STANDARD LEVEL LOWN CIRCULATION

WASTE DISPOSAL BY LANDFILLING

1974

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1974

Ontario
Ministry of the Environment

The Honourable
William G. Newman,
Minister

Everett Biggs,
Deputy Minister

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PREFACE

This manual is designed to provide information to municipal and private waste disposal landfill site operators and Ministry of the Environment inspectors. It discusses legislation, waste disposal practices and standards for landfill sites, operating procedures and emphasizes economical operation, environmental protection and public relations. The role and functions of Ministry personnel are presented.

The material incorporated in this manual has been gathered from many sources but most was obtained from the Waste Disposal Site Operator's Seminar which was sponsored by the former Waste Management Branch of the Ministry of the Environment.

It is hoped that those using the manual will provide comments on the content to the Training and Certification Section.

1974

WASTE DISPOSAL

BY

LANDFILLING

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C H A P T E R 1

I N T R O D U C T I O N

Article 1 ORGANIZATION OF MINISTRY

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Article 5 GENERAL ASPECTS OF WASTE MANAGEMENT

1.1

MINISTRY WASTE MANAGEMENT ORGANIZATION

1. Our environment consists of three elements: water, land and air, which are all essential to the existence of life. To ensure future generations of a healthy environment the Provincial Government of Ontario, prior to 1966, established two government agencies to manage and control the uses of our waters and air.

2. The Ontario Water Resources Commission (O.W.R.C.) was established in 1957 to manage and control the use of surface and groundwater. In the mid-1960's the Air Management Branch was established to manage, control and set standards regarding air emissions.

3. As a result of information received from many organizations and thoughtful citizens, the Province of Ontario was made aware that there were many problems associated with waste disposal sites utilized by municipalities and industries. Consequently, in the latter part of 1966, a Waste Management Section in the Department of Health was established to develop and implement solutions to waste disposal problems that had reached crisis proportions in some municipalities. Prior to this time, the disposal of wastes had traditionally be a local responsibility.

4. In 1969, all of the above government pollution abatement agencies were brought together in one department which in 1972 became known as the Ministry of the Environment. The major functions of the Ministry in relation to waste disposal site operation were and still are:

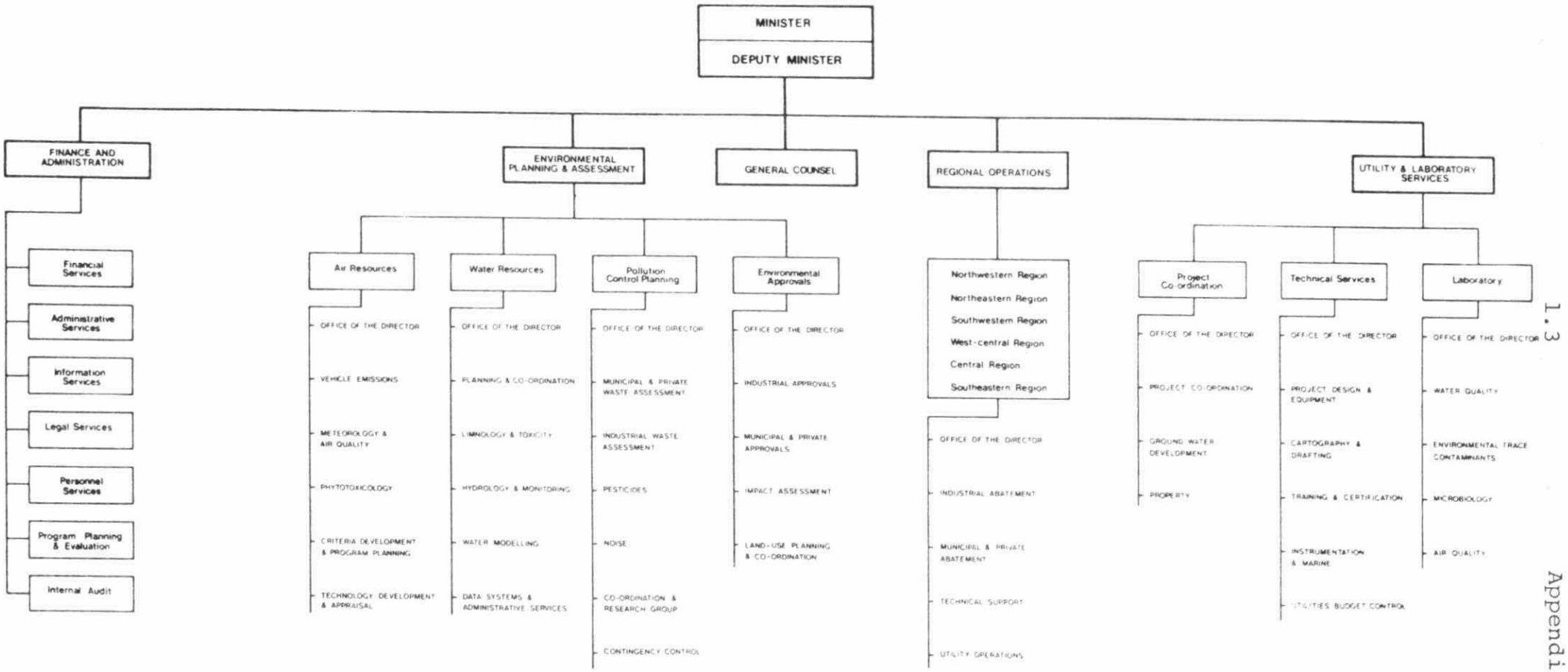
a. To provide information on the selection, development, operation and closure of sites.

b. To advise operators on sound management practices.

c. To assist in upgrading operations to meet the requirements of legislation.

5. The Waste Management Branch of the Ministry was responsible for the functions related to waste management practices and waste disposal sites, until April 1974, when the Ministry was reorganized on a regional basis, as shown in Appendices 1.1.1 and 1.1.2 of the section. In general, regions deal with operations and the main office deals with policy and provides support to regions.

Ministry of the Environment



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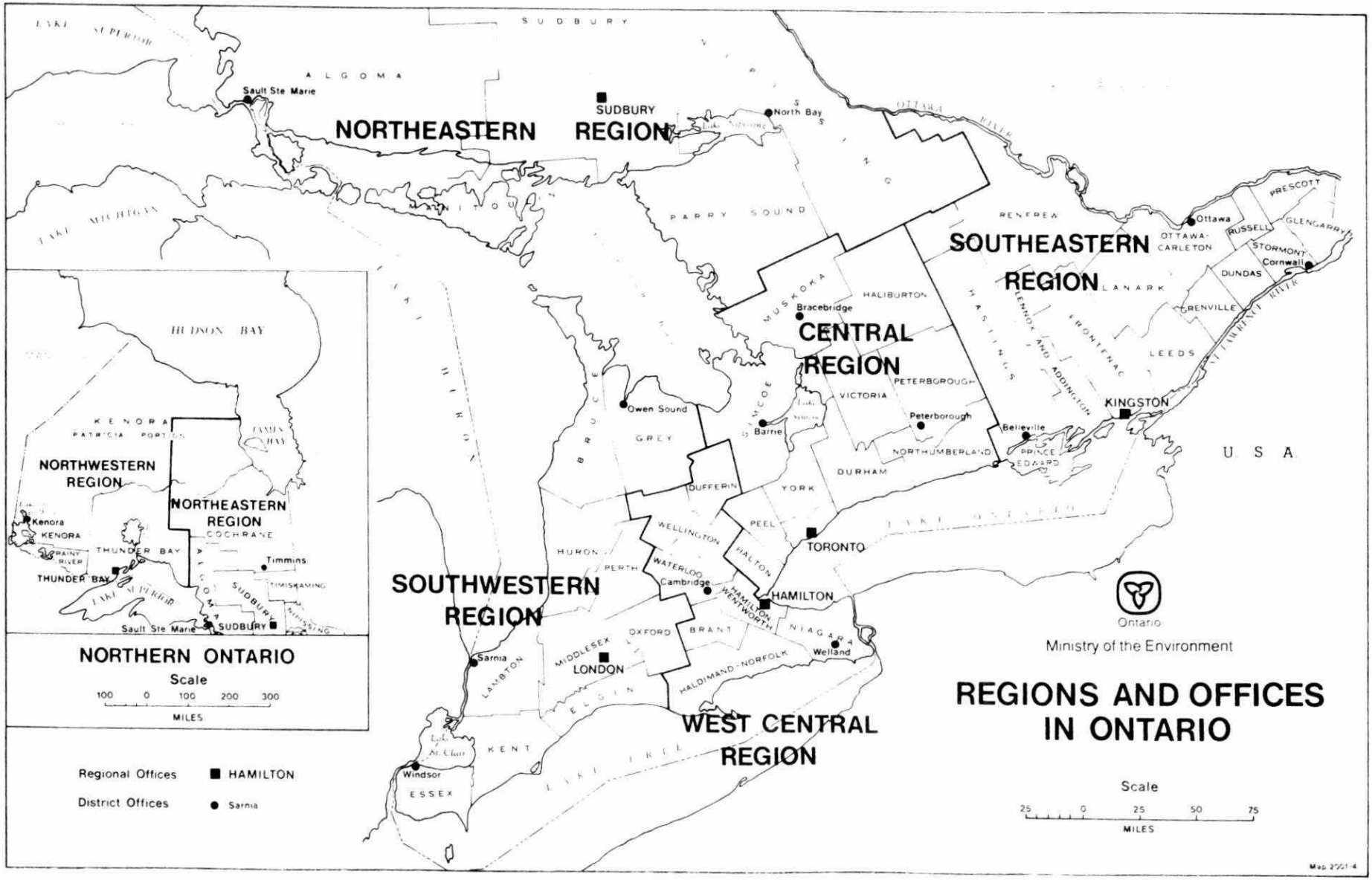
Appendix 1.1.1


NORTHEASTERN REGION
SUDBURY
SOUTHEASTERN REGION
CENTRAL REGION
SOUTHWESTERN REGION
WEST CENTRAL REGION
NORTHWESTERN REGION
NORTHEASTERN REGION
NORTHERN ONTARIO
Scale
100 0 100 200 300
MILES
Regional Offices ■ HAMILTON
District Offices ● Sarnia
Sault Ste Marie
North Bay
Ottawa
Bracebridge
Owen Sound
Barrie
Peterborough
Belleville
KINGSTON
TORONTO
HAMILTON
Cambridge
Sarnia
LONDON
Windsor
Welland
Timmins
Kenora
THUNDER BAY
Cornwall
U S A
Ontario
Ministry of the Environment
REGIONS AND OFFICES IN ONTARIO
Scale
25 0 25 50 75
MILES

1.5

LEGISLATION

General

1. The disposal of municipal and industrial wastes has been and continues to present problems. The operation and location of the majority of the disposal sites in use are satisfactory. A number of these sites are in need of improved operating procedures. As the sites in the Province are closed down for economic or other reasons, suitable alternative sites must be found and utilized. A poorly located and operated landfill site can, and all too frequently does, result in water pollution either to surface streams or to underground potable aquifers, air pollution by the deliberate or accidental burning of garbage, the breeding of rats and flies which are disease carriers, and the permanent disfigurement of the countryside. Government control is obviously required. Considerations which led to legislation and the Ministry's continuing concern are discussed in Article 5.

2. Applicable to both public and private operations, The Environmental Protection Act (formerly the Waste Management Act) and related Regulations are designed to solve this problem. They provide direction and control for disposal sites and waste management systems to ensure that they are designed, located, and operated in such a way that the risk of pollution, health hazards or nuisances is reduced to a minimum.

The Environmental Protection Act

3. The Act includes the control and regulation of waste collection transportation systems, and disposal sites, and covers all treatment and disposal methods. This legislation has provided the Province with what are probably the most effective controls in Canada and indeed, North America. Regulations under the Environmental Protection act, 1971, dealing with abandoned automobiles and processed organic waste were introduced in 1973.

4. The Environmental Protection Act assigns certain powers and duties to the Minister of the Environment. It permits him to order changes in waste management systems or any waste disposal site. Changes might include upgrading the standards of operation and expansion of a system or a waste management system may be introduced if one does not exist and if such a service is in the public interest. The Act also establishes an appeal system (Part X) as well as defining and assigning authorities to provincial officers (Part XI).

5. The following points in Part V of the Environmental Protection Act should be noted:

a. Sections 28 and 29 deal with the interpretation and application of Part V of the Act.

b. Sections 33a and 33c deal with public hearings. Where a new site or system is proposed, a public hearing is required if it is to serve a population greater than 1500 persons. A public hearing may be required for sites serving less than 1500 people at the discretion of the Director. Section 33b of the Act authorizes the Director to issue a Certificate of Approval without a public hearing if an emergency situation exist.

c. A Certificate of Approval or a Provisional Certificate of Approval is required before a waste management system or a waste disposal site can be used, operated, established, altered, enlarged or extended. Certificates are dealt with in Chapter 6.

d. Section 46 states that former waste disposal sites cannot be used for a period of twenty-five years unless the proposed use has been approved by the Minister.

e. Section 47 deals with offences.

Regulations 824

6. Regulation 824 is made under Part XII Section 94(4) the Environmental Protection Act. Included in the Regulation are standards for the location, maintenance and operation of waste disposal sites and dumps as well as the standard for the operation of a waste management system.

7. Other sections to note in the Regulation are:

a. Designation and exemption of wastes.

b. Classification and exemption of waste disposal sites and waste management systems

c. Section 13 which states where dumps may or may not be established.

1.8

PROVINCIAL OFFICERS

1. General - Part XI of the Environmental Protection Act specifically related to Provincial Officers (who are employees of the Ministry or other persons such as employees of municipalities which, under agreement with the Province, are performing functions of the Ministry) and so designated in writing by the Minister. A Provincial Officer may carry out an investigation of anything that he has reason to believe is or may be a source of contaminant and shall make a report of his findings and recommendations. Inspectors carrying out the functions required by Part V of the Act are required to be Provincial Officers and must be so designated by the Minister.

2. When carrying out his functions, a Provincial Officer must be in possession of a valid identity card. The identity card, clearly states that the holder is a Provincial Officer. The appointment is confirmed annually. It is the responsibility of each Officer to ensure that his identification card is current.

3. Powers of Provincial Officers - Section 84 of the Act authorizes a Provincial Officer to enter any structure, vehicle, land, water or air to carry out investigations, tests and inquiries including the examination of records and documents. It also requires every person responsible for a source of contaminant to furnish such information required for the purpose of the Act or the Regulations. If required, an order may be obtained from a Provincial Judge to gain entry for the purpose of an investigation.

4. If a Provincial Officer is obstructed from conducting an investigation, he is empowered to take such steps and employ such assistance as is necessary to accomplish what is required including requesting the assistance of a member of the police. Before taking action when obstructed, a Provincial Officer will consult with and obtain guidance from his immediate superior.

5. Matters Confidential - Section 87 of the Act requires that a Provincial Officer preserve secrecy in all matters that come to his knowledge in the course of a survey or investigation except for information in respect of the deposit, addition, emmission or discharge of a contaminant. He shall not communicate any information such as secret matters to any person except:

a. As may be required in connection with the administration of, or any procedures under the Act and Regulations

b. To his counsel

c. With the consent of the person to whom the information relates.

1.10

PUBLIC RELATIONS AND COMPLAINTS

General

1. Good relations with the public are essential to overcome the poor image generated by years of inadequate waste disposal practices as well as to encourage the public to use the facility. In the past, waste disposal sites, usually appropriately called dumps, were havens for rodents and flies, and, with waste scattered everywhere, were an eyesore. Indiscriminate burning resulted in acrid fumes contaminating residential areas. Garbage was left unburied resulting in wind blown litter and an unbearable stench. Often the site was the bottom of a ravine, where a stream or creek ran through. Neither environmental pollution nor public concern were considered in carrying out waste disposal operations.

2. With the increased public concern in environmental pollution and land use problems, poor operational planning and practices are no longer acceptable. Waste disposal has become a matter of public debate. Complaints have increased and proposals for new waste disposal sites are always resisted. The public image of waste disposal must be improved by enforcing the regulations and employing good practices.

Public Relations

3. To minimize later criticism and complaints, the requirements of and effects on the general public must be major factors in selecting a new site. Public hearings should be considered a forum in which to convince the public of the need. Once a site has been approved, development must be carefully planned. When in operation, good public relations can be attained by ensuring:

a. Good supervision

b. Controlled access with an attendant on duty

c. Regular compaction and covering of wastes

d. Good roads, treated to control dust

e. Litter control and good housekeeping practices

f. Prevention of air or water pollution

g. Proper signing

h. Rodent and fly control

i. Informing the public in advance of any planned activity which might result in undue public concern.

Complaints

4. The number of complaints received is one of the criteria by which to judge the efficiency of the site operation. If many are received, it is likely that operations require improvement. Each complaint must be dealt with promptly.

5. If the complaint is received by the operator, the course of action to follow is:

a. Record the details of the complaint as well as the name, address and telephone number of the person lodging it.

b. Investigate it promptly and take corrective action if necessary. Record findings.

c. Provide the complainee with an answer informing the person of the action taken.

d. Review operating procedures to ensure the problem does not recur.

6. If a complaint is received by an office of the Ministry of the Environment, it will be dealt with in accordance with standard operating procedures.

1.12

GENERAL ASPECTS OF WASTE MANAGEMENT

1. General - Before going into detail in subsequent chapters on the various aspects of waste disposal site operation, a discussion of some fundamental questions of waste management is necessary to provide a broad background knowledge.

2. Waste - What is waste? One definition is that waste is any material which the owner considers will cost him more to keep than to discard. In examining this definition:

a. First, the cost is not necessarily purely monetary; it may comprise a penalty in terms of time or effort, or of nuisance or hazard, including health hazards.

b. Second, these values may, and often do, vary. What is considered waste one day may be prized as a valuable commodity on another.

c. Third, the decision, conscious or unconscious, whether material is waste or not is an individual one, made by the owner. Until recently, the cost to the community or the environment of discarding waste was not taken into consideration.

3. Waste Management - Another question which deserves examination is what is meant by waste management? The term Waste Management includes the complete system of storage, collection, transportation, treatment and disposal of waste. The individual elements of the system are intimately interlinked and cannot be dealt with in isolation. The management of waste may well have to take into account some of the questions raised in the definition of waste--whether a community can afford to accept without question the decision of the owner of the material; for example whether the original manufacturer of the product should not be responsible for considering in its manufacture the problems which may be involved in its handling and disposal as waste.

4. Public Concerns - The problem of one waste, sewage, has been recognized for many years. It is only comparatively recently that the public have become aware of the problems involved with other wastes. There are a number of reasons for this; but three in particular should be noted.

a. First, though improper management practices can result in health hazards. the relation of cause and effect is less obvious, as these hazards are generally not infectious nor transmissible.

b. Second, until comparatively recently in North America, the urban-rural interface was well defined. The wastes from a city could be transported beyond its boundaries for disposal in a relatively sparsely populated area. Urbanization has now progressed beyond the boundaries of the cities and may extend for many miles into formerly rural area. Land area is therefore at a premimum and land use planning usually neglects to consider requirements of waste management.

c. And third, the increase in packaging and disposable convenience merchandise, compounded by the increase in population and its concentration in urban areas, has vastly increased the volume, variety and hazard of material which must be handled and disposed of.

5. Government Concerns - Government is concerned about waste management because of direct hazards, environemtnal pollution and economic loss.

a. Direct Hazards

(i) Insects and rodents resulting from improper refuse handling are vectors of human disease.

(ii) Accidental injuries are a direct consequence of improper refuse handling practices.

(iii) The open burning of solid wastes creates hazards by restricting or obscuring vision.

b. Direct Effects on the Human Environment

(i) Nuisances resulting from improper refuse handling are increasingly serious with crowding.

(ii) Blighting of the natural scenery with scattered refuse is now too evident to to ignore. This "visual pollution" now reaches out to spoil our beauty sites.

(iii) Air pollution results from burning at dumps, home storage sites, and at makeshift incineration or salvaging operations.

(iv) Water pollution occurs as a consequence of open dumping, and improper disposal site selection or design. Untreated quench water and scrubber water from some outmoded incinerator designs add to the problem.

c. Economic Losses by Poor Refuse Management

(i) Decreased property values are a certain consequence of poor operating practices.

(ii) Economic losses due to poor service are perhaps more common, and more often tolerated, than is the case with other municipal services.

(iii) Lost time by accidents resulting from makeshift containers, powered equipment, and insufficient safety training.

6. Classification of Wastes - The wastes, which are considered below, can be separated into six major classifications, with widely differing hazards, problems and solutions. They are:

a. municipal and industrial solid wastes;

b. liquid industrial wastes;

c. hazardous wastes;

d. agricultural wastes and sewage sludge;

e. abandoned automobiles;

f. litter.

7. Municipal and Industrial Solid Wastes

a. This classification includes domestic and commerical refuse together with non-hazardous solid industrial waste. It is generally collected and disposed of under the control of the municipality where it is generated. The actual composition varies from country to country, day to day. Appendices 1.1.3 and 1.3.2 illustrate this variably.

b. On the average, in Canada, this type of waste can be expected to comprise about fifty percent paper and paper products, fifteen to twenty percent organic waste or garbage, ten to twenty percent metals and glass, and five to ten percent ashes. The remainder , usually about ten percent, may include almost any substance imaginable.

8. Liquid Industrial Waste - The bulk of the waste produced in this category has a limited degree of potential hazard, compared to that resulting from municipal and industrial solid waste. However, since it is liquid, its disposal onto land is undesirable for two principal reasons.

a. Firstly, the possibility of run-off to surface waters or percolation to sub-surface aquifers is greatly increased and consequently suitable areas for disposal are very limited.

b. Secondly, it is undesirable to utilize a sanitary landfill site for its dipsosal except in very limited quantities, since it may result in serious operational problems. Moreover, sanitary landfills are normally designed deliberately to reduce the quantity of liquid which will percolate through the waste. An exception might be the use of a completed municipal waste disposal site with a substantial depth of waste and underdrainage which will collect leachate for treatment.

9. Hazardous Wastes - The classification of hazardous wastes is restricted to those where a direct and significant hazard of fire, explosion, poison, or radioactivity may result, though in some instances biological and ecological effects must be taken into consideration. In comparison to the other wastes, the quantities involved are usually very small, and treatment and disposal practices could be considered which would be out of the question for general wastes. A very simple method, which is suitable for small quantities of a variety of waste, consists of sealing the material within a small container which in turn is placed in a larger container such as a forty five gallon drum. The annular space is filled with concrete. The drum is then buried in a suitable location, usually in an impermeable clay soil. If treatment is not feasible, permanent containment is the only reasonable alternative at present. More sophisticated methods are available and in use, but the principle is well illustrated by the example.

