preferred solution selection, and
- u preferred solution implementation.

The elements of these four states are outlined below:

Problem definition—determines 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.

Solutions identification—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 feasible or cannot meet the need, and describes the remaining alternatives within a systems context to allow subsequent evaluation.

Preferred solution selection—determines the evaluation framework including criteria development; assesses alternatives in terms of criteria to be used in the evaluation; undertakes the comparative evaluation of alternatives, and documents the results of this process demonstrating that the preferred alternative has been selected in a logical fashion and the selection is traceable.

Preferred solution implementation—once the preferred solution has been determined, this stage consists of two basic steps: site selection and conceptual design of the system or facility. During each step a similar process will be employed for reaching a preferred alternative (i.e., identify alternatives; screen alternatives; consider impacts and mitigation to minimize risks and impacts; comparatively evaluate alternatives from a net effects perspective, and select preferred alternative).

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's capacity, the components necessary to ensure environmental protection and conceptual level cost estimates.

2.2 Facility Design

2.2.1 Introduction

Because the MOEE applies different approvals processes, solid waste facilities fall into two primary categories:

- u Facilities considered to be final disposal sites-i.e., landfills, incinerators and energy from waste facilities.
- u Other facilities such as transfer stations and material recovery, processing, composting, autoclaving, solidification and stabilization facilities.

According to the EPA, a public hearing is mandatory if the nature and quantity of waste to be land-filled or incinerated is equivalent to the domestic waste of 1500 people or more. EAA approval would also be required for such a disposal facility or any other facility subject to specific legislation or regulations or as may be designated by the minister.

2.2.2 Preliminary Design

Final Disposal Facilities. The development of preliminary design for a final disposal facility requires a multi-disciplinary team to consider the impacts of the proposed facility at the preferred site, and then develop a design and operations report recommending measures to mitigate those impacts.

The design and operations report will include engineered systems necessary to control emissions from the site. The report will also describe site preparation, daily operation, site development, environmental monitoring and controls, system redundancy/contingency measures, site closure and post-closure monitoring and maintenance. A financial plan should be prepared for the sound development, operation, closure and post-closure care of the site. The regulator may also require a financial assurance plan.

The level of detail for the design and operations report should be sufficient to satisfy the regulators and the hearing board.

The following documents are generally required when an applicant seeks approval under the EPA for final disposal facilities, or any other facility that is subject to a hearing:

- u A Ministry of the Environment and Energy application form signed by the proponent requesting a Certificate of Approval. The application will contain general information on the applicant, the source, types and quantities of waste, and the proposed site location and size.
- u A detailed environmental impact assessment of the proposed site and its vicinity that describes the existing conditions and the estimated impacts.
- u The design and operations report.

Other Facilities. Preliminary design for these other facilities will generally follow traditional procedures for facility design. This may, however, be influenced by the regulator's and public's levels of interest. The preliminary design will include, but not be limited to, such features as a site plan showing the facility layout and the area topography, including screening berms, orientation and dimensions of buildings, equipment requirements and layout, a process flow diagram, materials handling facilities, site services and roadways.

The preliminary design will also include an operations and management plan and a monitoring plan.

A financial plan should also be prepared for the sound development, operation and close out of the facility. A financial assurance plan may also be required by the regulator.

Approval for these facilities is required under the EPA, and the following documents are generally required when an applicant seeks approval:

- u A Ministry of the Environment and Energy application form signed by the proponent requesting a Certificate of Approval. The application will contain general information on the applicant, the source, types and quantities of waste, the nature and size of the facility, as well as the site location and its role within the waste management system.
- u Preliminary engineering design documents describing all design features and an operations and management plan.

2.2.3 Final Design

The final design will build on the preliminary design and, in some cases, on experience gained in earlier phases of the project development (in the case of landfills) or on technological advances. The final design will include the preparation of detailed plans and specifications adequate for tendering and construction purposes.

The detailed design drawings and specifications for landfill 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 approval of a final set of drawings and specifications to the appropriate regulator.

2.3 Construction

The standards for engineering services for construction of facilities are generally outlined in other PEO guidelines. Construction of landfills is defined as preparation of the site to receive waste. Listed below are some special issues which are of particular relevance to Solid Waste Management facility construction.

Approvals/permits/licences—Approvals, permits and licences may contain conditions relating to certain aspects of the facility's construction. The engineer responsible for construction should be aware of all such conditions and permit requirements.

Quality assurance/quality control—Beyond the detailed records of construction that are normal for civil engineering works, the records for special features such as liners for landfills must be double checked prior to landfilling with waste. Special emphasis is applied to the QA/QC checks on material that can extend as far as inspecting the manufactured products. It is not uncommon to have reports independently prepared on the QA/QC process of construction of landfills.

- u Cross checks on construction
- u QA/QC meets compliance
- u Construction records
- u Factory product monitoring

Public relations/liaison—Because of the sensitive nature of solid waste facilities, clear communication with the public is important.