Agricultural Waste and Sewage Sludge

10. The fourth major category of waste comprises agricultural waste and sewage sludge.

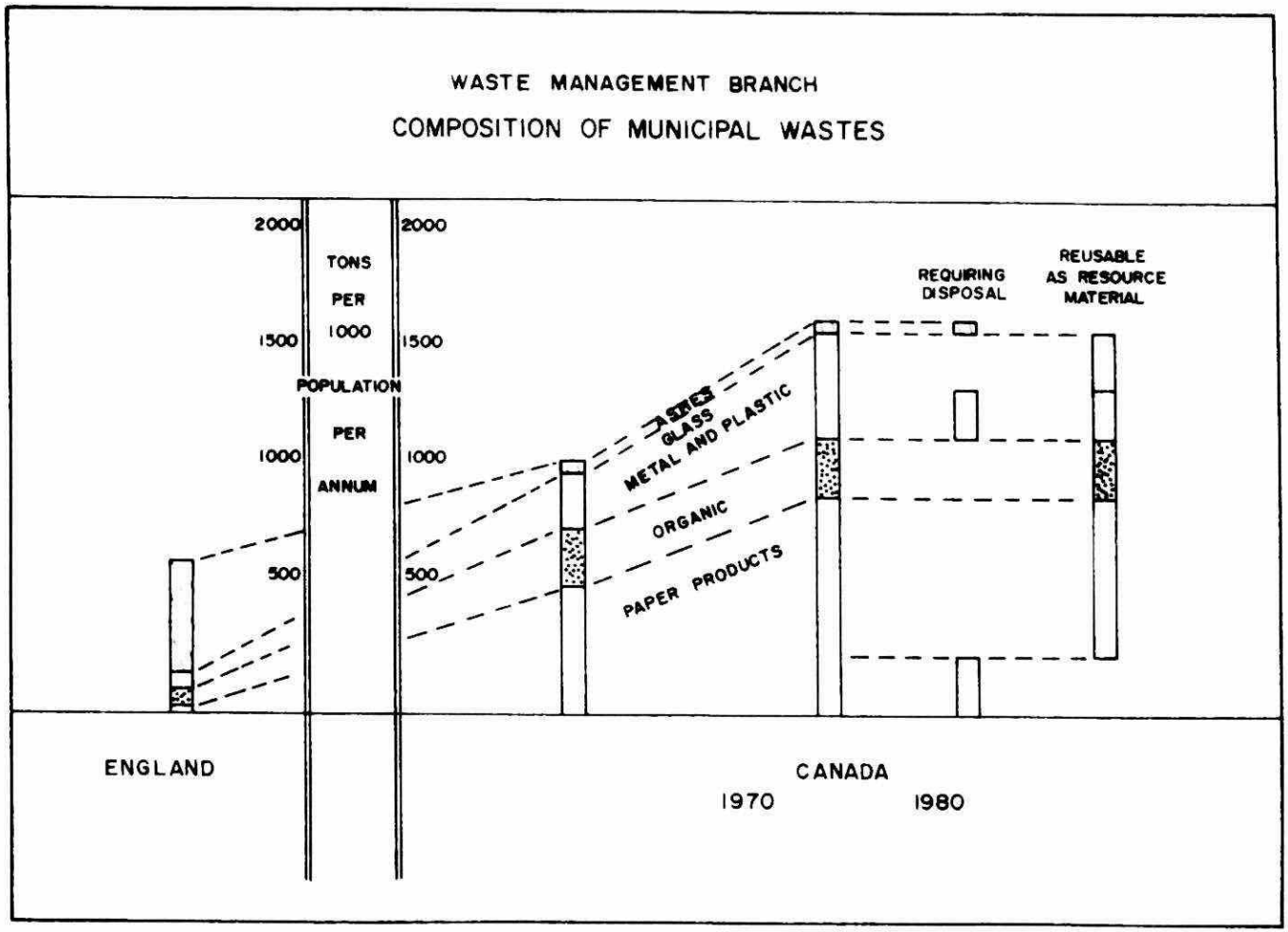
a. The agricultural waste consists of vast quantities of manures produced from the operation of cattle feed lots, piggeries, and confinement operations particularly for egg production. These are not, in fact, farms but factories, and should be treated in the same way as any other industry which abuses the environment. Waste produced and disposed of as part of normal farm operations are exempt from the regulations.

b. Traditionally, agricultural waste, which is purely organic, has been disposed of by spreading onto fields as a soil conditioner. In limited quantities, and providing common sense precautions are taken, this is of little concern. However, as the quantities involved increase and the area of land available for disposal decreases, major public health and environmental problems result.

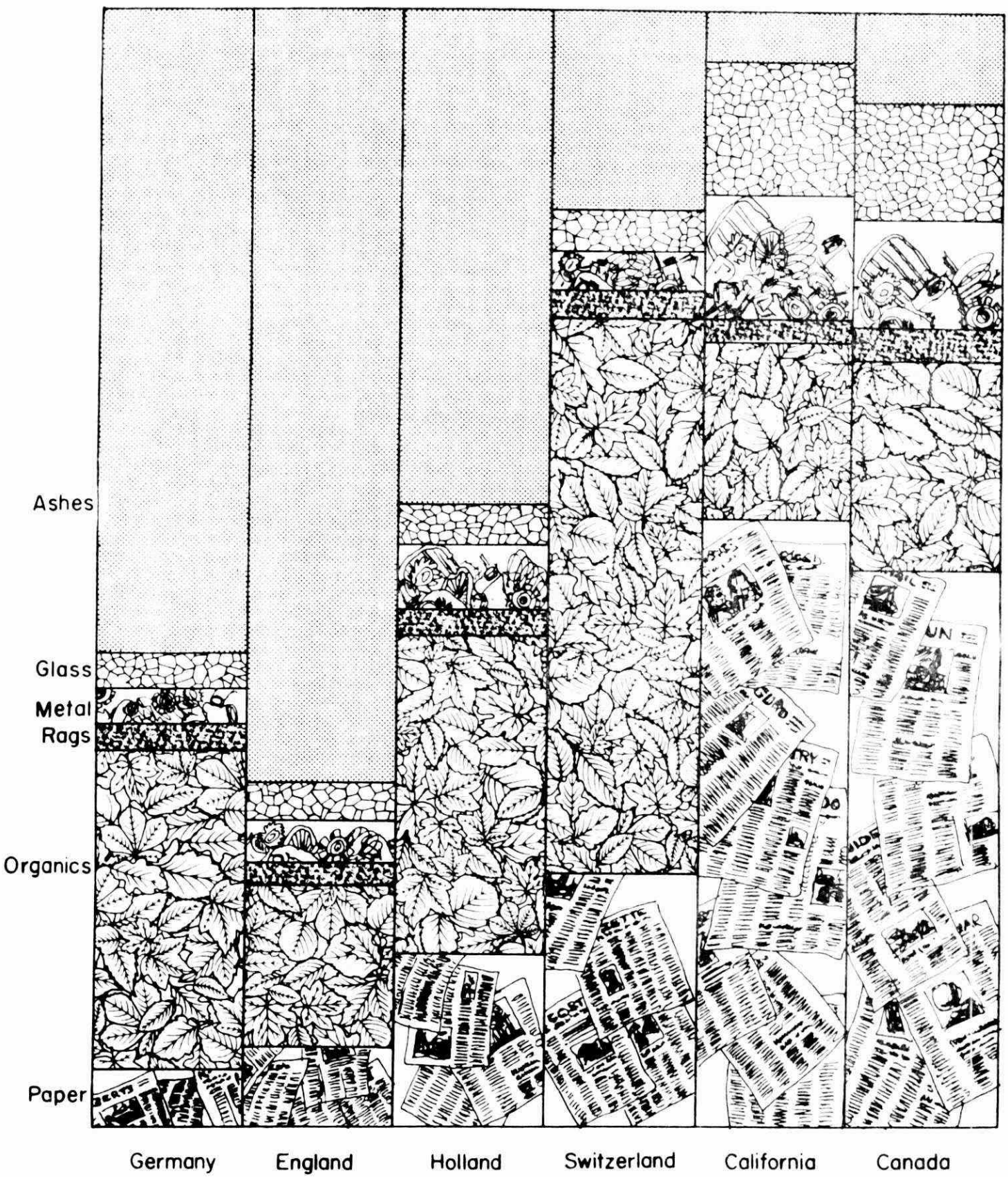
c. Digested sewage sludge poses a very limited hazard, providing the sewage plant operation is carefully controlled. Local problems, however, may arise particularly if the sewage treatment plant deals with disproportionately large volumes of industrial waste.

Abandoned Vehicles and Litter

11. The remaining two categories, abandoned vehicles and litter have very limited health implications; broken glass in litter, particularly on beaches, is obviously dangerous, particularly to children, and the snap-off rings on cans with aluminum tops have sharp edges which may also result in cut feet. It is anticipated that measures being undertaken in Ontario and described in Chapter 5, Article 2 will adequately deal with both of these categories of waste.


WASTE MANAGEMENT BRANCH
COMPOSITION OF MUNICIPAL WASTES
2000
1500
1000
500
TONS
PER
1000
POPULATION
PER
ANNUM
2000
1500
1000
500
ASHES
GLASS
METAL AND PLASTIC
ORGANIC
PAPER PRODUCTS
REQUIRING
DISPOSAL
REUSABLE
AS RESOURCE
MATERIAL
ENGLAND
CANADA
1970
1980

COMPOSITION OF HOUSEHOLD WASTES



C H A P T E R 2

W A S T E D I S P O S A L S I T E S

Article 1 SITE SELECTION AND CHARACTERISTICS

Article 2 LANDFILL EQUIPMENT

Article 3 WASTE DISPOSAL SITE COSTS

Article 4 GENERAL OPERATING PRACTICES

SITE SELECTION AND CHARACTERISTICS

Scope

1. This and subsequent articles generally deal only with the two main classifications of waste disposal sites, landfilling sites and dumps. Some mention is made of other means of waste disposal and future developments as information of interest to those in the waste disposal field.

Site Selection

2. General - It is the responsibility of a municipality to locate a disposal site suitable to its needs. The Ministry of the Environment will carry out an investigation to assist in determining site suitability by examining soil type, soil depth and water table levels. Usually the municipalities will be required to dig test holes, using a backhoe. Chapter 6 describes the Ministry procedures.

3. For sites serving a population of less than 1500, the Ministry inspection is usually all that is required. If, however, there is an expressed, extensive public concern or if the site is to serve a population larger than 1500, the proposal must be submitted to the Environmental Hearing Board. The purpose of this hearing is to evaluate the social and economic impact versus the waste disposal needs. If it is a complex problem or the municipality does not have the capability to conduct hydro-geotechnic investigations a consultant should be hired to develop all or part of the information required for the hearing. Appendix 2.1.1 lists this information.

4. Site Location Requirements - The location of a waste disposal site should be based on the following factors:

   a. Proximity to the area generating the waste

   b. Remoteness from dwellings

   c. Accessibility from existing roads

   d. For large sites, preferably serviced by utilities- electricity, telephone, possibly even water and sewers.

e. Accessibility to local municipal fire fighting resources to augment fire extinguishers which should be standard equipment on collection vehicles.

f. Adequate supplies of workable cover material

g. Environmental factors, i.e. adequate protection to prevent ground and surface water pollution, suitable soil conditions, etc.

h. Adequacy of screening from public view

i. Inconvenience and adverse affects on the minimum number of people.

5. Location requirements for dump sites are often confused with those for landfilling sites. A landfilling site (Section 10 of Regulation 824) may be located anywhere, but the location of a dump site (Section 12 of Regulation 824) must fulfill the following:

a. It shall not be subject to flooding and no direct drainage shall lead to a watercourse.

b. It shall be at least one-quarter of a mile from the nearest dwelling.

c. It shall be at least 100 feet from any watercourse, lake or pond.

d. It shall not be on land covered by water.

6. Size of Landfill Site - As a "rule of thumb",

a. One acre of land, which can take a depth of six feet deep of compacted refuse, will serve ten thousand people for a one year period.

b. One person will generate about 2-3 pounds of garbage per day. Some authorities use a figure of 5 lb. per capita per day. The amount of garbage varies according to the size of the area; agriculture, tourism and local manufacturing and commercial wastes must be considered where applicable.

c. The site should be large enough to receive garbage for at least ten years; capacity for 20 or more years is desirable.

Site Development Plans

7. General - A plan showing how the site will be developed and operated must be prepared before the site is approved by the Ministry. A well thought out plan helps to gain public acceptance either at a Public Hearing or in other dealings with the public, as well as providing the operator with a reference for the development and operation of the site. The plan should include: site preparations, access roads, fencing, size of working area, equipment, manpower requirements, hours of operations, final grades, and other specific items to be dealt with later. It should be supplemented by drawings and sketches to illustrate what is proposed.

8. Aesthetics - In general, people do not like disposal sites in the vicinity of their homes; they do not want a "dump" in their neighbourhood. Therefore, the site must be as aesthetically pleasing as possible. This may be accomplished by concealing the actual disposal operations from public view by means of foliage, natural elevation, distance from public roads or by constructing and seeding banks of sufficient height to screen the disposal site operations. A "green belt" can be used to make a disposal site more acceptable. It is a buffer zone between the disposal area and public roads in which grass and trees are planted to isolate the disposal operation from public view.

9. Housekeeping - Proper housekeeping reduces other problems. If the refuse is compacted and buried regularly, odours and rodents are eliminated. Refuse should not be burned. Litter should be controlled and the attendant should frequently collect paper and other light materials carried about the site, or on the adjoining property, by the wind. As each area of the site is completed, final cover materials should be applied and final grades established. A grass crop such as rye or clover should be grown on a completed area to control erosion of the cover material. This reduces the amount of water passing through the garbage and hence reduces leachate.

WEIGHT OF INDIVIDUAL LOAD (NET) FEE
200 LBS OR LESS NO CHARGE
200 LBS TO 500 LBS 75¢
OVER 500 LBS 75¢ PLUS
FOR EACH 100 LBS OR
PART THEREOF OVER 500 LBS
NO CHARGE WILL BE MADE FOR CLEAN FILL
TOWN of WHITBY
GARBAGE DISPOSAL SITE
½ MILE SOUTH
HOURS OF OPERATION
MON FRI - 8 AM - 6 PM SAT 8 AM - 4 PM
SUN & HOL -- CLOSED
CLEAN FILL ACCEPTED FREE
UNAUTHORIZED DUMPING PROHIBITED
Town of Whitby
WORKS DEPARTMENT

11. Roads

a. Well located and constructed roads are essential to develop and control site locations. The main access road should be built to all weather standards. On-site roads may be built to lower standards if provisions exist for dumping near the access road in inclement weather conditions. If the roads contain soft ground, uncovered garbage, broken wood and glass, or snow and ice-covered grades, vehicle operators will tend to leave their garbage wherever they can, adding to site maintenance problems and costs.

b. When the site is first opened, development may commence near the entrance. This will require a road-building program throughout the life of the site but a lower initial investment. Ongoing maintenance will be necessary since roads built over fill will probably settle unevenly.

c. When initial development is not near the entrance, good allweather roads must be developed immediately. The roads are shortened as the site is filled. Initial costs are higher, but once the roads are built, heavy road building equipment is not required again and disposal operations are not interrupted.

12. Fencing - The site must be enclosed by fencing to prevent use when the attendant is absent. Fencing discourages illegal entry and problems such as burning of domestic refuse, scavenging and dumping in undesirable locations. It also excludes most domestic and some wild animals whose entry might create a health hazard. Furthermore, fencing traps most wind-blown litter which would otherwise be carried beyond the site boundary.

GARBAGE DISPOSAL SITE

14. Weigh Scales

a. Section 10 (1) Item 11 of Regulation 824 states that, where required for accurate determination of input of all wastes by weight, scales shall be provided at the site or shall be readily available for use. They are not required or even desirable at small sites.

b. Weigh scales are installed at larger sites where the owner or operator wishes to accurately measure the wastes to estimate, among other things, the remaining capacity of the site and the charge to users based on the weight of waste deposited and to determine the effectiveness of compaction.

15. Final Cover

a. Prior to the application of final cover the site should be graded to provide surface drainage and to minimize infiltration and erosion. If trees are planted, several feet of earth are necessary in the area where the roots will grow. (Refer to Chapter 4 Leachate and Gas Control).

b. When fill is completed in one section of the site, final earth cover, compacted to a minimum depth of two feet, should be placed within two weeks over the surface of the final lift in that section. This will prevent exposure of the wastes by wind or water erosion, or differential settlement. It will also reduce the amount of rainwater that will percolate through the garbage, particularly after the cover is seeded or sodded. It also provides a good bearing surface for vehicles.

16. Custodian Quarters and Furnishings - As good working conditions contribute to employee morale and productivity, disposal sites should have a shelter for landfill employees during inclement weather. Water supply and sewage disposal are also desirable. Toilet and handwashing facilities promote good personal hygiene for both landfill employees and site users. Electrical power is desirable for lights and equipment. A first-aid box should be kept ready and accessible for use.

2.8

INFORMATION
FOR
ENVIRONMENTAL HEARING BOARD SUBMISSION

1. A written submission is required which clearly indicates how the site is to be developed and maintained to comply with the standards outlined in Regulation 824, Section 10.

2. A consultant should be retained to undertake a hydrogeological evaluation of the parcel. Thus all questions raised at the Environmental Hearing as regards water contamination due to the operation of the waste disposal site may be fully and competently answered.

3. Some applicants have found it beneficial to retain an Engineering Consultant Firm which is able to undertake all the work outlined below while other clients find they require professional assistance in preparing only the hydrogeological report.

4. The submission will include:

   a. Application and Supporting Information Forms, only those portions which are not more thoroughly discussed in separate supporting documents being completed.

   b. Legal description of the land controlled by the applicant and those portions of the property to be utilized for the disposal of waste material.

   c. Five (5) copies of a location map approximately 1" equals 4 miles.

   d. Five (5) copies of a map showing lots and concessions, within one full lot of the subject property. Detail to be included on this map to plan:

      (1) access roads to the property

      (2) areas utilized for the disposal of waste on the property

(3) location of homes, farm buildings, wells, rail lines, easements for unopened road allowances, hydro, pipelines, water courses and other topographic features.

e. Five (5) copies of development plans, which will include the following information:

(1) access road detail (drainage, gates, fencing etc.)

(2) site roads

(3) working areas

(4) buffer or neutral zone

(5) screening for adjacent property owners, roadways

(6) location of monitoring wells

(7) initial and final contours, if development is to be conducted using various techniques of landfilling, then stage development plans may be necessary.

LANDFILL EQUIPMENT

General

1. Equipment for landfill operations is required in three areas:

   a. cover excavation, haulage and spreading

   b. refuse spreading and compaction

   c. provision and maintenance of support functions.

Equipment used to perform these functions is essentially that designed for earth moving. While the handling effort required is less in waste disposal applications, it is a much more severe equipment application due to the hazardous nature of the material. Equipment is subject to abrasion from dust and chemicals, puncture from rods, beams and timber, overheating due to dusty atmosphere or obstructed intakes and broken fuel and hydraulic lines and leaking seals from vibration and torsion. There is a wide variety of construction equipment available and modifications and accessories can help to alleviate some of the hazards noted.

2. Careful consideration must be given to the selection and procurement of equipment for the functions listed above. The requirement for replacement during maintenance and repair periods is a most important factor. It is inevitable that failure to provide sufficient equipment to do the job right will result in lack of compaction or a lowering of standards. The lack of compaction will waste valuable space and could cause settlement problems during operation. If a desirable standard of operation is not attained, a landfill operation will fail to secure public acceptance.

3. Some factors to be considered in equipment selection are discussed briefly in Appendix 2.2.1.

4. Excavating, Hauling and Spreading Earth Cover

   a. The selection of equipment for this function is based on factors similar to those for a standard earth moving operation. A site handling up to about 400 tons per day may only need a single unit. This equipment must be capable of handling refuse, spreading and compacting garbage as well

as excavating, hauling, and spreading earth. Both distance travelled and the type of material to be excavated are most important considerations.

b. Material Handled

(i) Since the material to be excavated usually varies with depth and location, the crawler towed scraper is generally better suited for most landfill sites.

(ii) A self-propelled scraper with elevator self-loading has limited use, being suitable only for sand and gravel, top and upper sub-soil stratas and in no-frost condition. The rubber wheeled scraper has a high ground pressure and when loaded will contribute some compaction if routed over the refuse.

(iii) On glacial till, some clays, and in heavy frost condition a self-propelled scraper will not take on a full load unless assisted by a pusher. Unless there are several scrapers or other duties, a pusher is uneconomical. A crawler ripper could be used on a part-time basis to prepare the material for self-propelled loading or a crawler towed scraper could be used.

(iv) On large scale landfill operation or when trench method is used there may be an application for a 1-1½ to 2-2½ cu. yd. dragline. They offer a reliable high rate of production, unaffected by wet bearing surface or wet material. In till and some clays the dragline will require a crawler tractor for ripping in advance. In such difficult material and if regular operations include truck loading, a similar size backhoe should be considered. They are limited to excavating and deposition at a distance of roughly twice the boom length although this can be supplemented by a tractor.

c. Distance Travelled - As a rough guide, if the distance travelled is:

(i) Up to 300 feet radius, a crawler tractor and blade for earth moving should be considered

(ii) Up to 600 feet, a rubber-tired loader with truck should be considered

(iii) Up to 1000 feet a crawler towed scraper should be considered

(iv) Beyond 1000 feet self-propelled rubber-tired scrapers or trucks should be considered.

5. Refuse Spreading and Compaction

a. Compaction, as discussed elsewhere, is very important. Refuse is more compactible than earth but requires repeated impact loading rather than vibratory effort. This dictates maximum ground pressure and repetitive compaction passes. Larger machines with greater ground pressure may achieve more in 2 passes than a smaller unit could in 6 passes. Price of equipment should not be the sole factor in selection. Other factors to consider include design, capability of traction on wet or soft surfaces or steep slopes, clogging of wheels and undercarriage, stability, and transmission of vibration to the operator, availability of service and parts. The types and numbers of equipment used and owned must be based on the local conditions such as the type of waste, the level of operation and the availability of cover. The operator's skill in handling such equipment must also be considered. Many manufacturers are offering modified equipment for landfill operations. If the purchaser supplies his own special specifications the equipment can be both versatile and effective in landfill operations.

b. Specially designed compactors in several sizes are available. They are usually articulated, with wheels or drums instead of tracks. The articulation, structure and power train is similar to a conventional rubber tired loader. The wheels may be rubber tires sheathed in steel, or hollow steel cores with elliptical, triangular, tamping or cleated lugs, designed to break up larger objects and compact refuse. Compactors usually have lower, narrower blades and their lack of traction limits their grading and spreading capability.

c. Grading and covering with compactors can cause difficulties; the surface may be left with impressions of the lugs which increases rainfall percolation. Additional soil should be added and sufficient additional passes made to fully compact the soil; alternatively, a second machine without lugs may be used for grading.

d. Bulky items such as demolition lumber and brush are particularly well handled by the lugged wheels. The lugs also concentrate the load and provide traction. The tamping and cleating configurations are versatile in that they can be used for soil compaction. Greater ground pressures are achieved with the wheels and lugs, but on a reduced surface area on a crawler tractor and should be maintainable at less cost. Speeds of up to 25 mph are possible, compared with 10 mph for a crawler and 30 mph for a rubber-tired loader.

e. Articulated compactors have greater mobility than a crawler tractor. Their speed permits more passes to be made in a given period of time. They give 10% to 20% better compaction than a crawler or rubber-tired tractor of similar weight. However, the apparent better achievement may result from other factors such as different densities of trucked garbage or by differing amounts of effort. Comparisons should be made under controlled conditions.

f. A crawler has stability and good flotation which, with a 50,000 lb. class tractor, permits the use of a landfill blade 15 feet wide and 8 feet high, and enables a 25 cubic yard compactor load to be moved in two passes. The blade can also be fitted with a trash rack. A regular or modified blade should permit adequate operator vision over and through it. The framed top portion should allow the operator to see through it and also be free of headlight reflection when used after dark. It must be strong enough, particularly if an expanded metal trash rack is used, to withstand hard use. A larger blade will give added protection to the radiator and the track. The blade, because of its weight, is often combined with a multi-tooth ripper or counter weight to give added stability and weight. A double drum cable control unit can be substituted for the counter weight when used for towing scrapers. A crawler can also be fitted with a U-shaped or regular grading blade for use in both grading and refuse handling.

g. A 50,000 lb. machine has a ground pressure of about 10 psi. The use of a landfill blade and ripper or cable control or counter weight increases ground pressure by about 10% but at the expense of increased wear and fuel consumption. An additional roughly 10% can be achieved through use of a 22" width of track rather than 24". This will result in more compaction and ripping effect at the expense of flotation and traction. Also a 6 roller track-frame option is available on some models to reduce ground contact area and increase pressure with similar disadvantages and track wear.

h. If used on refuse compaction only

   (i) A 50,000 lb. class crawler tractor can handle approximately 800 tons per day

   (ii) A 35,000 lb. class unit, approximately 600 tons per day

(iii) A 25,000 lb. class unit, approximately 300 tons per day.

If used for refuse compaction and also providing earth cover from within a radius of 300 feet, the output of these machines is approximately half.

i. Crawlers and front-end loaders have a versatility which makes them suitable either for small sites or as specialized equipment with a hydraulic ripper and multi-purpose loader buckets. A 150 hp., 38,000 pound crawler loader also has a ground pressure of 10 pounds and will cost approximately the same as a 180 hp. tractor of the same weight but with a 10% wider track.

j. Rubber-tired loaders are the fastest, most maneuverable units. Their wheels exert the highest ground pressure of all but traction can be a problem. There are also tire hazards and tire replacement costs. Tires can be ballasted with water or calcium chloride solution for added weight: foam filling is also available at a cost of approximately $2000 per wheel on a 2 or 3 cubic yard loader. This adds weight and prevents tire failure due to loss of air pressure. The heat build-up associated with filled tires should not be a problem on off-highway application. The foam fillings will only avoid failure due to puncture. Tread and sidewall will remain subject to cutting, gouging and abrasion and retreading may not be possible. Fully enclosed tire chains are also available but heavy meshes do not have sufficiently small openings to prevent all punctures.

6. Support Functions

a. Compactors and graders are required for the construction and maintenance of roads. Except for the largest site, these would probably be rented or the work performed under contract.

b. The maintenance of the roads, which can contribute significantly to public acceptance of landfill, require sweeping and flushing to remove tire hazards and dust. Dust, mud clods, litter and debris on access routes can be hazardous as well as annoying. A tank truck may be required to provide a source of water. A salt spreader or waste oil spreading tank may also be necessary. A 500 to 1,000 gallon tank placed in a dump box can suffice or a modified street flusher can be used. Sweeping can be accomplished with an industrial tractor attachment, small self-propelled unit or a conventional street sweeper.

c. Towing out of bogged-down vehicles can be performed using refuse handling units.

d. Winter conditions will require equipment or service arrangement for snow plowing and sand-salt spreading. Compressed air equipment will be needed to clean radiators and a steam jenny to clean equipment and free tracks and rollers in freezing weather.

e. Pumping capabilities may be required for fire fighting purposes and for leachate handling.

7. The size of the site may preclude provision of some of the items mentioned above. A landfill rate of less than approximately 1,000 tons per day would require only limited use for special purpose equipment. Cost considerations would probably dictate the use of rented equipment or service contract. arrangements.

EQUIPMENT MODIFICATIONS AND ACCESSORIES FOR LANDFILL OPERATION

Specification Item	
Landfill Blade	- available for larger class machines to improve refuse handling, radiator protection and added weight factor
Regular Blade Extension	- available for all machines as alternative to landfill blade for improved grading
Power Shift Transmission	- greater speed of operation, less strain on engine and improved operator effectiveness
Ripper	- one or two tooth parallelogram type ripper for frost or till, clay and shale penetration prior to excavation
Ballast Weight	- balancing for landfill blade and added weight factor for compaction
Hydraulic Controls	- for frequent blade height adjustment in excavating or grading and improved operator effectiveness
Radiator Guards, Heavy Duty and Hinged 2 Section	- protect radiator from damage and obstruction and facilitate exposing radiator for frequent cleaning
Cab, Fully Enclosed	- for operator effectiveness under cold or dusty conditions and operator protection from flying debris, liquids and fire
	- sturdy construction and good visibility including wipers and defroster
Reversible Fan	- to reverse radiator air circulation and avoid intake of dust off dozer blade and provide winter heat particularly in absence of a cab

Specification Item	
Roll Bar	- in absence of a cab to protect operator safety in event of overturning on soft or shifting refuse mound
Engine Screens	- to reduce entry of dust and liquids into motor compartment also eleminate paper and debris and reduce overheating and fire hazard
	- should be of appropriate opening size and substantial construction and fully fitted around blade, hydraulic hoses or alternately the hoses brought through the top of hood
	- sectional with access panels to be provided at necessary points
Perforated Hood	- for improved ventilation of engine compartment
Security Details	- to eliminate vandalism - tamper proof ignition and all fuel, transmission, radiator crawlercase, hydraulic tank covers fitted with hasps
High Water Temperature Low Oil Pressure Audio Alarm	- for warning in event of overheating due to radiator malfunction or rupture and loss of fluid from radiator or oil from engine
Automatic Fire Extinguisher System	- for engine compartment and transmission area, temperature or manually actuated, 30 lb. system

Portable Fire Extinguisher - 10 or 20 lbs. ABC rated unit

Front pull hook and rear pin type drawbar.

Block heater, 1500 W.

Electric hour meter.

Exterior lighting package and light guards.

Exhaust pipe guard.

Seven roller track frame or maximum length and rollers.

Track shoes, heavy duty, extreme service grouser and centre holes.

Track roller guards.

Two stage dry type with transparent precleaner paper media and restriction indicator visible in operating position.

Dual air intakes and extension to 36" above top of hood.

NOTE: These items are generally applicable to crawler tractors but some are also applicable to rubber tired and crawler loaders and scrapers.

All items are not necessarily recommended for all machines or all sites. Individual assessment of site conditions and machine requirements must be made.

WASTE DISPOSAL SITE COSTS

1. Land Costs - The costs of land, although often high, are not usually the deciding factor in site selection. They usually amount to up to 10% of the total disposal cost or approximately between 10 to 40 cents per ton of garbage. In the past, selection involved looking for the low cost land which could not be used for anything else. Because of the criteria which have been established (and discussed in earlier chapters) other factors may predominate. In order to prevent contamination of the natural environment, development and operation may be expensive. For example, if it was proposed to reclaim low-lying land with a landfill project, preparatory work to be carried out first could include diking, erosion protection and raising the ground level with several feet of suitable earth fill.

2. Development Costs - Development could cost up to 10% of the total disposal costs or up to 40 cents per ton of garbage. If planning is inadequate, however, future operating costs could be significantly increased. Development costs include the following:

a. Engineering - The services of staff engineers, consulting engineers, and landscape architects are required to design the site to meet environmental standards. An investment for these services can avoid difficulties and greater costs later.

b. Access Roads - A high standard of construction will result in lower maintenance costs.

c. Fencing, for security and litter control.

d. Perimeter Drainage, for diversion of flow around the site and proper drainage of runoff from the site.

e. Utilities, for the provision of electricity, telephone service, sanitary facilities and potable water.

f. Personnel, Equipment and Weighscale Buildings

g. Leachate Control - This may include planned underdrainage or discharge collection with recirculation or treatment.

3. Equipment Costs

a. Equipment purchase and maintenance may well account for up to 50% of the operating cost. In 1973, crawler tractors of the 38,000 lb. class cost approximately $65,000 and 50,000 lb. equipments $80,000, when equipped for landfill work. Based on 10,000 hours of use and a 20 to 40% residual value the 50,000 lb. equipment depreciates at $5 to $7 per hour.

b. To reduce maintenance and repair costs to a minimum a maintenance schedule involving records and forms, a regular maintenance program and daily and monthly inspections is necessary. Daily inspections can be performed and the results reported by the operator. Monthly inspections are usually a service offered by the supplier but competent site staff can also undertake them. So that maintenance and repair costs can be related to operating time, an hour meter can be installed on each equipment. Major overhauls, which require the services of a specialist, are expensive. The lack of records and an inadequate maintenance program may violate the terms of the repair warranty. Examples of forms which might be used are attached as Appendices 2.3.1 to 2.3.6 inclusive.

c. The operating cost of the major components of a 50,000 lb. bulldozer can be roughly broken down as follows:

Engine	$1.00 per hour
Transmission and Converter	$1.00
Steering Clutches & Final Drive & Hydraulics	$1.00
Undercarriage	$1.25
Miscellaneous	$0.75
Lubricants, Filters, Oils	$1.25

Other costs such as insurance, operator, fuel, minor adjustments and repairs must be considered. In 1973, this machine rented for approximately $20 per hour without an operator.

d. Tender specifications cannot ensure that the equipment selected will result in the lowest maintenance and repair costs. Some equipment suppliers offer guaranteed maintenance purchase contracts but is is difficult to protect the interests of both parties. The arrangement is uncommon, when equipment operates in a waste disposal site where the non-homogenous material is unpredictable and may be hazardous.

e. Another alternative is leasing with all costs such as operator, fuel, insurance, and maintence and repair included. On small scale operations it simplifies budget consideration since operating costs are constant and in the event of failure there are no replacement costs.

f. Inadequate planning and absence of records prevents accurate forcasting and estimating. Without adequate support, funding requests may be low or disallowed. A proper operation cannot be achieved without the required funding.

Account No. _____ Name of Plant or Landfill _____

Sub-Account	Last Years Est.	Last Years Allocation	Last Years 6 mos. Exp.	Last Years 12 mos. Exp.	This Years Est.	This Years Allocation	This Years 6 mos. Exp	This Years 12 mos. Exp
01 Salaries and Wages								
02 Electric Power								
03 Mtce. & Repair Equip.								
04 Mtce. & Repair Bldgs.								
05 Mtce. & Repair Grounds								
06 Supplies & Services								
07 Diesel Oil & Gas								
08 Fuel Oil, Coal - Gas								
09 New Equip. & Furn.								
10 Water								
11 Refractories								
12 Crane Maintenance								
13 Weigh Scales								
14 Containers								
15 Truck Rentals								
16 Transfer Haulage								
17 Motor Vehicles								
18 Equipment Rentals								
19 Pest, Odour Control								
20 Protect, Clothing & Safety Equip.								
21 Tractor Maintenance								
T O T A L								

2.24

OWNER CARE REPORT
TRACTOR - LOADER

Date: _____ Unit No: _____

Make: _____ Model: _____ Serial No: _____ Hours: _____

Eng: _____ Model: _____ Serial No: _____ Hours: _____

Assembly	Good	Needs Adj.	Needs Rep.	Remarks
Engine				
Radiator				
Starter				
Generator				
Air Cleaner				
Oil Pressure				
Fuel Pressure				
Torque Converter				
Turbocharger				
Master Clutch				
Steering L.H. Clutch R.H.				
Steering Booster				
Crown Gear & Finion				
Final Drives				

Attachments				Remarks	Serial No.
Hydraulic Pump					
Hydraulic Control					
Dozer					

NON-LICENSED VEHICLES

FOREMAN'S DAILY REPORT OF
OPERATION AND MAINTENANCE Date: _____

UNIT NO.	MAKE	MODEL

HOURS OPERATED	Night		Days		Afternoon	

FUEL	DIESEL OIL IN GALLONS		GASOLINE IN GALLONS	
OILS	MOTOR OIL ADDED NO. OF QUARTS		OIL CHANGED NO. OF QUARTS	
	HOIST OIL ADDED NO. OF QUARTS		OIL CHANGED NO. OF QUARTS	

GREASE	TRANSMISSION lbs. added		DIFFERENTIAL lbs. added	

GREASED (ALL FITTINGS ON MACHINE)	Night		Days		Afternoon	

FILTERS	CLEANED		CHANGED	
	AIR		AIR	
	OIL		OIL	
	FUEL		FUEL	

NO. OF QUARTS OF RADIATOR COOLANT ADDED	

GENERATOR & REGULATOR CHECKED		HOSES CHECKED	

Remarks: _____

_____ _____ _____

FOREMAN OPERATOR PLANT SUPER-INTENDENT

Operating Cost for Unit No. _____ Serial No. _____

Original Delivery Date _____

Year	Dec. 31 Hour Meter Reading	Total Hours	Year Expenditure	Total Expenditure	Accumulated Hourly Operating Cost
19__					
19__					
19__					
19__					
19__					
19__					
19__					
19__					
19__					
19__					

All entries to be made at year end

COMP. LIFE CHART

HOURS on December 31st SINCE MAJOR OVERHAUL

	19__	19__	19__	19__	19__	19__	19__	19__
Engine								
Undercarriage								
Transmission								
Final Drive - right								
- left								

All entries to be made as the component receives a major overhaul.

Appendix 2.3.5

MAJOR REPAIRS SUMMARY FOR UNIT NO. _____

Serial No. _____

Classification: E=Engine U=Undercarriage T=Transmission M=Miscellaneous

Date Repairs Made	Class.	Hour Meter	Description	Cost $	Firm	P.O. No.

Date of Quotation _____

Quotation for repair of undercarriage on Bulldozer: Make_____

Model _____ Unit No. _____

Hour Meter Reading _____ Date of Reading _____

NOTE: Items listed below include alternatives and prices are to be entered only opposite applicable items.

All new and rebuilt parts are to be equal in dimension and quality to original equipment.

Price A should be based on rebuilt parts where possible and Price B should be based on new link assembly, new bottom rollers or roller shells, new sprocket rims.

Prices for labour and materials to be shown separately in every case.

ITEMS	Price A	Alt. Price B	Remarks
1. New link assembly including pins and bushings			
2. a) New shoes (state no.) b) Rebar grousers (state no.) c) Additional shoe hardware (Specify if any and itemize)			
3. Labour to transfer link assembly or grousers.			
4. Labour to weld rails (state no. of passes & depth)			
5. a) Labour to turn or replace pins and bushings b) New pins & bushings			
6. a) Re-surface sprockets b) New sprockets (rim) c) Add sprocket parts and drive seals (specify if any and itemize) d) Labour			
7. a) Re-surface idler b) Replace idler c) Additional idler parts (Specify if any and itemize) d) Labour			

ITEMS	Price A	Alt. Price B	Remarks
carried forward			
8. Bottom Rollers a) Rebuilt to standard - single - double b) New shells & rebuilt parts - single - double c) New shells & parts - single - double d) Labour (if any)			
9. Top rollers a) Rebuilt to standard b) New c) Labour (if any)			
10. Additional parts, labour or work not listed above (specify in detail with itemized prices, all parts included are to be shown separately from labour)			
Total			
Less trade-in allowance if any a) link assembly b) Rollers			
Total Allowance			
Undercarriage Net Firm Price			
Warranty provided is			
11. Additional work requested other than undercarriage, of any.			
12. Repaint machine including preparation of surface by steam cleaning and sanding, apply one coat under-coat and two finish coats of High-way Yellow (CIL # 2331-8643)			

GENERAL OPERATING PRACTICES

1. General - The successful operation of a landfill is directly related to the interest, knowledge, authority and ability of the site supervisor. Adequate equipment for site development, operation and maintenance must be allocated through systematic budgeting procedures. If a site is well kept and supervised, fewer people will abuse it. A successful public relations program to foster public good will must be implemented.

2. Wastes should be deposited in a manner and in an area to permit easy incorporation into the disposal face. Unloading must be coordinated with spreading and compacting. Controlled unloading reduces work, conserves landfill volume, permits better compaction, minimizes double handling, reduces litter, and expedites unloading from the collection vehicles. The unloading area can be controlled by signs, portable fencing and, when necessary, an unloading supervisor.

3. Records - Good records will show many things about operational costs. They need not be elaborate. Records permit an assessment of the costs of each operation, such as equipment repair and standing time, man hours, land costs, cover material used, litter control and trenching. Reasons for any high cost can then be ascertained, remedial action taken, and costs reduced. Further, future costs can be predicted and appropriate charges made to site users, whether through local taxes or otherwise.

4. Segregation of Wastes

   a. Rationale - On many sites separate disposal areas which should be screened from public view are set aside for materials such as scrap metal, appliance bodies, derelict motor vehicles, tires, brick and stone rubble from construction operation, and brush and trees. This is usually done for the following reasons:

(i) To reduce costs of disposal in the main face, either because less expensive equipment may be used, or because it will permit a reduction in the volume of cover material required. Only domestic refuse, semi-hazardous materials and paper and cardboard and the like need to be covered regularly.

(ii) Resale value of the segregated material. Ideally, the operator should verify that an economic market exists by obtaining quotations.

(iii) It may be cheaper to pay to have some materials hauled away rather than to bury them.

(iv) Some materials can be used as an aid to site operation. Oil drums and even tree stumps and logs can be used to delineate access to the disposal operations.

b. Materials Segregated - The following materials are usually segregated:

(i) Tires - These are difficult to bury. Sometimes a hauler will pay to remove them; sometimes he will have to be paid to take them away.

(ii) Appliance Bodies - These disrupt operations when dumped on the main disposal face. If collected together in a separate area, they can be flattened using a heavy-tracked construction vehicle and buried, either in this area or in the main disposal face.

(iii) Scrap Metals may have market value.

(iv) Derelict Motor Vehicles - Sites will be licensed separately by the Ministry of the Environment. Refer to Regulation 824, Section 13(b) for the conditions which govern operations of these sites. These vehicles are normally neither desirable nor permissible at a waste disposal site.

(v) Construction Materials - Rubble, brick, stone and material from road construction of on-site roads. Collection in stock-piles is often advantageous.

(vi) Brush and Trees - see paragraph 5 below.

(vii) Wire Fencing - This is often a problem in rural areas. To avoid damage to construction equipment, wire should be pressed down with the blade or bucket and covered with earth or stone, before compaction is attempted.

5. Burning - Brush and trees are difficult to bury because of their bulk. Before segregating and burning brush and trees, Ministry approval is required. In certain cases the Ministry will permit dry wood waste materials to be burnt, but as a general guide, no other material should be burnt. If burning is approved, brush should not be accumulated in an area greater than 20 feet by 20 feet and fires should be kept small and hot. When permission is granted, the following conditions are usually imposed:

a. Burning must take place in a Ministry designated location remote from the other disposal faces.

b. Smoke densities specified in Ontario Regulation 15 must not be exceeded.

c. There must be a 100 foot firebreak so that bush, grass or woodland areas do not catch fire.

d. The materials must be dry before they are burned.

e. If the site is within a Forest Protection Area, as designated by the Ministry of Natural Resources, a fire permit must first be obtained and the conditions on the permit must be complied with.

g. An attendant must be present when burning is in progress.

h. Residue must be buried.

OPEN BURNING AT A WASTE DISPOSAL SITE

7. Cell and Cell Cover

a. A cell is an accumulation of graded and compacted waste material that has been covered with suitable earth cover to prevent the exposure of the material to the atmosphere and to limit percolation of rainwater into it. Cells may be either bedded horizontally or graded and compacted to a 3 horizontal to 1 vertical slope. A well-compacted cell approximately six feet thick minimizes settlement, surface cracking, odour release, and offers increased protection against spontaneous combustion or accidental or deliberate burning. While most disposal sites are only one or two cells thick, large sites could have six or more. This cell method of development allows for easier, more efficient compaction.

b. Cell Cover

(i) A uniform compacted layer of at least six inches of suitable earth cover must be placed on all exposed solid wastes at the intervals specified by the Ministry or in its Regulations. The soil should have good workability and compaction characteristics. In areas of the Province where dumps are permitted, cover may be required on a weekly, bi-monthly, or a monthly basis. More frequent cover is necessary in summer (April to October) than in winter.

(ii) Desirable cover frequency cannot be dictated purely on the basis of the population served. The amount of garbage produced varies from area to area; consequently, the desirable frequency of cover also varies. The Ministry may exercise some discretion. For example, a front end loader which serves other municipal needs, may not be available for full time use at the landfill site.

In a remote area frequent cover may not be essential as in a densely populated area. In tourist areas the desirable cover frequency will vary with the season. The following frequencies of cover may be used as a guide:

(a) once per month per population of 500

(b) twice per month for a population of 1000

(c) once a week for a population of 1500

(d) twice a week for a population of 2500

(e) daily for a population of 3500 or more

(iii) In some areas, with the resources available, it may not be possible to cover the garbage in the colder months such as January and February. Compaction should, however, continue and a thorough cleanup should be undertaken prior to snowfall and in the spring. We have noted one situation in Northern Ontario where only clay was available. Adequate winter control was accomplished with daily compaction without earth cover. In the spring, the compacted refuse had not appreciably settled, showing that compaction had been adequate.

c. Size of Lift - The total depth of an area fill is decided after the site characteristics, the desired elevation of the completed fill area, and good engineering practices have been considered. The "lift" is the height of a single cell. Usually problems result if the lift, or cell height, exceeds 6 or 8 feet. If cells less that six feet in height are constructed, the life of the site will be shortened.

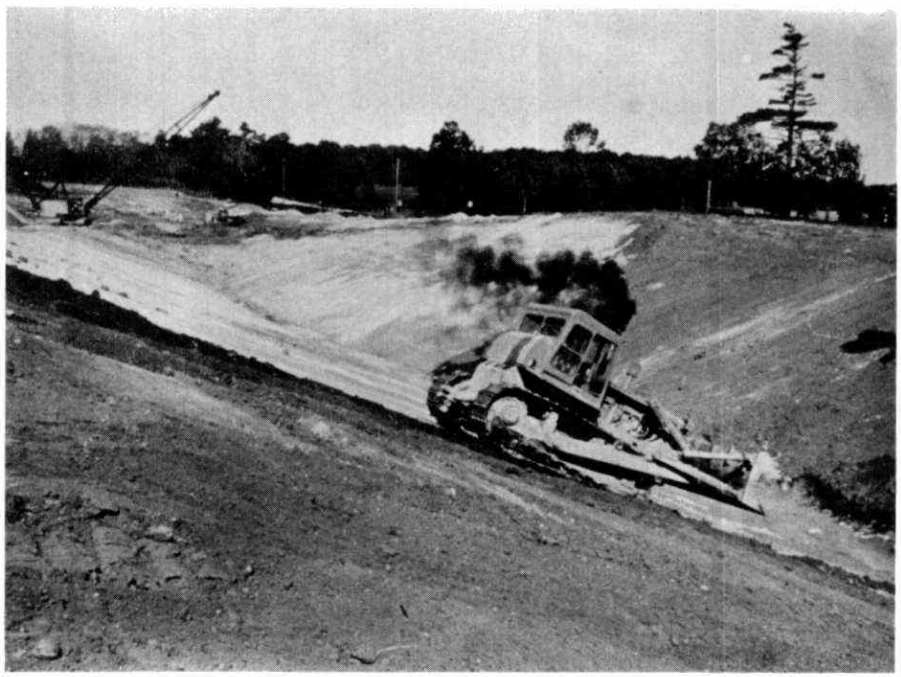
8. Compaction

a. Successful operation and maximum utilization of a waste disposal site depends on adequate compaction of the waste. Uncompacted garbage may weigh less than 300 lbs. per cubic yard while compacted garbage in a landfill weighs in the order of 900 lbs. per cubic yard. Thus compaction will help in conserving the life of the site itself. Covering costs could be four times as expensive, the life of the site four times as short if wastes are not compacted. Settlement will be excessive and uneven when the wastes are not well compacted. This can permit invasion by insects and rodents and limit the future usefulness of the site. You may intend to use it, for example, as a baseball diamond after the landfilling has been completed.

b. Optimum compaction, having regard to the effort necessary and the results achievable, occurs when the layers are about two feet thick. One cell may contain several such layers. Compaction is best initiated by spreading the solid waste with suitable equipment evenly in 2 foot layers on a slope rather than placing the material in a single deep layer. In this way cushioning and bridging are reduced in 2 to 5 passes. The repeated travel of equipment over the layers provides further compaction.

c. On large sites, a sheep's foot roller should be used to compact garbage. In spreading and compacting the 6 inches of earth cover material over the cell, use a bulldozer; a sheep's foot roller may drag up garbage through the earth cover.

FINAL GRADING AND COMPACTING AT A LARGE WASTE DISPOSAL SITE



9. Communication Equipment - Telephone or radio communication is desirable, particularly at isolated sites. When the site owner also operates a collection system, good communications can reduce his costs, by eliminating overlaps and speeding up the work. A machine can be dispatched to a problem area much faster.

10. Custodian Duties and Responsibilities - Most waste disposal operations will profit by regular supervision. The custodian or attendant is responsible for:

a. The deposit of waste in the proper areas

b. The acceptance of only authorized wastes

c. The admittance of only authorized users

d. Opening and closure of the site each day

e. Prevention of scavenging

f. Prevention of unauthorized fires

g. The weighing and recording of types and volume of refuse and collection of fees (where applicable)

h. Housekeeping, i.e. collection of blowing papers and general tidiness

i. Providing first aid in the event of accidents.

11. Inclement Weather Operations - Waste disposal sites must continue to operate under the most severe weather conditions; i.e. heavy rain, heavy snow, extended periods of cold and high winds. Each of these weather conditions give rise to numerous difficulties.

a. Heavy rains affect on-site traffic and covering operations and access to the disposal areas. Clay soil is particularly difficult both to work and drive on when it is wet. Poor covering and compaction may result. All weather access roads must therefore be constructed. Sometimes a wet weather disposal location is provided close to the public road. The site itself should be designed so that heavy rainfall can be discharged rapidly without causing problems.

b. Winter operations (heavy snow, extended periods of cold and high winds) are discussed in Chapter 4 Article 3.