Construction nuisance/discharge/emission control—As part of the design and operations report, special requirements are likely to be set out relating to minimizing construction effects and the monitoring of them. These will be related to both on-site and off-site impacts. Engineers should be aware of these requirements and ensure compliance.

2.4 Operations

The operations of a waste management system comprise a number of components for which engineers should be cognizant in the preparation of an operations manual. These items may also be addressed with special requirements within the Certificate of Approval.

The following is a general checklist, scoping all waste management facilities.

2.4.1 Environmental Compliance

Environmental Compliance addresses the impact of the waste management system on the adjacent and neighbouring natural and social environs.

<p>i) Review list of conditions of approval, permits and compliance</p> <p>ii) Identification/control of waste source and type of waste received testing protocol approval protocol acceptance procedures reporting forms non-acceptable/banned recyclable materials isolation/containment/storage/proper disposal of toxic materials notification procedures</p>	<p>iii) Environmental monitoring (defined as measuring impact on the non-social components) drainage/surface water groundwater gas migration (underground) air emissions/odours litter mud/dust noise vectors (birds, vermin, etc.) reporting</p>	<p>iv) Complaint/response recording forms distribution follow-up</p> <p>v) Hours of operation normal procedure to report other hours</p> <p>vi) Spills/emergency response procedure reporting</p>
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2.4.2 Operations Management Plan

The Operations Management Plan should address the control and administration of activities within the waste management system (including equipment, personnel, waste, data/information processing, financial documents, and users/clients) and the reporting of the performance and efficiencies of these activities.

<p>i) Staffing authority organization education/training/experience certification</p> <p>ii) Performance measures capacity usage complaints availability of equipment efficiency nuisance control</p> <p>iii) Abatement activities litter control water/leachate collection water/leachate treatment gas collection gas treatment mud (vehicle/road cleaning) dust reduction vector control</p> <p>iv) Mode of operation(s) scope/overall strategy procedures material flow control stations reporting variances contingency plans scope of operating reports provision for special weather conditions</p> <p>v) Health and safety rules</p>	<p>reporting incidents/accidents training procedures committee setup</p> <p>vi) Operating reports/activity diaries/daily logs/progress/field reports</p> <p>vii) Records/files preparation/coding/format storage retrieval computer application access security</p> <p>viii) Equipment operating/maintenance manuals replacement scheduling/utilization reports</p> <p>ix) Facility security access (fencing, gates, reporting stations identification) process/equipment materials/inventory information authorization</p> <p>x) Inspection of facility/operations</p> <p>xi) Control of users signage (rules, instructions) speed/traffic directions containment of wastes</p>	<p>safety conduct on-site violation notices/penalties (reporting) reporting stations</p> <p>xii) Waste load recording source (generator/geographic area) hauler, truck, driver date/day of week arrival/departure time classification of waste type of vehicle manifesting revision of data protocol</p> <p>xiii) Transaction ticket form/mode of fees/billing procedures</p> <p>xiv) Budgeting/cost control procedures/forms authorization revenues/payments</p> <p>xv) Contracted services equipment services</p> <p>xvi) Public involvement Citizen's Liaison Committee Public Relations/Technology Transfer</p>
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2.5 Facility Closure

Closed landfill sites require long-term monitoring and maintenance, and other facilities may require thorough decommissioning. The emissions from waste management facilities may be toxic and hazardous, and may contaminate soil, air and water. Issues that must be addressed include:

<ul style="list-style-type: none"> i) Design preliminary final ii) Approvals closure plan iii) Specification(s) iv) Tendering v) Construction vi) Site Decommissioning and End Use 	<ul style="list-style-type: none"> vii) Post Closure Care. Since the implications of the contaminating life of landfilled waste could extend to hundreds of years, the post-closure care, monitoring and maintenance is an essential part of the waste management process that is unique. The post-closure care should be itemized and costed at the preliminary design state, and the financial planning 	<p>should be initiated upon approval of the facility for such things as:</p> <ul style="list-style-type: none"> access vegetation/landscaping erosion/settlement storm drainage control leachate management gas management remedial contingencies
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2.6 Special Services

The special services indicated may have applications in previous sections of this document. Because of the controls needed to safeguard the natural environment, the complexity of technology used and the strict regulatory requirements, the following special services are required:

2.6.1 Testimony

The approvals process often involves hearings and the testimony of engineers at these hearings. Testimony may also be required at inquest hearings, at courts of law, at discoveries, through interrogatories, and before committees. Such testimony should be confined to expert testimonials that are within an engineer's realm of experience and chosen discipline. It could also involve directly advising 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.

2.6.2 System Monitoring

The monitoring and reporting of the performance of the waste management facilities and the system as a whole are required in order to provide information with respect to performance and compliance. This information may then be used to improve performance and ensure compliance and also for long-range planning of waste management facilities and experimentation of new processes and markets.

2.6.3 Waste Reduction Planning

Engineers may be required to determine characteristics of an existing waste stream and make recommendations with respect to waste reduction strategies and initiatives.

2.6.4 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.

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