12. Litter Control - Refuse should be disposed of in a sanitary, nuisance-free manner. If papers and other light materials are scattered about the site, fire hazards and unsightliness result. Litter should be picked up on a regular basis by the site attendant. Unloading should be carefully supervised on windy days. Moveable fencing in the unloading area can help. It should be kept clean to be effective. Once a fence is clogged, air flow patterns will change and the paper will be carried over it. Earth banks or depressions, trees and bush in the site can provide sheltered areas where the problems are minimized.

POOR HOUSEKEEPING AT A WASTE DISPOSAL SITE

CHAPTER 3

METHODS OF

SOLID WASTE HANDLING

Article 1 GENERAL CONSIDERATIONS

Article 2 LANDFILL BY THE RAMP METHOD

Article 3 LANDFILL BY THE AREA METHOD

Article 4 LANDFILL BY THE TRENCH METHOD

Article 5 OTHER MEANS

3.1

GENERAL CONSIDERATIONS

1. In selecting the type of operation to be used the advantages and disadvantages of each method or combination of methods must be considered as well as the site preparation and treatment and placement of garbage. The characteristics of a site usually lead to the adoption of a combination of methods. This chapter deals with the three basic methods of burying waste materials, The Ramp Method, The Area Method, The Trench Method. While it is important to understand each method, it is often undesirable to follow any one of them rigidly when developing a new site.

2. Other methods which are briefly discussed in Article 5 of this chapter include:

a. Transfer Stations
b. Grinding
c. Baling
d. Incineration
e. Composting
f. Recycling

3. Site Preparation - Fill Imported - There are four possible reasons why an operator might wish to import fill:

a. To separate the waste from either rock or water table by increasing ground elevation. The fill in such locations is necessary to reduce environmental contamination to acceptable limits by preventing garbage from being deposited in water and to provide adequate soil through which the leachate will percolate.

b. To provide a bank against which garbage can be imported.

c. To provide cover for garbage cells.

d. To provide final cover over the garbage. This fill is necessary not only to limit the intrusion of surface water, but also to provide a suitable medium for the growth of vegetation.

4. Site Preparation - Removal of Existing Soil - The need to remove soil should be examined before any work is done. This will lead to the establishment of a well-planned, well organized site. The general considerations described above for imported fill apply.

   a. If a trench type operation is considered, a hole or trench is required.

   b. Surface grading, to one degree or another, will be required to ensure that water run-off will not interfere with the operations.

   c. Ditches and ponds for leachate collection and treatment may have to be constructed.

   d. On site roads may necessitate earth transfer, either to or from the road locations.

5. Treatment of Garbage - The economic factors which should be considered, before the selection of the type of disposal method to be used include:

   a. Cost of buying and moving soil

   b. Cost of moving garbage waste materials

   c. Cost of compacting garbage waste materials

   d. Cost of covering garbage waste materials

   e. The method(s) of garbage delivery

   f. Desirability of grinding processes.

6. Placement of Garbage

   a. Ideally, garbage will be placed by incoming vehicles in locations that minimize double-handling. If the ratio of cell cover to garbage is minimized, then

      (1) The life of the site will be maximized

      (2) Garbage handling and earth moving costs will be minimized.

Appendix 3.1.1 shows how a cell size is calculated.

b. Shapes with the smallest ratio of surface area to contained volume are spheres, or cubes, if the shape is to be bounded by straight lines. These shapes are impractical. A shape with equal height length and width such as a paralleloloid is the one normally used. In forming such a shape the garbage should be compacted in sloping layers.

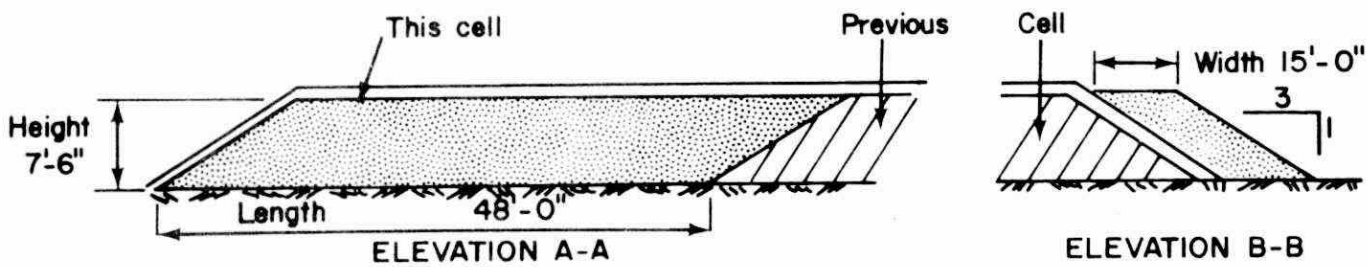
CALCULATION OF CELL SIZE

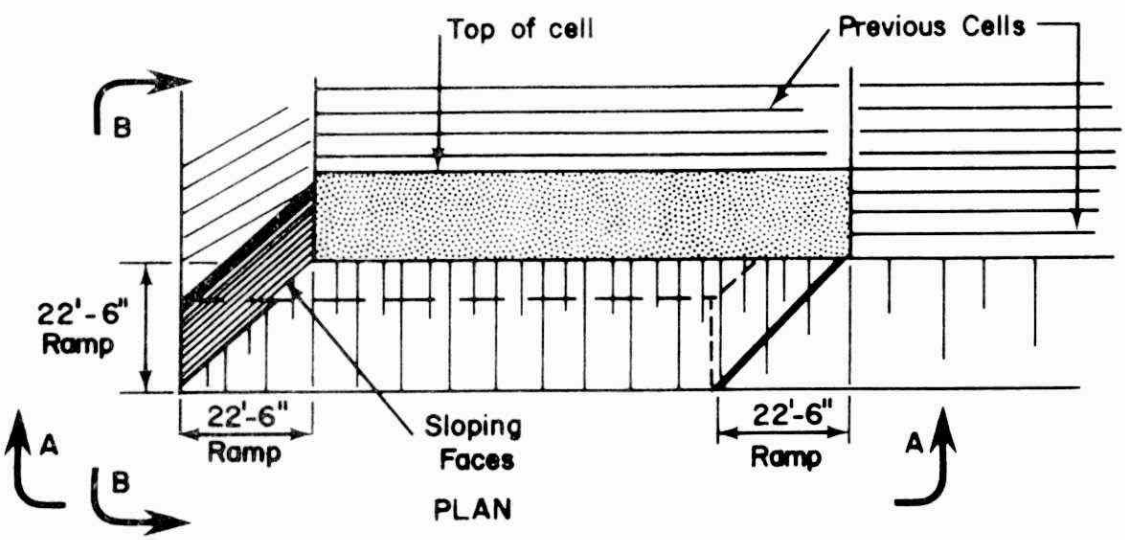
At a waste disposal site 600 cubic yards of garbage is required each day. Experience indicates that a volume reduction to two thirds can be expected after compaction. Only rarely are more than three vehicles at the disposal face for unloading purposes. Assuming that cover is provided on a daily basis, determine the practical proportions of a cell such that the life of the site and equipment used is optimized.

1. Maximum practical cell height is about 8 feet allowing 6 inches for compacted earth cover. Height of garbage in cell is 7½ feet.

2. For width required to unload one vehicle = 16 feet
   Therefore, total face width = 3 x 16 = 48 feet

3. Total volume of incoming garbage = 600 cubic yards = 16,200 cubic feet
   Volume after compaction = 16,200 ÷ 3 = 5,400 cubic feet
   Hence width of cell = 5,400 ÷ 48 ÷ 7½ = 15 feet





Note that when viewed from overhead the cell appears much larger and requires a rectangle measuring 70½ feet by 37½ feet to contain it before earth cover is added.

3.5

THE RAMP METHOD

1. General - This is a simple method to use and it involves little planning. Earth is excavated and a bank created adjacent to the hollow. Wastes are then deposited in the excavation and compacted to form a ramp with about a 3 to 1 slope. Cover materials are compacted over the wastes and the process is repeated. Refer to Appendices 3.2.1 and 3.2.2.

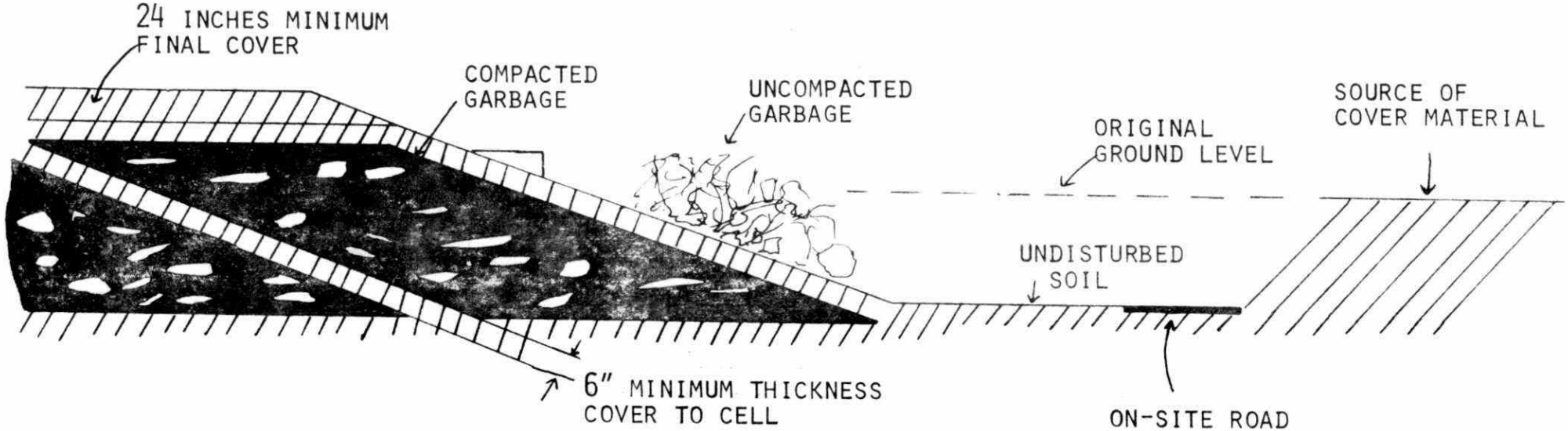
2. Application - The ramp method is suited to most areas but, because only one bulldozer such as a D-4 is required, it is widely applied in small operations. In rolling terrain, it is often unnecessary to construct a bank or ramp. If a high water table exists, the ramp method which requires only shallow excavation can be employed. The method makes efficient use of earth on the site but more equipment time is required than with the trench method.

3. Size of Working Face - The smallest practical face is one and a half times the width of the bulldozer blade, say 15 feet, so the bulldozer has space to move and compact the entire face. The cell depth is measured perpendicular to the working face.

4. Loading - It is usually desirable to unload the waste materials at the bottom of the face in order to decrease litter problems, reduce equipment wear and increase the efficiency of earth moving operations.

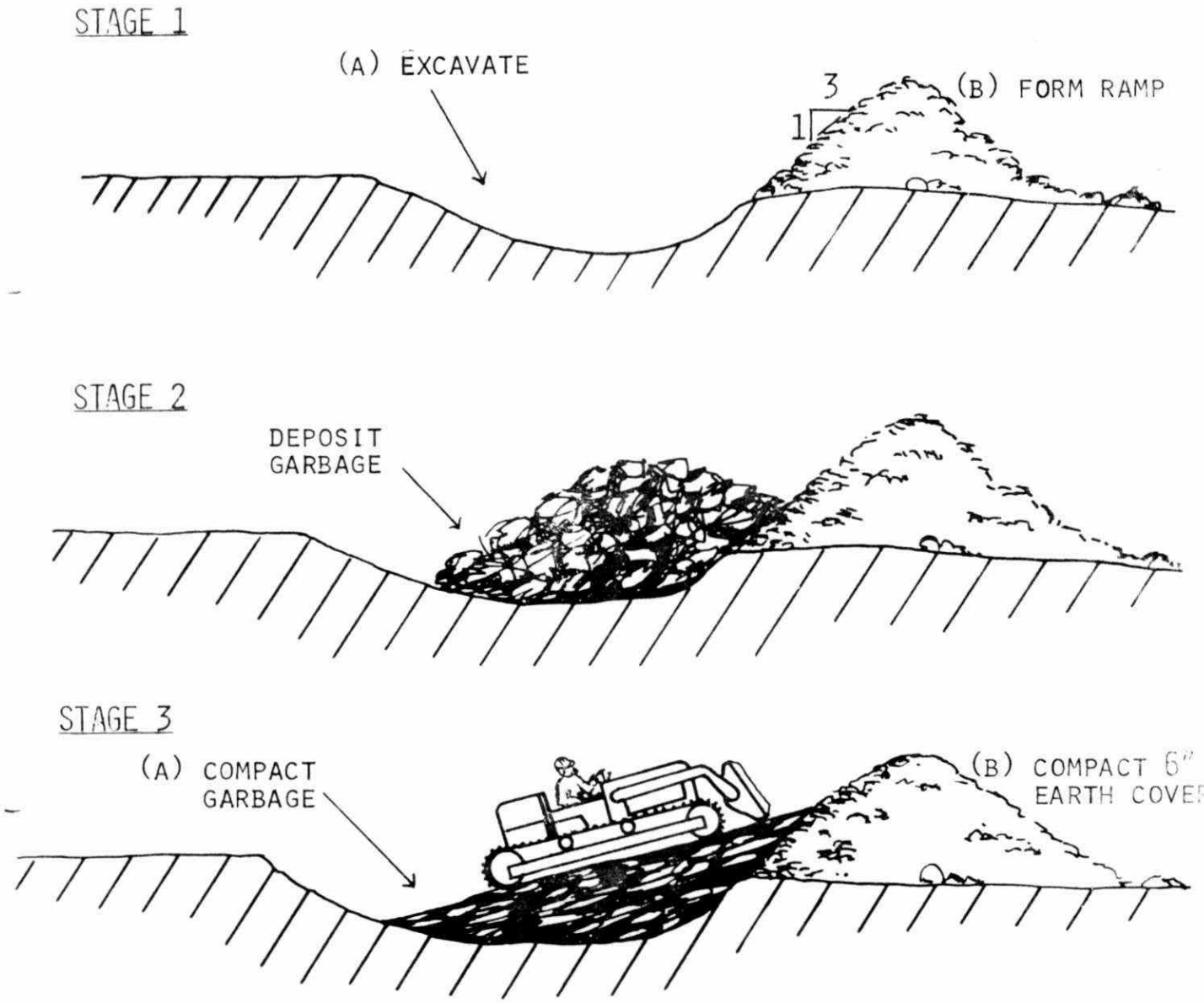
5. Cover - A sand loam with some clay has good properties. It is easy to work and allows little seepage of rainwater into the wastes. It also permits the establishment of a crop cover on a compacted landfill to control erosion.

RAMP METHOD



NOTE: 3:1 SLOPE OF COMPACTED GARBAGE

RAMP METHOD


STAGE 1
(A) EXCAVATE
3
1
(B) FORM RAMP
STAGE 2
DEPOSIT
GARBAGE
STAGE 3
(A) COMPACT
GARBAGE
(B) COMPACT 6"
EARTH COVER

3.8

THE AREA METHOD

1. General - In most cases where this method is employed refuse is deposited above existing ground level, compacted and covered in successive cells. The necessary soil cover is obtained from a nearby borrow pit. If fill is close at hand, the area method is very similar to the ramp method. Wastes however are spread on either

a. the natural surface of the ground

b. previously deposited garbage or

c. an area from which overburden has been removed.

Appendix 3.3.1 depicts the Area Method.

2. Application - The area method can be widely employed. It can be used on flat or gently sloping land, in abandoned sand and gravel pits, in depressions such as ravines or valleys and where wet soil conditions prevent trenching and disposal of refuse below grade.

3. Cover - When there is not sufficient soil at the site to provide the daily or periodic cover to form the cells, soil is brought in to cover the garbage. A fine sandy loam with some clay, is easy to work and is ideal because it allows little seepage of rainwater into the wastes. It also permits control of erosion by the establishment of a cover crop on a completed landfill.

4. Water - The area method which does not require any excavation tends to protect and isolate the water table from the garbage. When the final 2 feet of earth cover is applied to a completed area, a suitable, fairly flat grade is established to help carry surface water away from the disposal area. The grade depends upon the grain size of the cover material, but should be steep enough to prevent uneven settlement and ponding during wet weather.

Working Area

5. a. Size - The approaches and accesses to the working face should be kept as small as possible, so that the operation of covering refuse with the 6 inches of clean fill takes as little time and material as possible. The face itself should not normally exceed 8 feet in height. It should be maintained at a slope of not steeper than 1:1.2 or approximately 20°, so that covering and compacting equipment can operate safely. In the winter months flatter grades may be necessary, e.g. 1:3 or even 1:4. At very small rural sites a 10 feet long face may be quite suitable, while larger municipal sites, which have compacting equipment working during the unloading operation by garbage vehicles will require much longer faces. Note that it may take an hour or more to unload a vehicle by hand.

b. Traffic Control - At the dumping face, barriers, consisting of tires,45 gallon drums or portable snow fencing, etc., can be placed so that vehicles can only approach the drop-off area at the required location. Sufficient parking, passing and turning room must be provided so that a traffic jam does not happen.

c. Drop-off Area - Two different methods can be used to develop an area fill. In the first, refuse is dumped over an embankment; in the second and preferred method refuse is dumped at the bottom of the working face. If the site is on a level field, either option is available. When the method is employed on a property with slopes and depressions, dumping over an embankment is more feasible, but there is then the tendency for the garbage face to grow in height and become too steep. If this happens waste will not be compacted properly. When refuse is dumped at the bottom, the face height can be controlled, but increased road maintenance may

be required. Although dumping at the bottom is normally preferred, individual sites must be carefully examined to select the best method. At larger sites, both methods may be employed simultaneously, heavy haulage equipment dumping at the bottom and light vehicles and cars at the top.

6. Cell Construction - Appendix 3.3.2 illustrates a sequence for the construction of cells so that the operation is screened from public view.

7. Advantages

a. A large volume of refuse can be disposed of, as several cells can be constructed on top of each other.

b. Land, not usable in its present form, can be reclaimed.

c. Preparing trenches does require a large capital outlay.

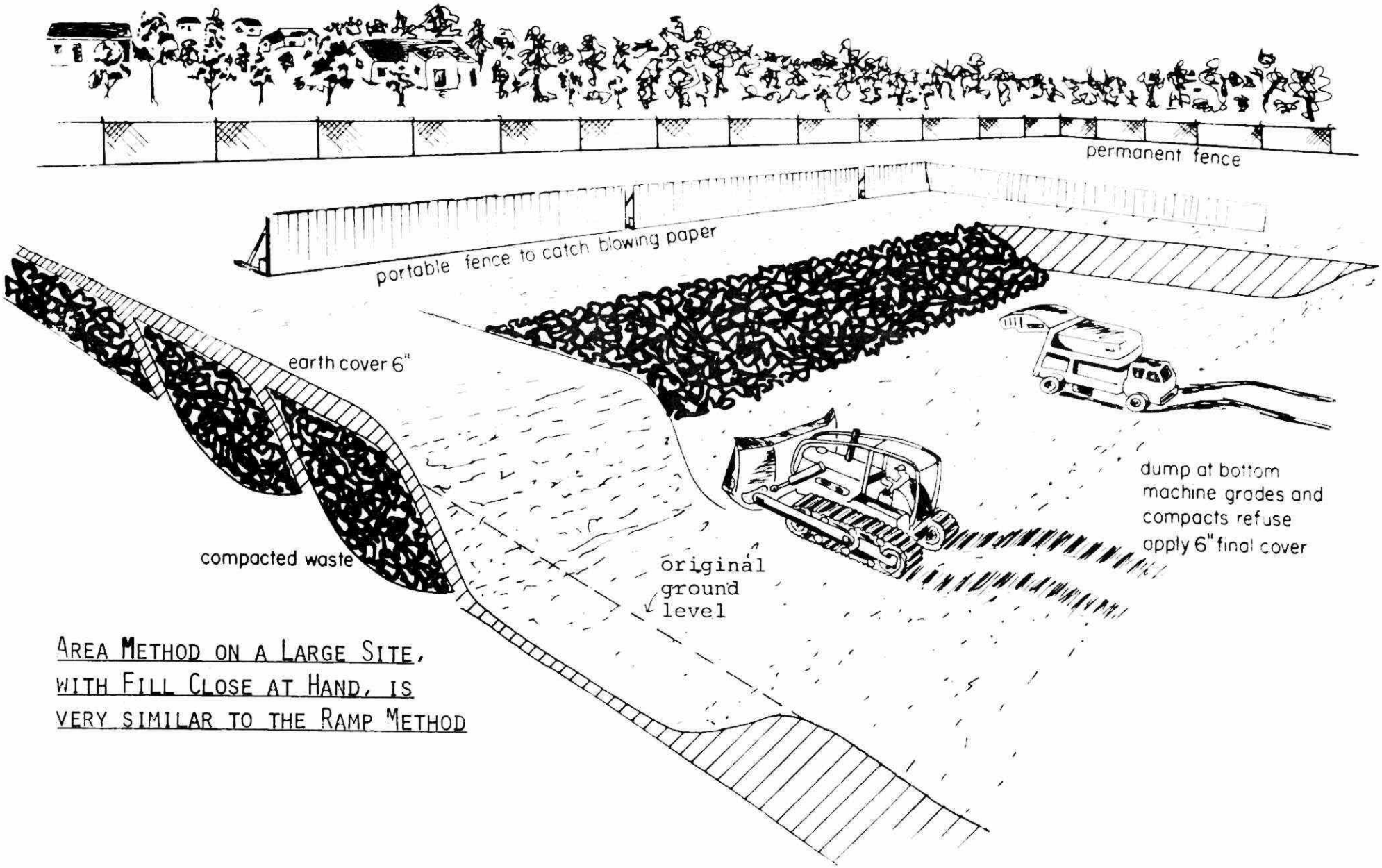
d. As area fill may be developed on top of a trench-and-fill site which has reached its full capacity, the useful life of such a site can thus, be extended.

8. Disadvantages

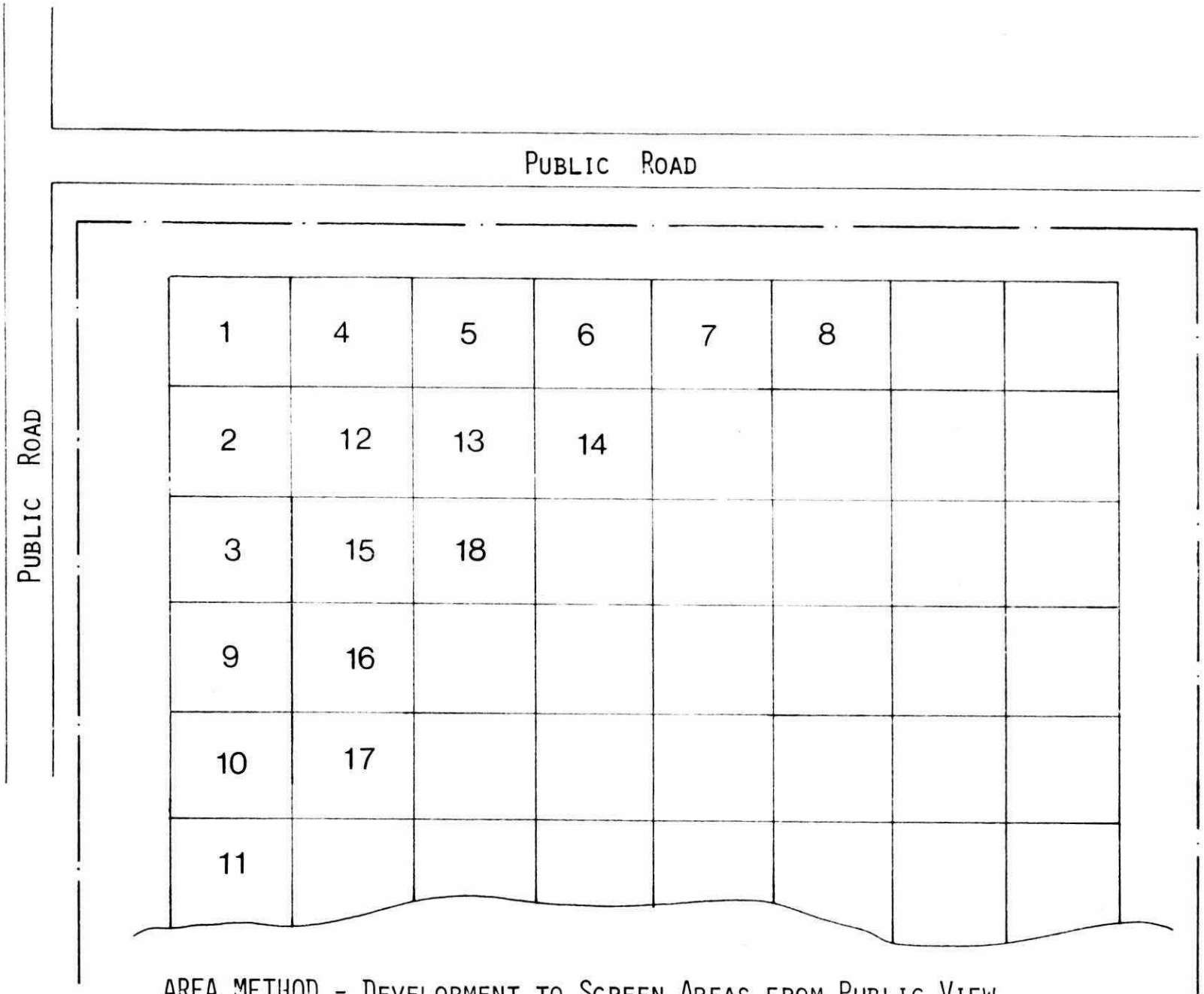
a. Artificial barriers must be arranged to control windborne debris.

b. Without close control and supervision, the active working face may tend to increase in height and width.

c. Fill used for cover must be brought to the disposal site.



AREA METHOD ON A LARGE SITE, WITH FILL CLOSE AT HAND, IS VERY SIMILAR TO THE RAMP METHOD



AREA METHOD - DEVELOPMENT TO SCREEN AREAS FROM PUBLIC VIEW

CONSTRUCT CELLS IN APPROXIMATE NUMERICAL ORDER ILLUSTRATED.

3.13

THE TRENCH METHOD

1. General - In a trench-and-fill operation, a trench is cut into the ground and the refuse is deposited into the trench. When the refuse has reached a certain depth it is gathered together, usually at one end of the trench, graded, compacted and then covered with six inches of earth cover material. The layers or cells may be either sloping (1:3) so that the trench is filled at one end first, or flat so that the final layer completes the filling of the trench. The method to be employed should be based on the quantity of garbage deposited between cover operations and the depth of the trench. When the trench is full, a final two feet of cover is applied, including a top layer which can support the growth of vegetation. Appendices 3.4.1, 3.4.2, and 3.4.3 illustrate the trench method.

2. Application - Trench-and-fill operations are suitable for areas where the terrain is either flat or rolling. The principle considerations, in determining if a location is suitable for a trench fill site, are soil type and depth and the amount of usable soil above the water table. These considerations also apply when determining trench locations on the site.

3. Soil - Soil depth and composition are of great importance. A site with only a few feet of overburden would not be suitable. Fine grained soils intermixed with large boulders would make trench construction most difficult. During wet weather or very cold operations, heavy soils, such as clay, create problems in excavation and operation.

4. Water Table Level - Before selecting a site for a trench operation the depth to the water table must be determined. This should be measured during the spring when the water table will be at its highest. Well records and inspections in the immediate area will also provide an indication of the maximum water table level.

5. Drainage - Drainage of trenches and roads is very important. Proper road ditching, intercept ditches along slopes and drainage ditches from trenches, all help to reduce costs created by surface water problems. Ditches and berms should be constructed to direct all surface run-off away from the trench area. Site topography must be considered when locating the first trench. On sloping ground the initial trench should be commenced in the highest area and progessively extended toward the lower area. This will prevent delays in wet weather by providing proper drainage and preventing standing water. The second trench should be paralled and close to the first and so on, to ensure the best use of the site.

6. Size of Trench -

a. Considerations determininng trench size are the volumes of waste to be handled, the type of soil in the area and the availability of equipment and resources to operate the site. Trenches should be a minimum of six feet deep. At least 3 feet of earth should be maintained above the high water table or rock. The width should be a minimum of fifteen feet or one-and-a-half bulldozer blades wide so that effective use can be made of the heavy equipment. Much wider trenches are often desirable to reduce the amount of soil lost between trenches. The length will vary with the quantity of garbage. Some municipalities prefer to dig a large trench to accommodate at least six months waste, thereby reducing the costs for heavy equipment.

b. Data may not be available on which to base the size of the first trench and in this case it is better to oversize. When records are available the ideal length can be determined. With good operating records the operator can plan subsequent land use fairly accurately.

7. Roads - The main access road should be built to all-weather standards so that the site may be used in inclement weather. On-site roads may be of a lesser standard, but should be constructed so as to last until the trenches they are serving are closed. A road may be located to serve two trenches at the same time.

8. Advantages

a. A large volume of waste can be concentrated and easily controlled in the designated area.

b. Placement of wastes in a trench reduces the amount of blowing paper since wastes are below ground level.

c. The use of major construction equipment occurs at fixed intervals; hence costs of equipment rental are lower.

d. Since the dumping edge does not change very much, road construction and road costs are minimized.

e. The life of the site can often be extended by using the area method over previously filled trenches utilizing excavated material.

f. Portable fences can be located, more easily, in strategic locations.

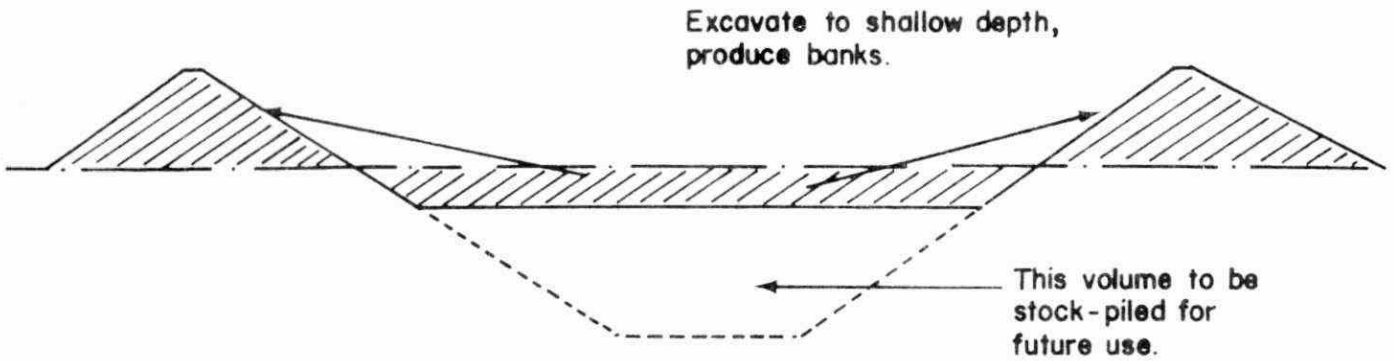
9. Disadvantages

a. Land, which is often fairly valuable, is used up relatively quickly, since only one lift is possible.

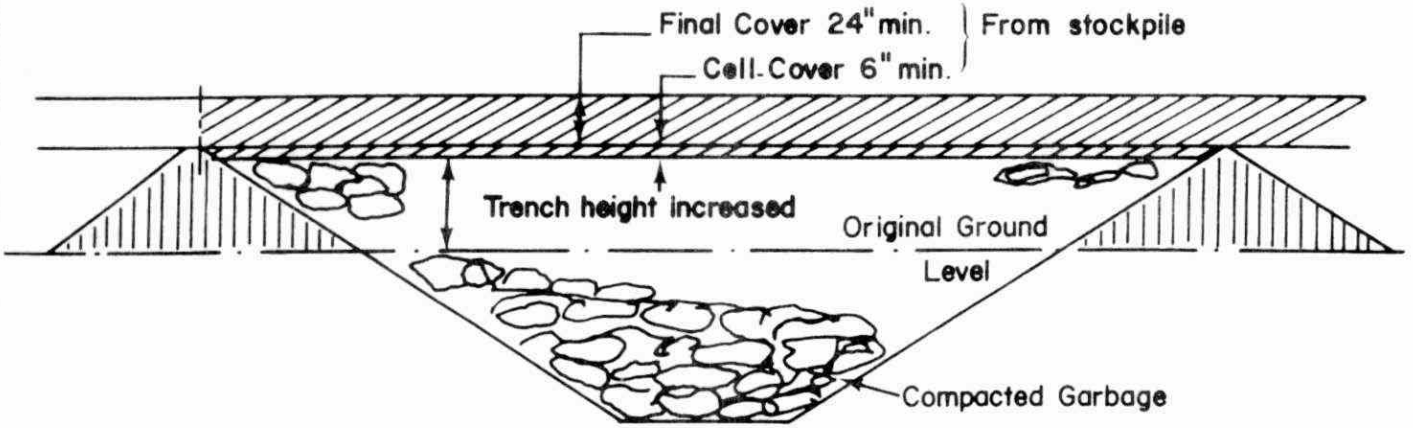
b. The method is unsuitable for rock areas.

c. Heavy soils, such as clay, restrict trench excavation to the warmer months.

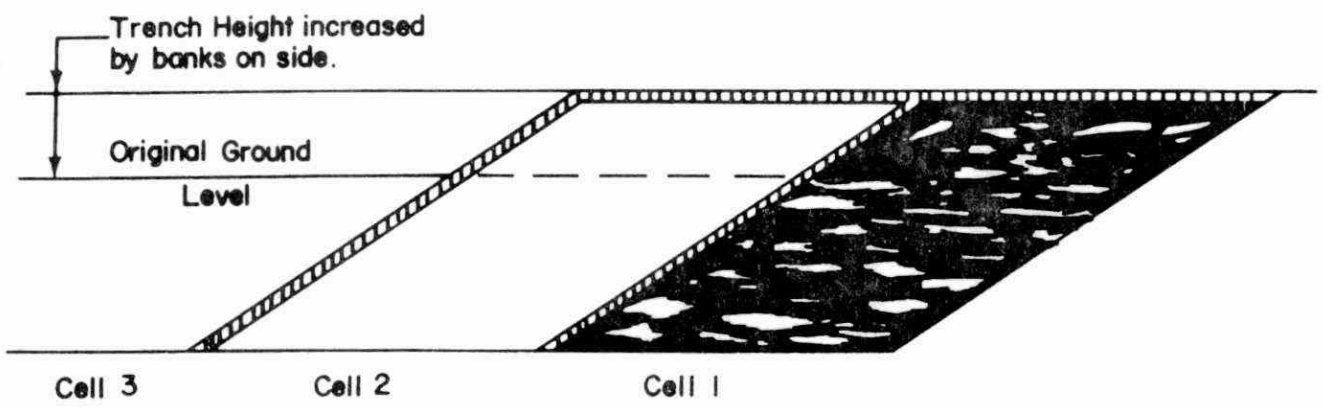
TRENCH METHOD WITH BANKS



STAGE 1

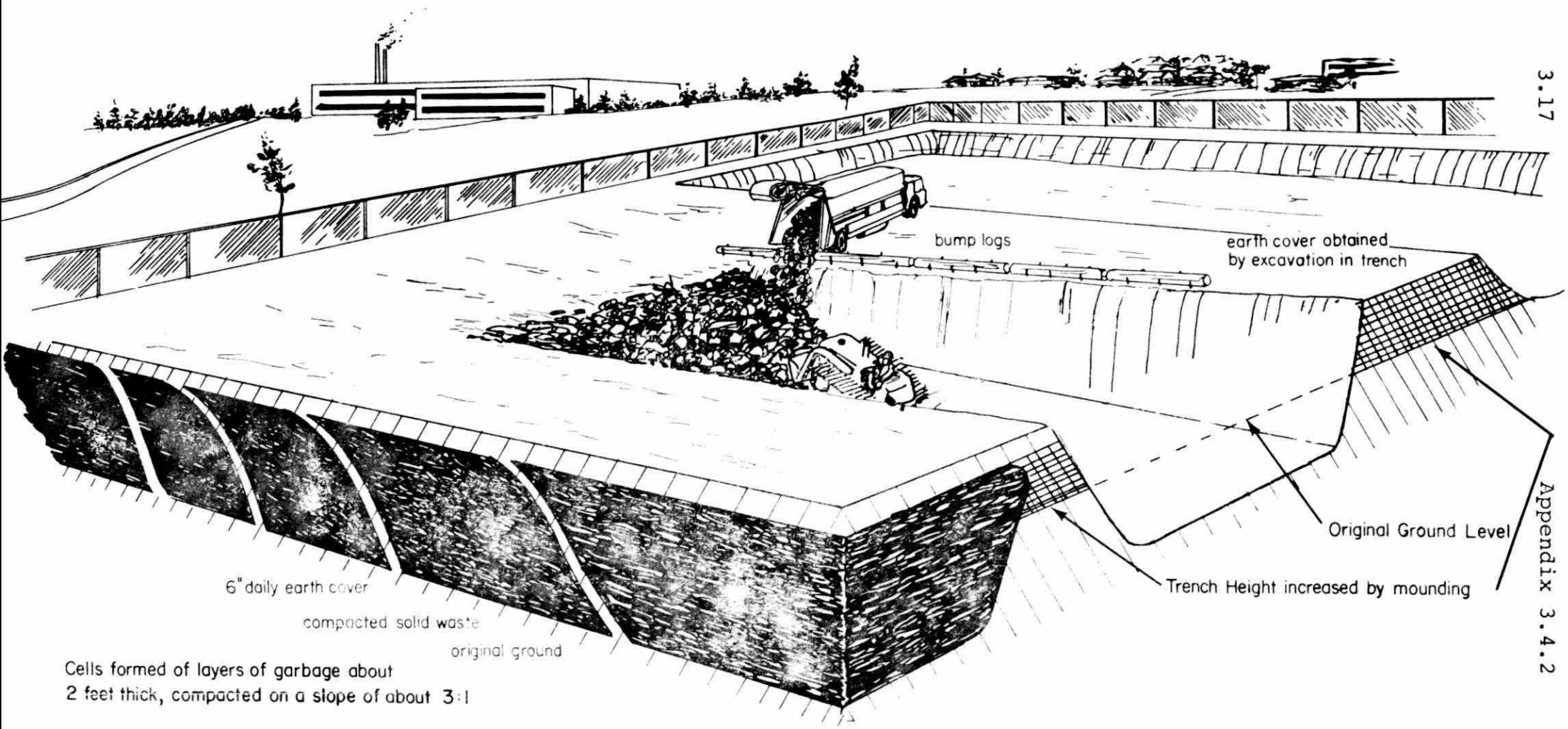


STAGE 2



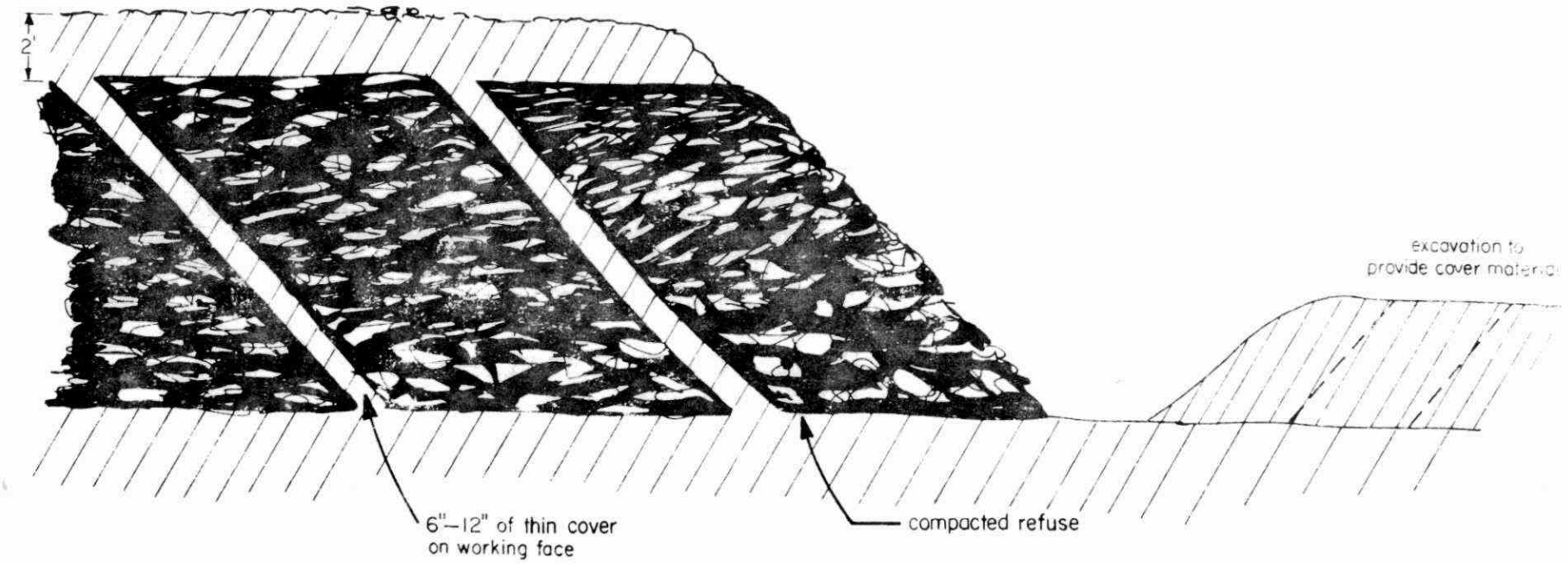
STAGE 2 (along trench centreline)

AREA TRENCH METHOD



Cells formed of layers of garbage about
2 feet thick, compacted on a slope of about 3:1

TRENCH METHOD OF SANITARY LANDFILL (ALTERNATIVE)



OTHER MEANS OF SOLID WASTE HANDLING

Transfer Station

1. A transfer station is a place to which the solid waste is transported and unloaded, reloaded to larger vehicles and transported to another location for final disposal. Reloading may employ four or five cubic yards sized containers or transport units of sixty or more cubic yards. Segregation, separation, grinding, and compaction of the waste may take place at the station.

2. Transfer stations are often preferred by rural dwellers because they provide relatively close drop points. Rural municipalities often employ them because a central large disposal site is more economical to operate than a number of smaller sites. Transfer stations may also be preferred by larger communities because haulage costs are reduced particularly when the disposal site is a long distance from the collection area.

3. Appendix 3.5.1 illustrates a refuse transfer station.

Recycling

4. Recycling involves the separation of the waste into recoverable resources. After removal of all the material which can be readily separated and reused, the balance, which should contain a large proportion of organics, can be composted. If no outlet for the compost is available, it could be dealt with at a landfill site or by one of the new processes described in Chapter 5.

5. To be economical, a recycling plant needs a large, regular supply of waste and markets for the separated materials. The major classifications of the materials separated will be:

a. paper and paper products
b. ferrous metals
c. non-ferrous metals
d. plain glass

e. coloured glass
f. organic material
g. some proportion including plastics, that cannot be reused and must be disposed of.

6. Three types of system are possible but the selection will depend to a large degree whether the home separation of of wastes such as newsprint is part of the system.

a. The simplest system will rely heavily on hand picking of the refuse to remove paper, cardboard, non-ferrous metals, and possibly glass.

b. A fully mechanized plant which does not depend on hand sorting; in this case, the material would probably be rough ground, and separation would be carried out first by dry methods such as air classification, screening, or ballistic separators, with, at a later stage, wet separation to a limited degree.

c. An exclusively wet separation system such as the fibre-claim process, which is basically designed for the recovery of paper fibre.

7. A major recycling operation requires a large initial capital outlay for equipment such as shredders, magnetic separators, air separators, ballistic separators, conveyors and structures such as equipment sheds and storage bins. Recycling is only economical when the dollar value of the segregated materials is sufficiently high that the method will be preferred to landfilling and markets for reclaimed material are available.

Grinding

8. There are two main reasons for grinding wastes. Firstly, it may be a necessary preliminary to recycling. Secondly it can have advantages at a disposal site because:

a. It reduces waste volume and the increases of the life of a disposal site.

b. It makes waste more readily compactable and easily handled.

c. It reduces odours.

d. It eliminates flies and rodents by eliminating their food supply.

e. It reduces both the time and the amount of settlement that occurs at a landfill site and so makes it more useable for other purposes after the site has been completely filled.

f. Cover costs are reduced.

9. Grinding can be undertaken at either a transfer station or at a landfill site. Initial costs are high, but benefits may out weight the costs.

Baling

10. In this method refuse is compressed and baled prior to landfilling. Some authorities have suggested that cover is not necessary. The Ministry has as yet, taken no position on the question of cover as baling is not presently practiced in Ontario. While it increases equipment requirements, its reputed advantages in landfilling include:

a. The resulting high compaction extends site life.

b. It eliminates "offensive" odours.

c. It does not attract flies and rodents.

d. It facilitates handling of the waste and the construction of the landfill.

e. It usually requires little cover.

f. It ensures uniform and rapid settlement and promotes higher grade uses for the site when closed.

11. Although baling may be undertaken on a disposal site its prime application is at transfer stations. Economic benefits are achieved in both hauling and disposal. Shredding, prior to baling, will increase the bundle density and may further reduce haulage and disposal costs.

12. In Japan, solid waste bales covered with concrete are used to construct sea walls. It is claimed that the concrete prevents leachate from escaping from the wastes.

Incineration

13. The pit incinerator is a relatively unsophisticated unit, but it is only suitable for use in areas remote from development and has a limited application. Essentially it comprises a concrete pit in which the waste is burned with a certain degree of control over the emission of burning debris and particulate matter by the use of air blowers to set up a rotating current of air in the pit. The unit is screened with wire mesh and the newer units have remotely operated gates.

14. It cannot be emphasized too strongly that incineration does not eliminate waste disposal problems and may create pollution problems. A landfill site must be associated with every municipal waste incinerator for the disposal of solid residue and the comparatively large proportion of municipal waste which for various reasons cannot be incinerated. A landfill site for this purpose may require as careful location and operation as one used for untreated waste. Metallic residues which have been identified in incinerator ash include copper, lead, zinc, cobalt, cadmium, and chromium, manganese, nickel and arsenic. The concentration and the form of such material at an incinerator ash disposal site may in fact require greater precautions to prevent leaching into surface or underground waters.

15. The emission of air contaminants can be substantially reduced by suitable incinerator controls, but it is important to recognize the limitations, and the consequences of implementing them. For example, an electrostatic precipitator will remove a very high proportion of the particulate matter, scrubbers can be installed to remove sulphur dioxide and other chemical systems used to remove other gases but only at extremely high relative cost. Moreover, to a large degree, all that is being achieved by such measures is to change the air effluents back to the solid state, converting them once again to water and land pollutants. See Appendix 3.5.2 for a schematic diagram of an incineration operation.

16. The cost of controls can be reduced if it is practicable to utilize the heat developed either to produce steam for district heating or electricity. However, substantial problems are involved, and it appears at present unlikely that any such approaches will be found practicable in North America except in specific limited circumstances, as for example to serve a large compact high density development, possibly in association with improved waste handling methods such as vacuum collection.

17. Grinding prior to incineration may result in a number of advantages, though these remain to be proven. Storage and handling of the ground material is much simpler, and it should be possible to improve combustion and obtain a more stabilized ash.

Composting

18. One other basic technology for waste disposal is the composting of organic wastes, with which is usually associated to a greater or less degree the salvaging of some of the more readily reclaimable materials such as metals and glass. Its use in North America is at present extremely limited as markets are lacking for the material produced. This is essentially a soil conditioner with very little fertilizing value. It has been intensively investigated in Europe, and firm data is available on public health implications.

19. Windrow composting is carried out by piling the raw material, (ground garbage, sewage sludge or manure with a filler of sawdust, ground corn cobs, etc), adding liquid if necessary, and the heaps turned frequently to provide aeration. The operation takes between six to twelve weeks to provide a crude compost.

20. Mechanical composters provide a means to control temperature and the degree of aeration so as to optimize the process, and ensure pathogen kill. A stabilized compost can be produced in about five days. A number of types of proprietary equipment are available. See Appendix 3.5.3 which shows a schemactic layout of a composting operation.

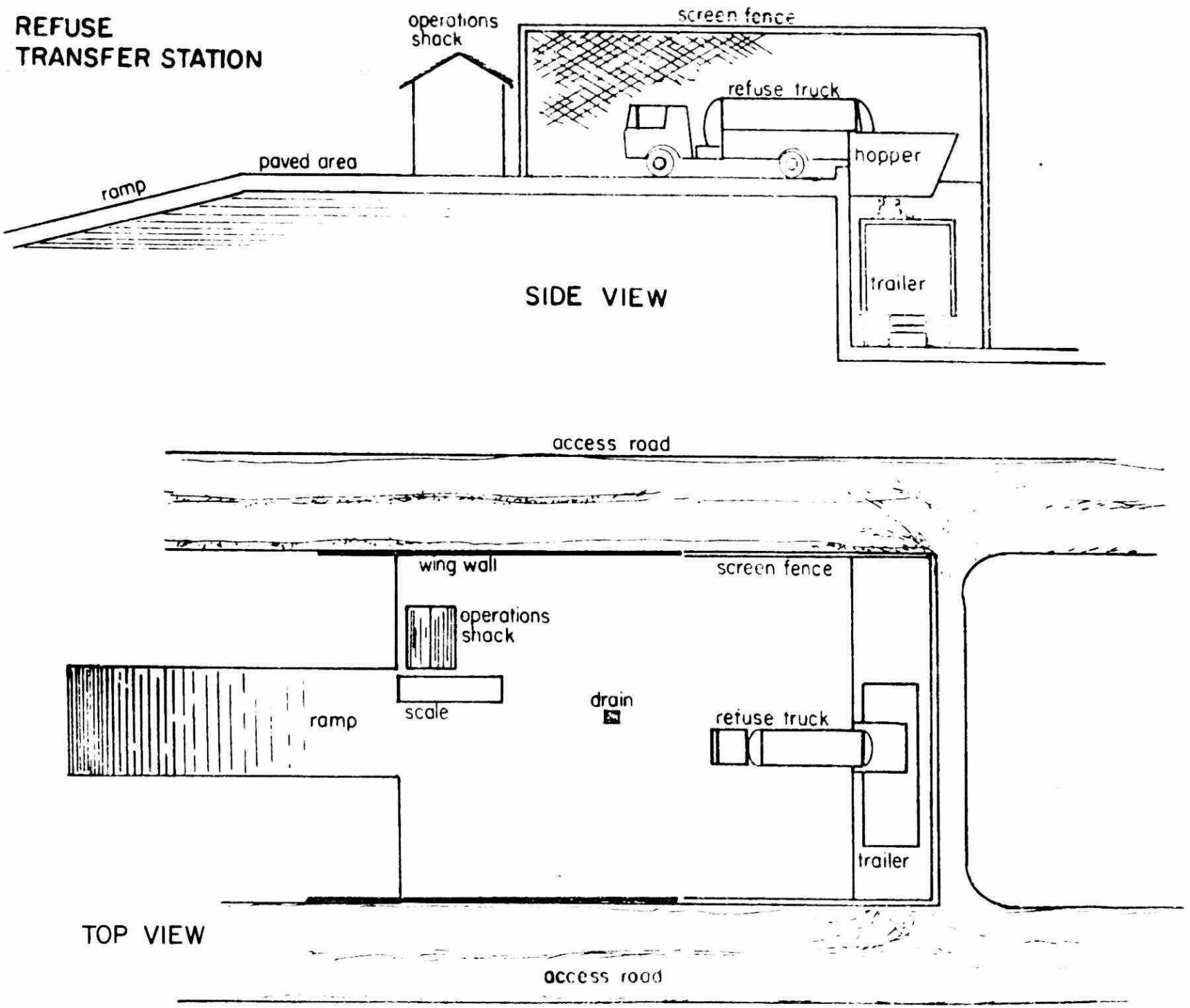
21. If municipal waste is composted, the product is of limited value even as a soil conditioner, unless further processing is carried out. To be sold commercially, it must be screened to remove all inorganic material, dried and pelletized, and suitable fertilizers may be added. Previous experience in North America shows clearly that this cannot be carried on as a commerical operation. The most promising approach is likely to be the preparation of crude compost and its use for landfilling to rehabilitate pits and quarries, mine tailing areas, and to provide humus cover where this is lacking. Even this use, however, is entirely dependent upon developments in bulk transportation, or heavy subsidization of transport costs.

22. Whether windrow composting or mechanical composting is used, the public health implications hinge largely on one critical factor, the temperature to which the treated material is raised, and the duration of its exposure. In any properly controlled process, the likelihood of survival of a pathogen, or of a fly larvae and eggs, appears to be remote. The same comment may apply to many resistent forms of parasites, though some doubt exists as to whether it is also applicable to pathogenic fungi.

23. Some aspects of the plant operation and the process effluents require further investigation for public health reasons. Obviously, the sources of the waste require careful investigation to determine accurately the composition of the material being handled, and the process operation carefully checked to determine the mode of dispersal of contaminants in the surrounding environment. For example, hazardous industrial wastes should obviously be excluded, and care must be exercised in accepting institutional wastes such as pathological waste from hospitals. Greater care would need to be exercised if undigested sewage sludge was to be composted with the organic municipal waste, or if a concentration of pesticides and herbicides was anticipated.

Summary

24. It will be obvious from the preceding paragraphs that it is not possible to make a general statement that any one method is better than any other method of treatment or disposal of waste, existing or proposed. The selection of the right method will be dependant on the circumstances, taking into account all of the factors involved including the degree of air, water and land pollution, health hazards, sociological factors, and of the use of resources and of energy, which in turn has a resource use and pollution penalty.


REFUSE
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SIDE VIEW
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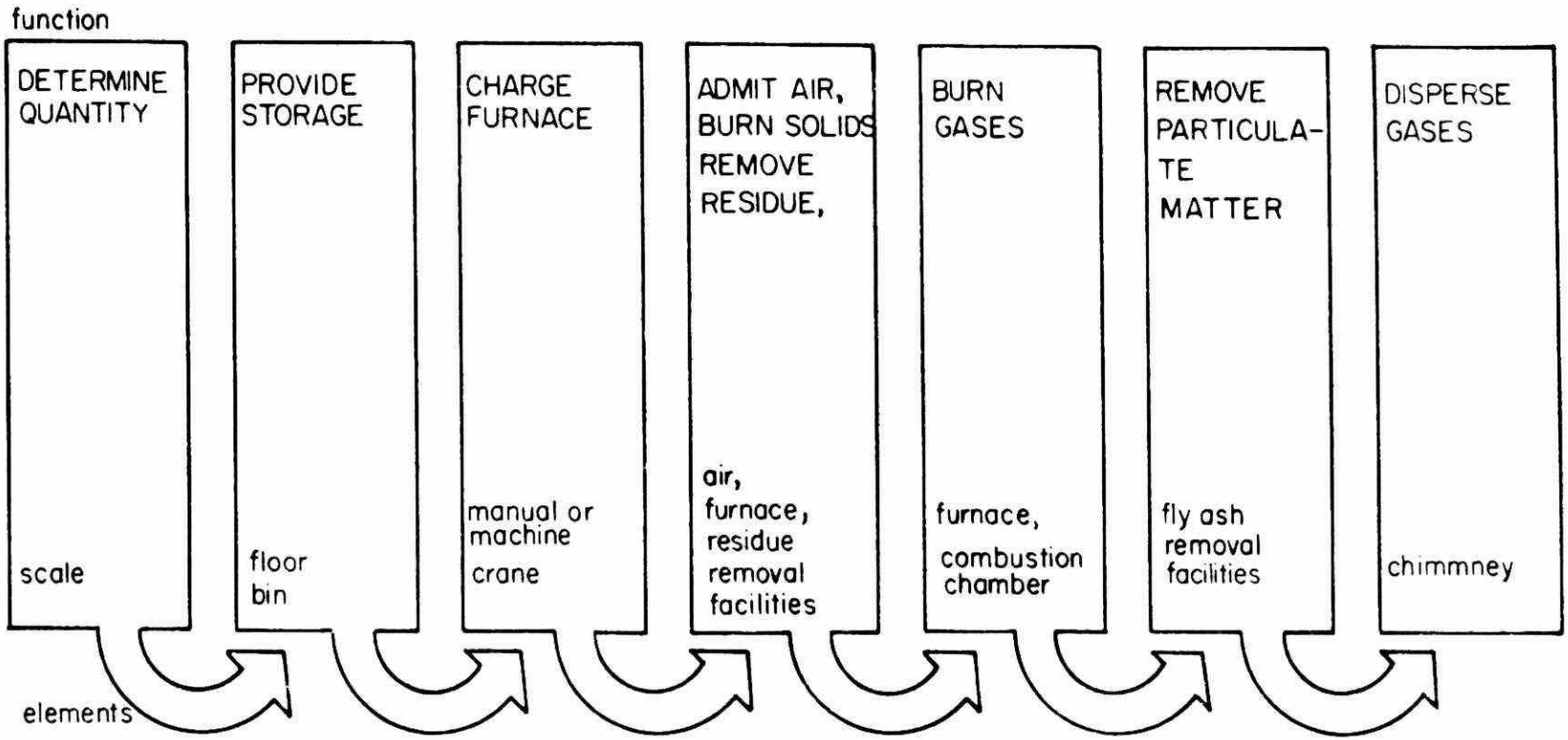
ramp
scale
drain
refuse truck
trailer
TOP VIEW
access road

INCINERATION MUNICIPAL REFUSE

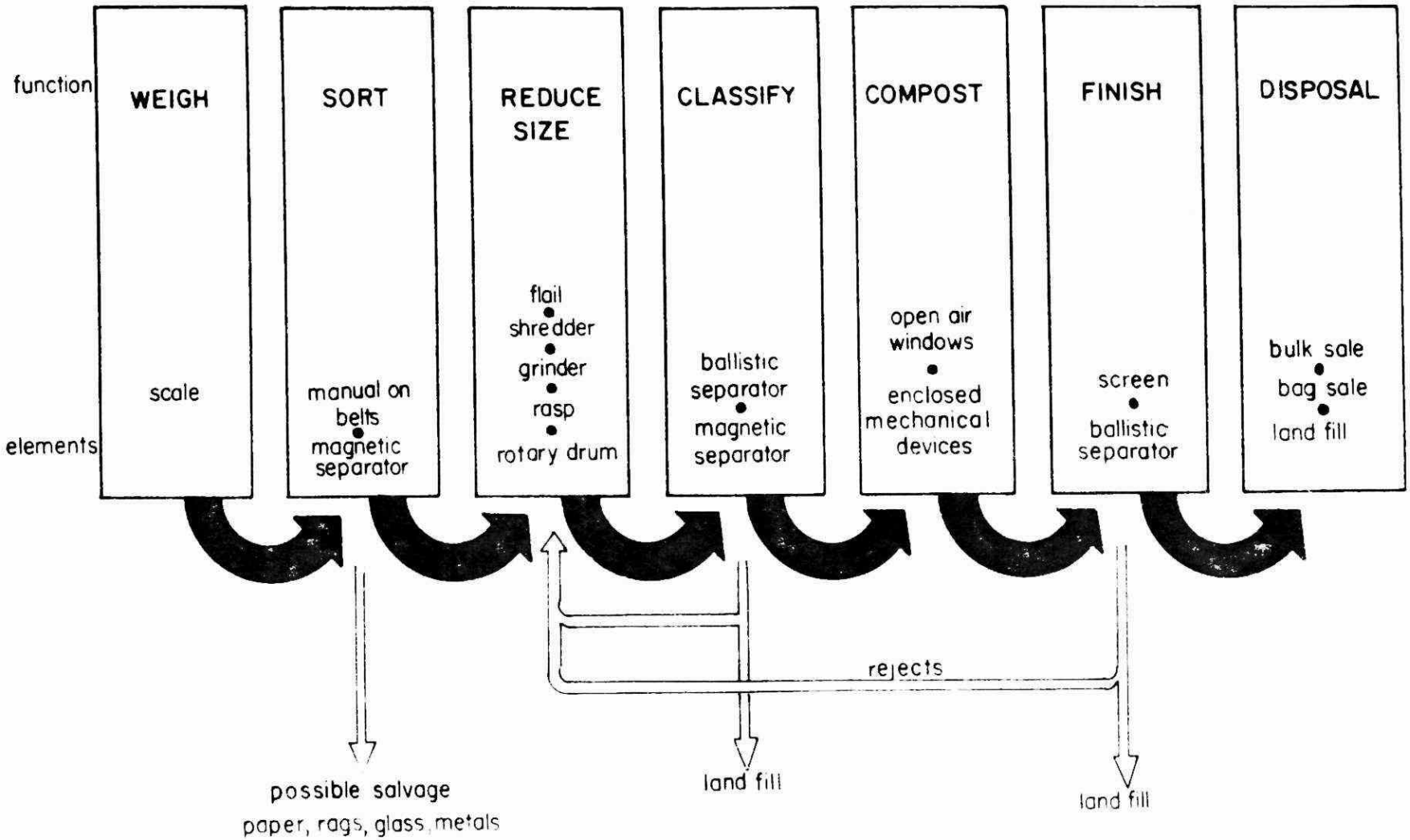


ULTIMATE DISPOSAL MUST BE PROVIDED FOR FLUE GASES(atmosphere)

FLY ASH,(sanitary landfill) NON BURNABLE RESIDUE (sanitary landfill)

COMPOSTING OPERATIONS

NOTE: the elements are in most instances alternatives: Not all of the operations are necessary for a composting operation



C H A P T E R 4

S P E C I A L P R O B L E M S

Article 1 LEACHATES

Article 2 GAS CONTROL

Article 3 WINTER OPERATIONS

Article 4 SITE CLOSURE

4.1

LEACHATES

1. Leachate is a liquid produced when moisture passes through refuse. It varies considerably in concentration and composition at different sites. In poorly located or operated sites, it may be seen seeping from the bottom of garbage-filled slopes. Its composition is influenced by:

   a. The type of refuse (organic, inorganic, degradable, nondegradable, soluble and insolobule.

   b. Temperature and soil properties, including alkalinity or acidity and moisture.

   c. The age of the site.

   d. Characteristics of incoming water

2. As the leachate passes through soil self purification occurs by percolation. Mineral content, Biological Oxygen Demand and Chemical Oxygen Demand are reduced in proportion to the depth of the soil. A sufficient depth of soil must be maintained as a barrier between the refuse and the groundwater table to minimize contamination. Leachate entering ground water will:

   a. Move principally in the direction of the ground water flow.

   b. Be diluted by the receiving waters.

3. To minimize the production of leachate and the possibility of contamination of groundwaters, the quantity of water passing through the refuse should be reduced by:

   a. Directing surface drainage away from the disposal area.

   b. Directing rainfall away from the disposal area by grading and covering the refuse.

   c. Placing the refuse at least 2 feet above the high groundwater level to protect the ground water.

4. To determine the suitability of a site for waste disposal, soil tests must be made and high groundwater levels located for it and the surrounding area. Data collected is evaluated and a design produced to meet the requirements. The design should include a monitoring system, which in the case of large disposal sites, might include peripheral wells. If monitoring should indicate that a leachate problem exists a correction program must be developed immediately. Attached as Appendix 4.1.1 are guidelines for the design of monitoring wells.

4.3

GUIDELINES FOR THE DESIGN OF MONITORING WELLS FOR SANITARY LANDFILL SITES

General

1. There should be flexibility to design, to achieve and to deal with a large number of variables. These include, depth and gradient of the water table, physical properties of the sub-surface materials, nature of the disposed material and the type of information desired. For example, near a groundwater discharge area there is an upward component to groundwater flow and shallow monitor wells may suffice. In a groundwater recharge area, there is a downward component to groundwater flow and the monitoring of several depths may be required. Because of these potential complexities, the number and location of monitoring wells at each site should be determined by qualified groundwater personnel.

2. Basically, monitoring wells should be similar in construction to water supply wells in that they include a protective casing, a screening device, a sanitary seal and that they are developed to an essentially sand-free condition.

Protective Casing

3. Plastic (ABS and PVC) and steel casings are commercially available. Both types have certain drawbacks. Steel casings may result in iron contamination of samples as well as conduciveness to increased bacterial breeding that, over a period of time, may plug the screen, The plastic casings are known to contain trace amounts of phenols which would introduce errors when monitoring for this parameter in a sanitary landfill.

4. Monitor wells constructed very near a landfill should be constructed of plastic to resist corrosion. Steel casings have the obvious advantage of strength. The use of casings with a minimum inside diameter of 4 inches is recommended. This size would facilitate sample recovery by pumping and well development.

Screening

5. The type of screening required for a monitoring well is also dependent upon several variables. Two types are commercially available; stainless steel and plastic. Selection would depend primarily on the nature of disposed wastes. Design specifications can be modified for either variety to suit the existing geological conditions. However, it is recommended that for all wells, the screen should be installed at least three feet below the lowest seasonal level of the water table. The length of screening can be adjusted to suit the amount of aquifer to be monitored and its permeability. Particle size analysis of aquifer material would determine the size of mesh for the screened portion of the well.

Sanitary Seal

6. To prevent down-hole contamination in monitoring wells from surface infiltration, it is recommended that grouting procedures be adopted. Cement or clay (usually bentonite variety) can be used for ground-surface enclosures of the casing as well as hydraulically sealing off both ends of the screen when monitoring a specific section of aquifer. The well casing should extend at least 3 feet above the surface exposure of the grout to allow easy identification and minimal down-hole contamination.

Well Development

7. All monitoring wells must be developed soon after installment to allow easy flow of sediment-free water from the aquifer to the well. Since most, if not all, instances of monitoring wells occur in relatively permeable sites initial overpumping will probably be adequate as a method of development. Submersible pumps (suited for casings with a 4" I.D.) could be employed in this regard. Compressed

air may be used as an alternative method.

Sampling Techniques

8. Samples are obtained using normal water sampling techniques. It is essential that samples be taken from the screened portion of the casing to avoid sampling stagnant water in the casing. An alternative method is to pump out the standing water before sampling but this can be a time consuming process if there are a number of monitoring wells. Down-hole brass samplers should be used with caution as metal contamination may occur.

Testing Parameters

9. Specific test parameters must be selected, based on the type of wastes being disposed of. These should be determined on the basis of the general classification of the wastes which, for this purpose, may be grouped as

a. Domestic refuse
b. Sludge (Sewage)
c. Commercial and industrial wastes (solids)
d. Liquid wastes.

Leachate Components

10. Below is a list of the components of a typical leachate which may be derived from a sanitary landfill and which are usually investigated in related monitoring programs:

Alkalinity ($CaCU_3$)	Nitrogen - NH_3)
BOD (5 day)	Nitrogen - Kjeldahl
Calcium	Nitrogen - NO_3
COD	Potassium
Copper	Sodium
Chloride	Sulfate
Hardness ($CaCO_3$)	TDS
Iron - Total	TSS
Lead	Total Phosphate
Magnesium	Zinc
Manganese	pH

As a word of caution, when examining alkalinity, Ca, Ma, and other metals: if sediment is contained in the sample, it should be filtered prior to analysis.

GAS CONTROL

1. Types of Gases - Decomposition of refuse in a waste disposal site produces a number of gases and a hazardous situation could result. At large sites a gas monitoring program is essential. Gases produced include:

   a. Carbon dioxide which is odourless and heavier than air in a confined area. It may replace oxygen causing men and animals to suffocate. If carbon dioxide enters ground water, it increases water hardness.

   b. Methane which in concentration of 3% to 15%, is highly explosive.

   c. Other gases. The type depends on the refuse deposited. For example, high concentrations of sulphur compounds produce significant quantities of hydrogen sulphide.

2. Decomposition Process - The decomposition processes which occur at a much slower rate when waste is dry, depend mainly on the action of bacteria and other micro organisms. There are two basic types of organisms - aerobic and anerobic.

   a. Aerobic organisms multiply and decompose refuse in the presence of oxygen and produce carbon dioxide.

   b. Anerobic organisms work in the absence of oxygen and produce mainly methane.

Since oxygen is initially present when refuse is deposited, the initial decomposition process is aerobic. However, when the oxygen is depleted, anaerobic organisms will become active. Aerobic and anaerobic fermentation take place in two stages: carbohydrates are broken down to organic acids by various (saprophytic) organisms, and later biochemical reactions convert these acids mainly to carbon dioxide and methane.

3. Movement of Gases - The gases move away from the disposal area in all directions due to pressure gradients, convection, and diffusion processes. Gas heavier than air,

such as carbon dioxide, moves downward, spreads laterally and displaces air from soil. Lighter gases, such as methane, usually rise and disperse into the atmosphere. Under conditions when upward movement is prevented, these gases can move laterally for significant distances, sometimes to adjacent properties. In these conditions explosive concentrations can build up. Nevertheless, methane levels will decrease near the ground surface if upward diffusion is not prevented. It will then quickly become diluted and undetectable.

4. Problem Correction - The correction of gas problems is usually more costly than the initial measures which will prevent their occurence. Where gases have become a problem, the following procedures have been used:

a. Vertical pipes have been installed to vent gases to the atmosphere.

b. At the site peripheries, trenches have been excavated and filled with gravel to intercept the lateral gas movement and vent the gases to the atmosphere.

c. In areas around closed sites where soils are very porous, trenches have been filled with impervious soil to prevent horizontal movement of gas.

4.8

WINTER OPERATIONS

1. Winter operations require advance planning for site preparation, staff quarter, equipment maintenance and snow control.

2. Site Preparation - Many problems occur as a direct result of failure to prepare an adequate disposal area in advance of winter. An area sufficient to hold more than the expected volume of refuse should be prepared in advance. Disposal areas for emergency dumping, stockpiles of cover material, areas for piling snow, turning areas for snow plows and snow fences to minimize and control drifting should also be completed before winter.

3. Location - When possible a well drained area with a southern exposure is chosen for winter operation. Such an area thaws first and dries out quickly, which permits a quicker clean-up and application of covering. Prevailing wind direction however, must be considered and a sheltered site may be preferred to one with a southern exposure.

4. Size - Up to twice the estimated required area for disposal should be prepared so that problems due to heavy snow and equipment failure may be minimized. If the summer disposal trench was 100 feet long for a five month operation, then the winter trench might be as long as 200 feet. If the area method is employed and 1 acre used in the summer, then 2 acres might be required in the winter. The area prepared, if not used during the winter, can be filled during the following summer.

5. Slope - Access to ramps and dumping edges should have a slight uphill grade. This is very important at sites where there is no supervision. Site users will not drive down an incline to dump for fear of getting stuck. If on-site roads to the disposal area have a slight uphill grade, dumping in undesirable locations can be minimized.

6. Sand Boxes - Sand boxes should be located on the site available to site users should they get stuck. This is most important at small unsupervised sites.

7. Cover Materials

a. Fine grained soils such as clays or clay sands cannot be excavated as a cover material in very cold winter conditions. In these circumstances the operator should either truck in and stockpile coarse grain sands or gravel for winter use, or spread and compact refuse without cover material. The large cell created during the winter should be covered as soon as the weather and soil conditions permit. Experience has shown that little settlement occurs. The method appears to have merit for small sites in clay areas.

b. The coarser grained materials such as sand and gravel are usually suitable for winter cover. Sands with a high moisture content may freeze but with reasonable care in material selection and stockpile location this can be avoided. In Northwestern Ontario several sites serving populations from 3,000 to 107,000 have operated successfully with temperatures of up to thirty below zero.

c. Frozen stockpile sand can form a dangerous "overhang" as it is removed. If available equipment cannot remove the danger, ditching powder can be used to blast out the hazard area. This problem should be considered at the preplanning stage.

8. Snow Problem - Snow fencing, snow ploughing, snow removing and storage are typical of the precautions that must be taken to avoid snow problems.

a. Snow fencing must be placed where local knowledge and experience indicate a need. The protection that hedges and trees provide should also be considered when the winter area is selected.

b. Snow ploughing and piling requirements must be considered in advance. The road should allow snow ploughs to operate effectively. A dumping area served by a loop road allows the snow to be

ploughed away from the dumping face. Additional passes can then create space for both dumping and driving. Some wide trenches with a slight grade at each end have been constructed for winter operations so that the trench can be ploughed along with the road. In this operation, the refuse must be well compacted prior to the snow fall so that little refuse is removed with the snow. This type of operation is unsuitable for clay soils due to ponding.

c. Snow Removal - At many sites snow has to be removed and piled after ploughing. The location of suitable areas for snow-dumps as well as planning for quick and economic snow removal should be carried out well in advance of winter. In selecting snow-dumping areas, the melting problems that will occur in spring should be borne in mind. Locations where the melt will flow into the garbage should be avoided. A snow fence around the pile area to contain papers after the snow melts is useful in controlling spring litter.

9. Emergency Dumping Areas - At some sites, emergency dumping locations are necessary. Most are close to the entrance and act as a holding area when the main area is out of use. However, small landfill areas near the entrance,which can be operated without removal of garbage to another location, are often used. These areas should be designated so that access can be denied when normal operations are resumed. Fencing, gating and temporary signs are necessary

10. Equipment Maintenance - In planning site operations, facilities for equipment repair and maintenance, housing for site personnel, winterizing of equipment, lighting, record keeping, hours of operation and daily routine should all be considered.

a. A heated garage is required for equipment maintenance. With proper heated maintenance facilities, equipment will last longer, give a better return for the investment and breakdown less often.

b. A daily equipment check should be performed using a checklist. Waste disposal site operations, particularly in winter, are extremely hard on equipment. Daily maintenance such as removal of wire and papers from rollers, radiator, belly skids, idlers and sprockets are even more necessary in winter. Daily checking involves:

(1) Check belts and liquid level in radiator before starting.

(2) Idling the engine for five minutes before moving.

(3) Check that all rollers are moving.

(4) Check frequently for wire etc. during the day.

(5) Check the machine completely at the end of the day.

(6) Record the daily checks made, together with running time and any repairs made.

c. A winter cab and heater is essential if the operator is to function at his best. He can stay on the job longer and accomplish more work.

11. Staff Facilities - Large sites require staff facilities. A minimum requirement would be a heated building, with lunch and washroom facilities. At smaller sites, a building with a space heater, table and a few chairs may be sufficient. Some sites have small portable buildings, sheds, or trailers which can be removed so that they are always near the disposal face.

12. Lighting - Because of shortened daylight hours, auxiliary lighting is needed. The continual movement of the dozer blade and the angle of the dumping face prevent the dozer's lights from being effective. Two solutions to the problem are available:

a. An independent generating system supplying flood lighting of the working area. This system includes a gasoline or diesel generator with portable light standards. The sizes of the generators range from small home or travel models to large trailer types. Large sites use the diesel models because of their fuel efficiency and greater durability.

b. The dozer's lights can be relocated at a higher level, as is done on snow ploughs. This is an effective practice at smaller sites, but it does require modifications to the machine. Alternatively, additional lights are attached to the roof of the machine.

13. Temporary Signs - As mentioned earlier, it is often necessary to establish temporary signs. Printed signs on movable standards should be prepared in advance. They can be easily replaced and are cheap to make.

14. Daily Routine - A planned daily routine for maintenance ploughing, record keeping, time for compaction, hauling, cover and compaction of cells ensures an efficient operation. Good timing and daily routines under adverse conditions do not just happen; they are the result of well thought out plans.

a. Experience will indicate the time required to maintain the site under all winter conditions. For example, if a six inch snowfall takes one hour for clearing prior to opening of the site, and during the winter, there is an average of twelve six inch snowfalls, then either extra hours must be worked or the opening hours must be reduced. The funds available for winter operations indicate which course should be followed.

b. Areas should be ploughed according to their priorities. Plan the areas to be ploughed first and those which require less priority.

c. The time required for hauling cover material must also be known; again records and experience will help to allow haulage during daylight. The hours of opening may need to be reduced so that the site can be closed at a reasonable hour.

15. Spring Clean-Up - Disposal sites may be unsightly in the spring. Papers previously hidden by the snow become exposed. The snowmelt occurs in northern areas over several weeks. The clean-up is therefore a continuing item and must be planned. Cleaning snow fences and other fencing of debris must be undertaken throughout the winter to reduce the work necessary in

spring. Location of winter operations on a southern slope or in a sheltered area also reduces litter.

16. Hours of Operation And Public Information

a. The hours that the site is open in winter are often reduced by weather conditions, particularly at smaller sites where the equipment must be used for other work. Some areas have large summer populations but limited winter populations, and in these cases hours of winter opening are not a problem. At large sites volumes of refuse do not drop significantly in winter and a reduction in opening hours is not possible. The hours of work for the operators, therefore, are often greater in winter than in summer.

b. It is usually a matter of a week or two before the public becomes aware of changes in the hours of operation. Dumping at the gate usually occurs. Changes of hours should not, therefore, be made until the public has been informed through the press, radio, notices and other methods of public information.

4.14

PROCEDURES FOR SITE CLOSURE

General

1. It might be assumed that, to close a site, all that needs to be done is to burn the garbage on it and leave the rest to nature. Nature, however, has its limitations and we must ensure that closure will not damage the environment. Our role is to help nature and to limit harmful effects.

2. To elminiate potential closure problems, the composition of waste as well as other factors are considered during site selection. These were discussed earlier. The tin cans, glass, cardboard, lettuce heard, orange peel etc. are really chemical compounds. By bacterial and natural chemical action they produce gases such as carbon dioxide, methane, ammonia, hydrogen sulphide and leachates, which have been discussed elsewhere. Site closure must ensure that:

   a. Penetration of water into refuse is limited to minimize the generation of leachate and gas.

   b. The site can be used for other purposes.

General Procedures

3. The closure of a site can be considered in four stages, planning, education, implementation and maintenance. The first step in any closure program must be to assess the problem and PLAN appropriately to ensure that the closure proceeds smoothly, the environment is protected, and that no harm comes to the people living in it. Once the assessment and planning stage is completed to ensure adequate safeguards have been included, it is then necessary to EDUCATE the general public.

4. The next general step in the closure procedure is to IMPLEMENT the plan. This includes the start-up of the new site, a rodent extermination program, grading, compacting and covering of the old site and the seeding of the site with appropriate vegetation to maintain the integrity of the cover material.

5. The final general requirement of a site closure procedure is to MAINTAIN it for a period of two years. This is necessary as several things may happen in the initial years after closure which may require periodic attention.

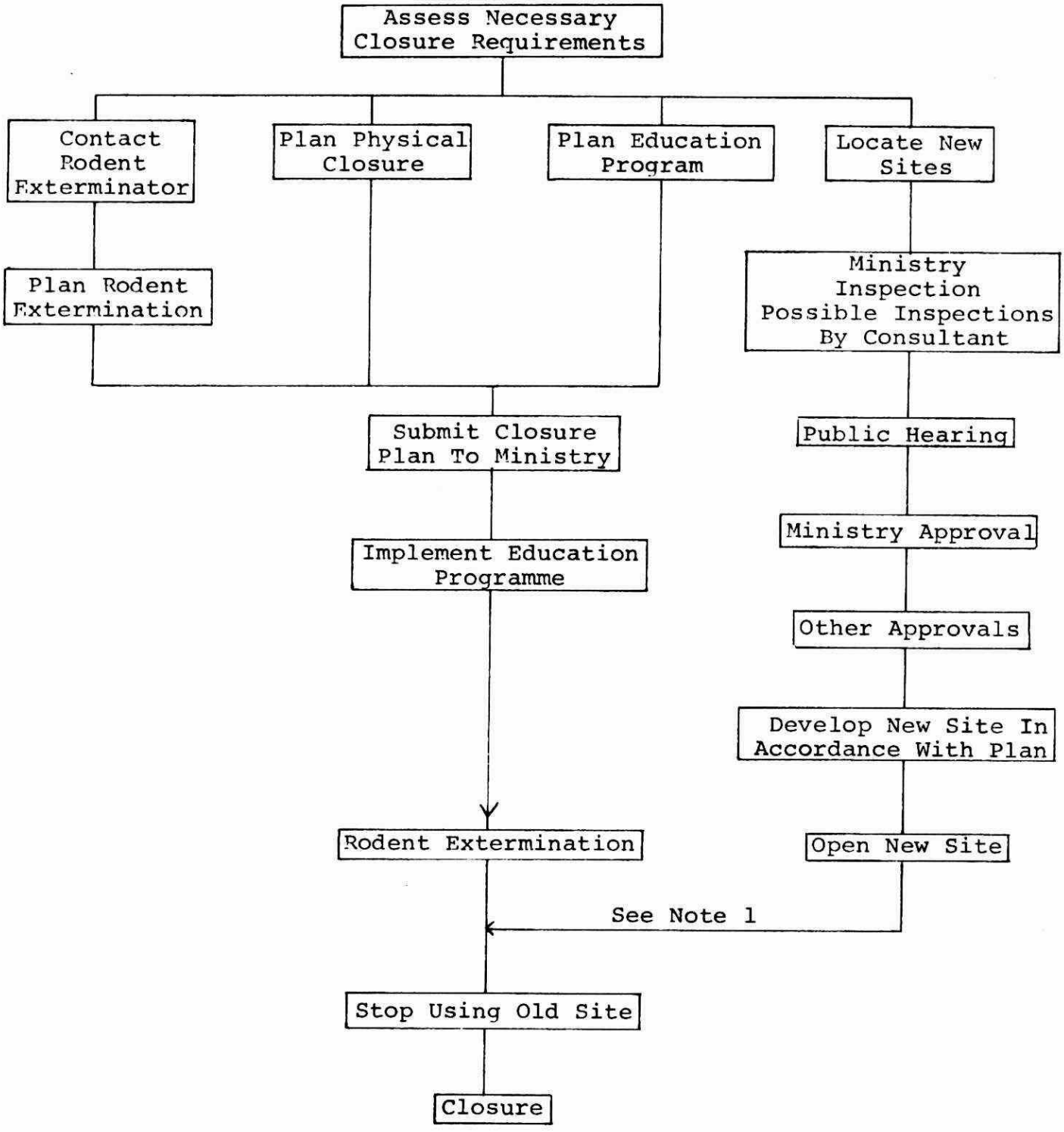
Planning

6. There are three basic requirements to consider when planning the closure of a waste disposal site. They are:

a. A new site
b. Rodent extermination
c. Physical closure of the old site.

The physical closure is the only requirement common to all closures as, in some cases, there may not be a need either for rodent extermination, or a new site. It will always be necessary to have an alternate disposal location but this may be an existing site rather than a new one.

7. The following diagram outlines a closure plan where all three requirements exist.



Note 1 Two to eight weeks should be allowed between the opening of a new site and ceasing the use of the old site to ensure that the public information program is effective.

8. The complete closure plan with dates must be submitted to the Ministry for comment and approval prior to the implementation. The purpose of this is to ensure that the programme is adequate and that the procedure and timing ensure protection of the environment and nearby residents. For example, if rodent control is started after dumping is stopped then the rats will have left the dump creating a nuisance and health hazard in the surrounding neighbourhood. Again to prevent infiltration of water into refuse after closure, certain steps may be necessary to ensure proper drainage. In some situations Ministry staff may be able to provide the necessary guidance; in more complex situations the operator may have to employ a consultant since the investigations can be costly, time consuming, and require special expertise.

Planning Physical Closure

9. Some sites will require substantial work. Planning will save both materials and man-hours and ensure that the Regulations have been met. The erection of fences to restrict access will discourage entry by both humans and animals. Signs, sometimes in both of Canada's official languages, should be placed at the entrance, and in the case of a landfilling site, along a perimeter road at approximately 200 foot intervals to indicate that:

(i) the site is closed
(ii) That poisons are being used to eradicate rodents and insects
(iii) That refuse must be taken to a new location.

Directions to the new site should be supplied. Closure should include grading, compacting and covering of the refuse with a minimum of two feet of compacted cover material. Revegation should be undertaken.

Implementation

10. There will be few problems, if the plan is carefully followed. Emphasis must be given to the public information program and if necessary to rodent extermination. Careful coordination is required between commencing use of the new site and stopping use of the old site. Covering, grading, compacting,

and seeding to maintain the integrity of the cover material at the old site should be accomplished as soon as possible after use ceases.

Education

11. A public information program will ensure that the closure of a disposal site will be carried out successfully. It will also reduce confusion, prevent physical and health hazards and reduce closure costs. Dumping at the gate after the site is closed will be minimized. Since human activity always results in garbage generation, it is imperative to keep the public informed about the planned closure and the alternate site.

12. The public information program can take many forms, from newspaper advertisements, T.V. and radio coverage to public meeting. Media announcements should be repeated for about 3 weeks but the duration of the program should be decided by those familiar with local problems. The methods used must be effective in reaching the public. Any constructive criticism received from the public should be considered. Some suggestions may save money or time.

Rodent Extermination

13. Rodent extermination should begin before dumping has stopped and should be carried out by a qualified exterminator. He should be requested to provide a 12 months warranty for his work. Signs should be posted at the roadway entrance, the main gate and around the site perimeter at 200 feet intervals, to indicate that poisons are being used. Daily supervision must be provided until the program is complete.

14. The program in outline progresses as follows:

a. Feeding stations are set up to keep rodents at the site, establish their food preferences and enable the exterminator to determine their numbers and establish locations where the poison feed stations will be set up. This phase takes two or three weeks.

b. Foods that the rats prefer are then spiced with fast-acting poisons, and placed in the feeding stations.

c. Fast-acting poisons are removed and the feeding stations are rebaited with preferred foods spiced with anti-coagulant poisons. This phase lasts three or four weeks.

d. The refuse is covered. If subsequent inspections reveal new burrows, poison gas may be used. Baiting stations, with non-poisonous foods, can then be set up again to establish the effectiveness of the program.

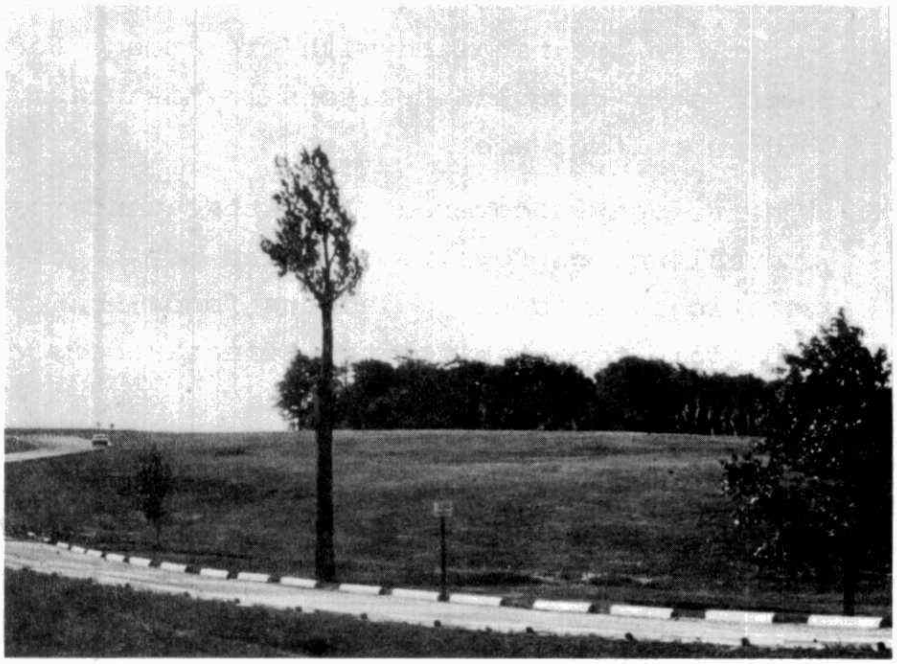
Maintenance

15. After a site has been properly closed it is then licensed for a further period of two years to ensure, among other things, that little water infiltrates into the garbage. Regrading of the surface, revegetation and elmination of run-off streams from the side slopes may be necessary during this period. In the regulations this is referred to as "maintaining the integrity of the cover materials".

16. Finally it should be noted that no use may be made of former waste disposal site for a period of 25 years, except with the agreement of the Minister. For most recreational uses the Minister's consent would be obtained very easily.

FINAL CLOSURE OF WASTE DISPOSAL SITES

(GRADED - COMPACTED - COVERED - SEEDED)



C H A P T E R 5

F U T U R E T R E N D S

Article 1 NEW PROCESSES

Article 2 MINISTRY OBJECTIVES

5.1

NEW PROCESSES

General

1. Due to the expanding population and the increased rate of refuse generation, waste disposal will, in the future, require more careful engineering, planning and a high level of practical expertise at disposal sites, to ensure that environmental contamination is minimized. The increases in man's comsumption of his resources and expanding population are parallel trends. Appendices 5.1.1 and 5.1.2 reflect these trends. Appendix 5.1.1 also shows what impact planning and engineering can have.

2. Society is coming to regard solid waste as a resource which can either be used for energy production or as a source of raw materials. Man now has the technology to do this, but not economically. Reuse, recycling and reclamation will provide the only rational ultimate solution to problems of waste management, not primarily to conserve resources, although this will be a valuable bonus, but as the only foreseeable means of keeping within reasonable limits the cost to the public.

3. It should be emphasized that all of the practices described earlier, except landfill, would be prohibitively expensive on a small scale operation. Only by concentrating the wastes from a large population at one disposal site will it be possible to give any consideration whatsoever to other processes. This implies a detailed study of the area, not only in relation to the municipal waste generated, but to other classifications of waste such as sewage sludge, agricultural and industrial wastes. It also requires detailed examination of the methods of handling and transportation of waste since in terms of overall cost this element accounts for three to four times the cost of disposal.

New Processes

4. None of the following developments are at the stage where they can seriously be considered as an alternative to presently available methods of treatment or disposal for

municipal wastes. Moreover, it cannot be repeated too frequently, that all wastes will require ultimate disposal into one of the sinks, air, land or water, with resulting pollution problems and health hazards which must be carefully investigated. As an example, the reclamation of newsprint separated from municipal waste is commonly assumed to be associated with a de-inking process so that the fibre can be reused for the same purpose. Consideration of the practicability of such a process will include not only the examination of cost, and effect on the forest industries and pulp and paper companies, but must take into account the water pollution which will inevitably result, the disposal of the solid wastes from the plant, and the energy requirement for the process, which itself has environmental implications.

5. Fluid Bed Incineration - This process involves incineration on a bed of sand "fluidized" by injecting air through the bottom of the bed. It has been used for industrial waste for some time, and has recently been developed specifically for use with sewage sludges. It is applicable where incineration of material of comparatively low combustibility and high moisture content is indicated. Its use in relation to municipal waste will probably be limited to wet processes such as fibreclaim, where composting is not acceptable.

6. Pyrolysis - This is the destructive distillation of organic materials by high temperature decomposition in the absence of oxygen. The products of this process include combustible gas, tars, and light oils. Some plants incorporating pyrolysis units are being designed, but the process is yet to be proven for municipal waste.

7. Hydrolysis - This process incorporates the hydrolysis of cellulose to produce sugars which in turn can be fermented to provide alchol. This method is even less advanced than the others discussed, and in view of the vast quantities of cheaper and more easily handled organic materials available for the production of alchol, is unlikely to be of any value whatsoever.

8. Wet Oxidation - Wet oxidation involves the combination of oxygen with organic material in water under high pressure and temperature. It has been used for the disposal of sewage sludges (the Zimmerman process). It has the advantage that the degree of treatment can be controlled to provide a product ranging from a completely stablized ash to a minimum degree of biological stabilization to simplify disposal, at reduced cost. Unless the process can be developed for the recovery of organic chemicals, its application to municipal waste will probably be limited except in special circumstances.

Recycling

9. A project being undertaken by the Province of Ontario as a joint venture with Metropolitan Toronto is the Resource Recovery Center with a capacity of approximately 200 tons per day. A prerequisite to recycling is shredding. In the shredding process refuse is reduced to a manageable size, such that its constituents will pass through a sieve with holes between 1" and 8" square, usually about 2" to 4" square. Magnets can then be used to remove ferrous metals. One way in which a part of the remainder can be used is to produce energy. Refuse can produce about a third of the energy in the form of either steam or electricity that can be produced by the same weight of coal.

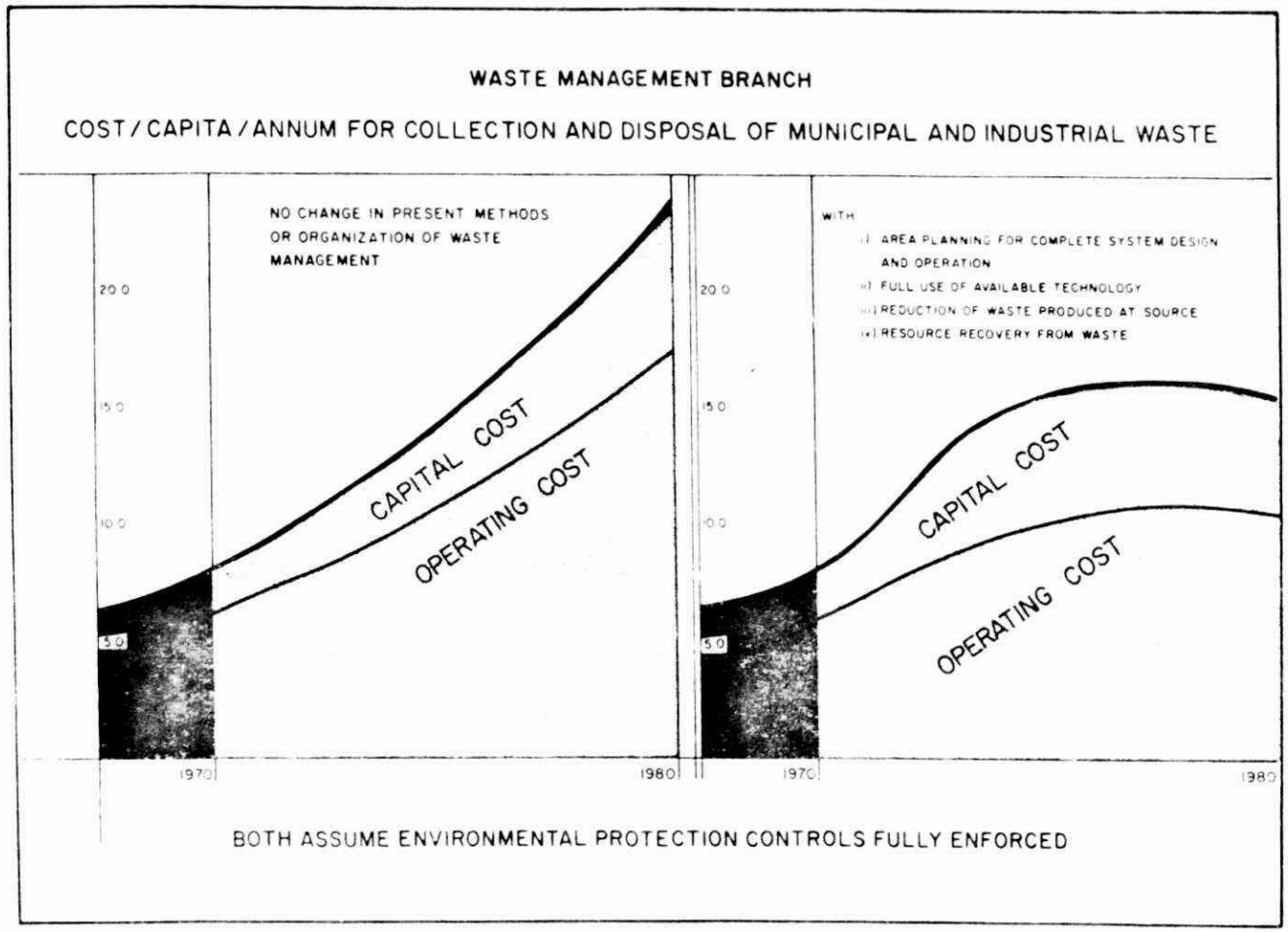
Waste As A Fuel

10. The "Watts from Waste" venture is jointly sponsored by the Ministry of the Environment, Ontario Hydro and Metropolitan Toronto; it demonstrates the use of refuse as a fuel. It will, in 1976, involve burning up to 1000 tons of refuse per day as an auxiliary fuel in one of the eight boilers at the Lakeview Generating Plant in Mississauga. Consideration is also being given to using this fuel in the production of cement.

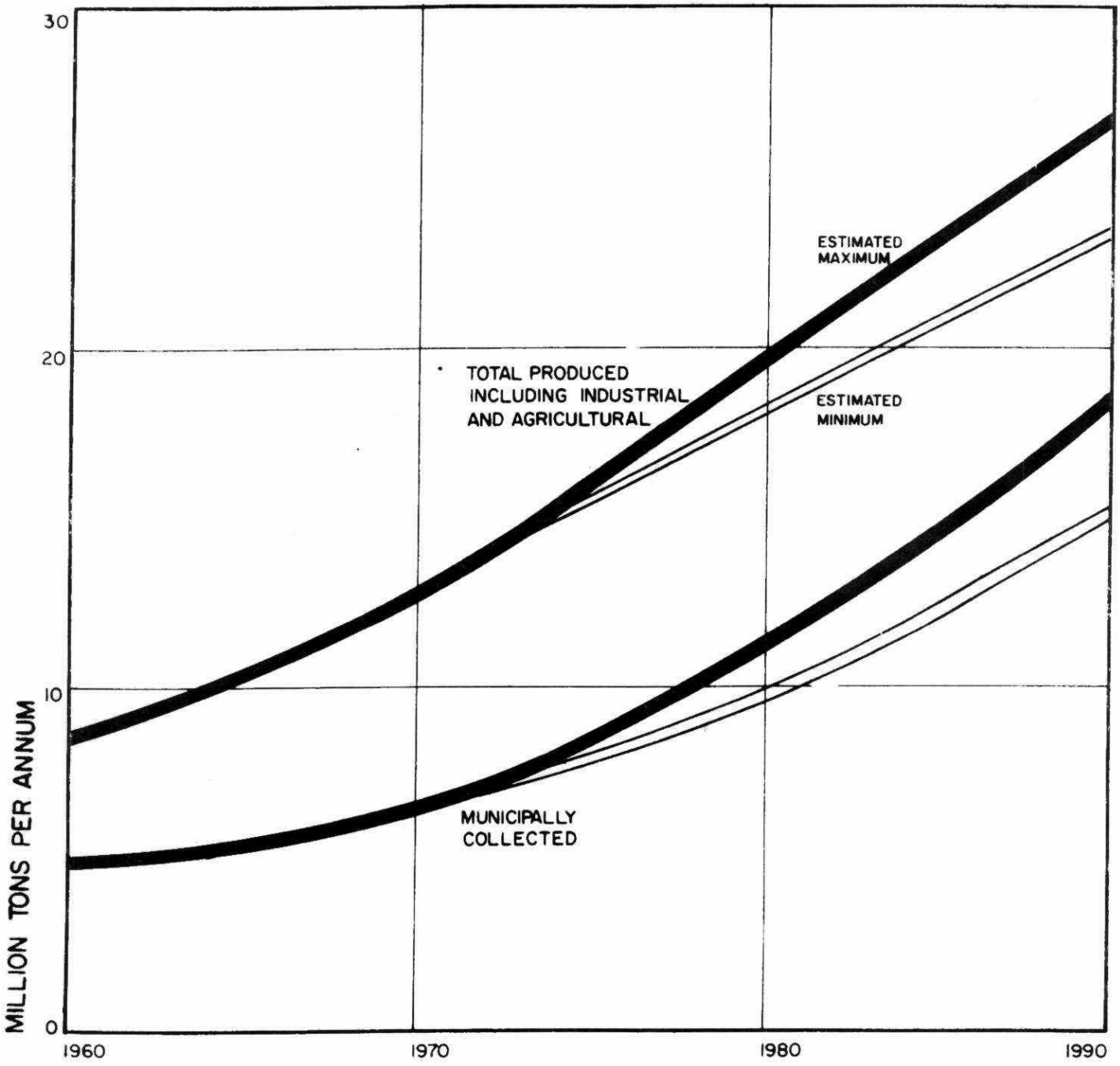
11. In the future using the refuse as a fuel it could be subjected to further separation processes which may allow the paper content to be recycled for secondary fibres and to allow reuse of other components such as glass, plastics, non ferrous metal, etc.

Waste Handling

12. One of the present problems in handling wastes material is its low density. Very large vehicles must be used to transport loads of low weight. Since large vehicles are expensive we may expect that vehicles with more sophisticated compaction equipment will be developed. Of course, the cost of the compaction equipment and the costs of purchasing and maintaining larger vehicles will have to be assessed against one another but this is a promising area for reductions on costs of solid waste handling.


WASTE MANAGEMENT BRANCH
COST / CAPITA / ANNUM FOR COLLECTION AND DISPOSAL OF MUNICIPAL AND INDUSTRIAL WASTE
NO CHANGE IN PRESENT METHODS OR ORGANIZATION OF WASTE MANAGEMENT
20.0
15.0
10.0
5.0
CAPITAL COST
OPERATING COST
1970
1980
WITH
(i) AREA PLANNING FOR COMPLETE SYSTEM DESIGN AND OPERATION
(ii) FULL USE OF AVAILABLE TECHNOLOGY
(iii) REDUCTION OF WASTE PRODUCED AT SOURCE
(iv) RESOURCE RECOVERY FROM WASTE
20.0
15.0
10.0
5.0
CAPITAL COST
OPERATING COST
1970
1980
BOTH ASSUME ENVIRONMENTAL PROTECTION CONTROLS FULLY ENFORCED

Municipal and total waste production in Ontario 1960 to 1990



PROGRAM OBJECTIVES

MINISTRY OF THE ENVIRONMENT

1. The goal of the Ministry of Environment is to provide the necessary direction and control over the production, handling and reuse or disposal of waste so as to minimize deleterious environmental effects, reduce cost to the public, and conserve natural resources. The Ministry program requires cooperation not only between its branches but also with other agencies in other Ministries of the Provincial Government.

2. The situation in 1971, when the Province, by legislation now incorporated in the Environmental Protection Act, took responsibility for the control of the waste management activities, was most unsatisfactory. More than 90% of the waste produced was disposed of by landfill. Generally, each municipality and many industries owned and operated a disposal site, or a number of sites, to handle only its own wastes. Many of such sites were open burning dumps, resulting in significant pollution and health hazards. Most waste management activities were completely unplanned, established and operated without regard to social or environmental offence. The first objectives of the program were:

a. to ensure that all new waste management sites and systems are located or established, and operated to the required minimum standards

b. to ensure that all existing sites and systems are upgraded to the required minimum standards, or replaced by assisting owners to develop such programs.

Appendix 5.2.1 illustrates the existing waste management system while Appendix 5.2.2 depicts a future system based on area planning and employing a variety of methods to reduce costs.

3. When waste management legislation came into effect in 1970, more than 2,100 disposal sites were in operation, of which less than 10% could be considered satisfactory. By October 1973, more than 500 of these had been closed and of the 1,600 operating sites, 65% were considered satisfactory.

4. Generally, the program has been characterized by flexibility in dealing with the very wide variety of types of operation, from the small rural dump to highly sophisticated landfills and incinerators. The emphasis has been placed on advising and working with municipalities and private operators to upgrade their operations, rather than depending upon legal action, which was only taken where serious problems could not be solved otherwise.

Area Planning Studies

5. The cost of waste disposal can only be reduced to an acceptable level by advance planning for complete waste management systems throughout a suitable geographical area. Apart from this aspect, it is realized that only by reducing the very large number of small individual operations, attaining the benefits and economies of scale, could new and improved treatment and disposal methods be introduced. The next step in the program, therefore, was to encourage this advance planning by the provision of 50% provincial grant. Studies are now in progress, generally covering entire counties or regions of the Province.

Financial Assistance Program

6. Despite the extra efficiency gained by the above measures, and by advances in collection, transportation and treatment technology, municipalities will still be faced with considerably increased costs; in particular, as more sophistocated techniques are adopted, vastly greater initial capital expenditure will be required.

7. The next step in the program is to encourage municipalities to implement the area planning studies by providing provincial financial assistance for the capital expenditures involved. This program is underway. It is hoped that it will have equally successful results as the similar program for the development of sewage treatment and water supply facilities. These programmes will result in a marked reduction in the total number of landfill disposal sites in the Province, principally due to the consolidation of a large number of small sites into a few very large central treatment facilities which can be improved in stages to resource recovery centers as reclamation processes and equipment become practicable. Appendices 5.2.1 and 5.2.2 illustrate this concept.

Reuse and Reclamation

8. In parallel to these approaches, the problems resulting from the continued uncontrolled increased in the quantities of waste produced, and the proliferation of types of material appearing in waste are being considered. This is linked with two major objectives of the goal - reduction of cost to the public, and the conservation of resources. In the view of the Ministry, the only ultimate solution to these problems will require a substantial reduction in the quantity of waste produced, and the use of every means possible to encourage the reuse, recycling and reclamation of waste.

9. There are a number of basic approaches to achieve this objective, and almost certainly action will have to be taken along all these lines to achieve success. This is a most significant point. It is a common misconception, held not only by the packaging industries but by the various consumer and anti-pollution groups, that the development of municipal reclamation plants will be complete solutions and that no other action will be required to attain the millenium.

a. Action has already been initiated by Government to reduce the quantity of waste produced, and to restrict materials which eventually become waste. Regulations under the Environmental Protection Act have prevented the use in Ontario of disposable plastic milk jugs and the 3-quart plasticised paper milk container. A report on milk containers has been submitted to guide future action, and another report on beverage containers is now being considered and will lead to Government action. The decision has been reached to establish a Solid Waste Advisory Committee to deal with the problems arising both from existing packaging and new types which may be proposed.

b. Separation at Source - A number of projects have been completely funded or partially subsidized to develop information on the feasibility of home separation of waste and the separate collection and reclamation of some commercial and industrial waste.

c. Central Reclamation Plants and Processing Facilities for Reclaimed Materials - A number of major projects are now being developed in this important field. In considering waste as a resource material , its potential as a source of energy is extremely promising, particularly in view of recent developments. Three different approaches are being considered.

   (i) Waste Incineration as a Source of Steam for District or Process Heating or Cooling - As a result of waste management area planning study for the Ottawa-Carelton region, the National Capital area and the Quebec Municipality of Outaouais, a central waste incinerator has been proposed for that area as well as the City of Toronto, producing steam which would be fed into an existing district heating network.

(ii) The Use of Pulverized Waste as a Fuel in Cement Kilns - Material in waste, such as glass and aluminum, may have value in cement production. The cement companies are very interested in this possibility and further development is being encouraged.

(iii) "Watts from Waste" - This approach, which involves burning pulverised waste, after the removal of the glass and metal fractions, for the production of power in generating station boilers, has been studied in detail. A joint project with Ontario Hydro and Metropolitan Toronto has been developed in detail.

10. The technology for the separation of reusable material from waste has not been developed to the same degree as the technology for the recovery of energy. The economics of the various processes which depend on the marketing of relcaimed materials is uncertain. The Ministry of the Environment has for this and other reasons developed the concept of a Resource Recovery Centre, which would incorporate a full-scale working reclamation plant. This will provide the capability of testing in practice any existing or new processes whose theoretical feasibility has been demonstrated and, equally important, will provide a reliable supply of reclaimed material for testing by industry, to determine its marketability either as separated or after further processing. This is a most important development. It will be unique to Ontario; no comparable facility is available anywhere else in the world.

Liquid Industrial Waste

11. The disposal of liquid industrial waste onto land is generally undesirable except in limited, specific circumstances. For some years, the Province has been encouraging the development of central treatment facilities for such wastes and three plants are now in operation. These are entirely private enterprise ventures, in which Government has no financial involvement.

12. Deep well disposal is now adequately controlled, and an innovative program is under way by which a Government controlled fund is being established to provide insurance against possible contamination of water supplies, however unlikely this may be.

Hazardous Wastes

13. Hazardous wastes form a limited problem and the quantities involved are usually comparatively small. Institutional waste, and particularly pathological waste, is a special case. A study has been completed in the Metropolitan Toronto area and here again the solution may lie in the establishment of a central disposal facility serving all the institutions in Metro-Toronto and the surrounding areas.

Organic Waste

14. Organic wastes which include agricultural and food processing wastes, and the sludge from sewage treatment processes, are a major concern. In this case, there is no question that the desirable approach is the return of this material and the organic fraction of garbage to the land as a soil conditioner. A major program has been included to encourage and control this method of utilization, though the program will be limited at this stage to processed sewage plant residues. There is some concern over the heavy metal content, but a comprehensive research program is now underway which will ensure that this does not become a significant problem.

Derelict Motor Vehicles

15. Since it is estimated that there may be more than 400,000 derelict vehicles scattered throughout Ontario, their return for reclamation would represent a substantial conservation of resources. A detailed program including legislative controls and Government assistance is being developed to achieve this.

16. The principal objective of the Ministry will be to carry out clean-up campaigns, surveys, and studies in selected areas to determine the most efficient and economic use of Government resources to achieve the long term objectives. These are:

a. to ensure that collection centers, transportation equipment and reclamation plants for abandoned vehicles are operated to the required minimum standards

b. to promote the establishment of collection centers for abandoned vehicles throughout Ontario

c. to promote the establishment of systems for collection, transportation and reclamation of abandoned vehicles to ensure their immediate recovery.

Litter

17. This is primarily an aesthetic problem though a significant health hazard results from broken glass in litter. The encouragement of container reuse may form an important part of the solution. It should be noted that litter consists almost entirely of packaging materials, and containers form the most objectionable elements, so that special efforts may be justified to reduce their appearance in litter. Littering control program development has three separate aspects,

1. educational, public relations and clean-up campaigns
2. adequate numbers of approved types of litter receptacles to be provided
3. control of beverage containers.

18. At present, two alternative methods of control are being considered, and a selection of one or the other will have substantial implications for the development of a control program since it will determine the degree of cooperation which will be provided by the packaging and beverage industries.

19. The long term aims of this activity are:

a. by regulatory action, to reduce the incidence of beverage containers and the hazard resulting from broken glass in litter

b. to promote a change in public attitudes which would make littering a socially unacceptable practice

c. to ensure that facilities such as litter receptacles and litter collection systems are made available in adequate numbers for use throughout Ontario

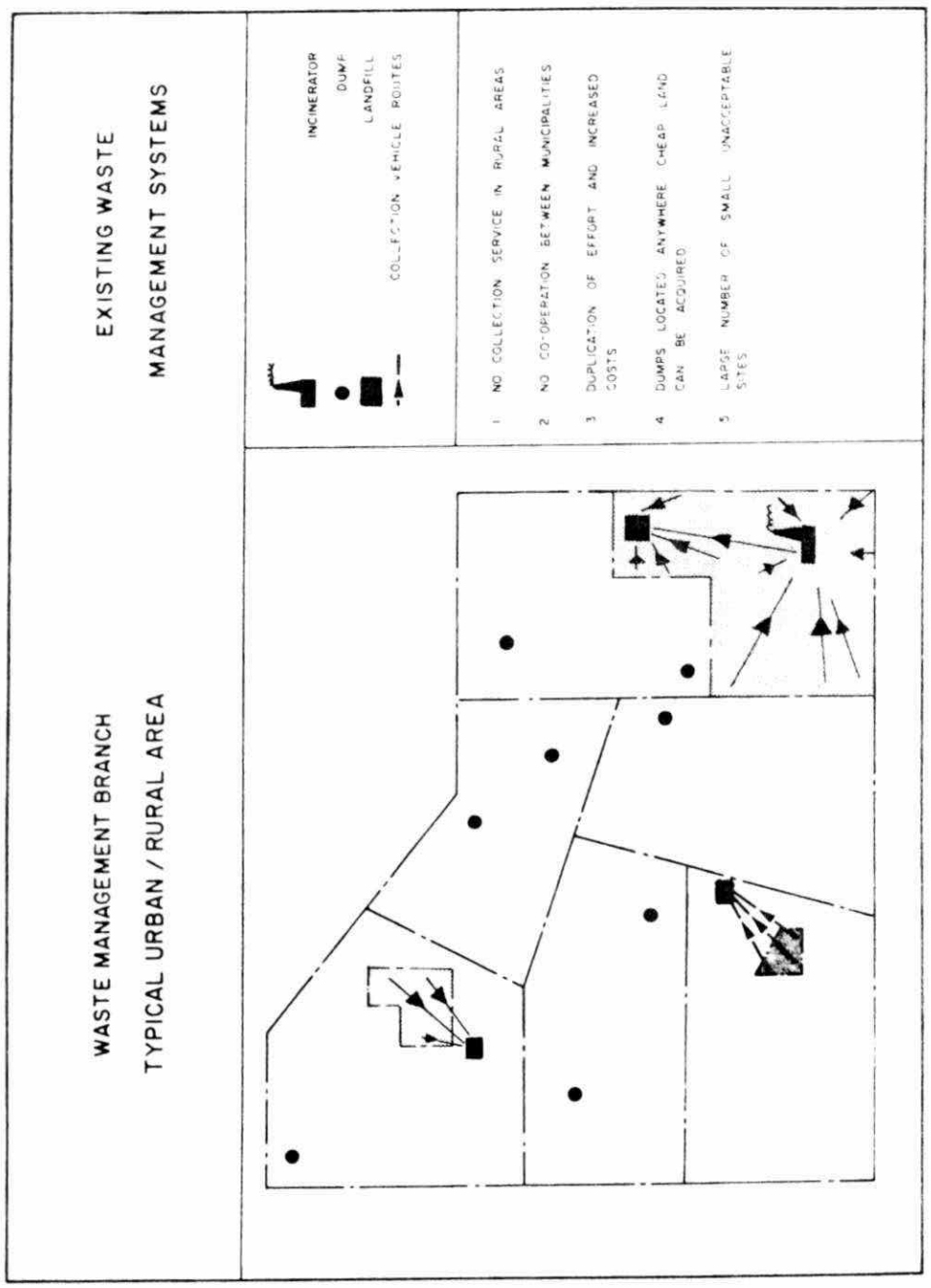
d. to promote the development and use of packaging materials and practices which will minimize the litter problem.

Planning and Special Projects

20. This is essentially a support program to provide data which can be utilized for the improvement of waste management practices, and the continued development of standards. In addition to providing in-put to other departmental planning functions, the Ministry will continue:

a. To make available information to municipalities, industries, private operators, other Government agancies and the public on waste management practices and costs in Ontario by the establishment of a data collection, storage and retrieval system.

b. To promote the utilization of new and improved technologies by carrying out the necessary research and development programs.


WASTE MANAGEMENT BRANCH
TYPICAL URBAN / RURAL AREA
EXISTING WASTE
MANAGEMENT SYSTEMS
INCINERATOR
DUMP
LANDFILL
COLLECTION VEHICLE ROUTES
1 NO COLLECTION SERVICE IN RURAL AREAS
2 NO CO-OPERATION BETWEEN MUNICIPALITIES
3 DUPLICATION OF EFFORT AND INCREASED COSTS
4 DUMPS LOCATED ANYWHERE CHEAP LAND CAN BE ACQUIRED
5 LARGE NUMBER OF SMALL UNACCEPTABLE SITES

WASTE MANAGEMENT BRANCH

TYPICAL URBAN / RURAL AREA

FUTURE WASTE

MANAGEMENT SYSTEM

TREATMENT FACILITY

TRANSFER STATION

BULK CONTAINER

COLLECTION VEHICLE ROUTES

TRANSFER VEHICLE ROUTES

1 - RURAL AREAS SERVED BY BULK CONTAINER

2 - TRANSFER STATIONS MAY INCLUDE BULK REDUCTION FACILITIES.

3 - TREATMENT FACILITY MAY INCORPORATE INCINERATION AND DISTRICT HEATING, RECLAMATION OR COMPOSTING, AND MAY INCLUDE TREATMENT OF INSTITUTIONAL WASTE AND SEWAGE SLUDGE.

4 - COST REDUCED BY -

(a) CONTAINERS IN RURAL AREAS

(b) MECHANIZED COLLECTION IN RURAL AREAS

(c) EFFICIENT LONG-HAUL TRANSPORTATION

(d) ECONOMICS OF SCALE

(e) AREA PLANNING AND COMPLETE SYSTEM DESIGN AND OPERATION

CHAPTER 6

MINISTRY PROCEDURES

Article 1 Certificates of Approval

CERTIFICATES OF APPROVAL

General

1. An application for a certificate of approval for a waste disposal site or a waste management system is submitted to the appropriate Ministry of the Environment office. The application is assessed by Ministry regional staff, who obtain comments from the interested agencies. It is then forwarded with recommendations to the Environmental Approval Branch.

2. The system for handling applications is designed:

   a) to provide a documented and structured process
   b) to ensure an opportunity for comment by other agencies.
   c) to establish accurate records of site and systems, applications and certificates.

Roles

3. Regional Staff - The prime role of the Regional Staff will be to recommend approval or disapproval of the application, the time period imposed, and conditions of approval for issuance. Further, the Regional Staff will be the prime field contact with the applicant and/or local officials to ensure compliance with the conditions of certificate approval and will make recommendations on re-issuing or revoking certificates. The Regional Staff normally will receive, review and forward the completed application with all supporting information, along with recommendations and reasons to the Environmental Approval Branch at Head Office.

4. Environmental Approvals Branch - The principle function of the Environmental Approvals Branch is to co-ordinate and co-relate all information relevant to the application and accept or reject the application. In cases where conditions are imposed or an application is rejected, preparation of notices to the applicant is required. It is also responsible for issuing the certificate or for notifying the applicant if a certificate is refused and of his right of appeal.

Procedures

5. Regional Staff - The Regional Staff will:

a. Provide applicants with the necessary forms and assist them in completing the applications. Appendix 6.1.1 is the application form for a Certificate of Approval for a Waste Disposal Site and Appendix 6.1.2 is the application form for supporting information. Appendix 6.1.3 is the application form for a Waste Management System and Appendix 6.1.4 is the supporting information form. (First page only, of each form included).

b. Receive and review applications.

c. Conduct a site investigation and complete a site investigation report. See Article 2, Chapter 6.

d. Make recommendations on the form attached as Appendix 6.1.5.

e. Forward to Environmental Approvals Branch, the application together with all supporting information, the site inspection report and the recommendations of the responsible manager.

f. Maintain files and records of applications and certificates issued. Copies of Certificates of Approval, Provisional Certificates and relevant correspondence will be forwarded to regional offices by the Environmental Approvals Branch.

g. On notification of the impending expiration of a Provisional Certificate of Approval by the Environmental Approval Branch forward, at least three weeks in advance of the expiry date and without further action by the applicant, recommendations and the appropriate information to the Environmental Approval Branch.

h. In cases where a hearing is mandatory or considered desirable on the recommendation of the regional staff or an appeal filed, the regional staff will represent the Ministry at the hearing.

i. Carry out periodic inspections for:

(i) updating and re-issuing certificates
(ii) establishing conditions of approval
(iii) enforcing the Act and Regulations.

6. The Environmental Approvals Branch - The Branch will:

a. receive and review applications from Regional offices.

b. co-ordinate and co-relate all information relevant to application and accept or reject application.

c. issue a certificate on such terms and conditions as deemed appropriate. See Appendices 6.1.7, 6.1.8, 6.1.9 and 6.1.10 for the form of a Certificate and a Provisional Certificate of Approval (Original only included)

OR

refuse issuance of a Certificate in which case the applicant is notified of the decision, with reasons and of his right of appeal.

d. issue certificate with copies to the applicant and the Regional Office.

e. maintain files and records of applications and certificates issued.

f. notify Regional Offices six weeks in advance of the expiration of a Certificate of Approval so that the Regional Staff can review the site and/or system in order to recommend re-issue or otherwise.

g. upon receipt of a regional recommendation related to the expiration of a Certificate, issue or refuse issuance of a new Certificate of Approval.

h. where a hearing is required or desirable the Environmental Approvals Branch will make an appropriate presentation with the request to the Environmental Hearing Board.

Ministry of the Environment

Ontario

FOR MINISTRY USE ONLY

File A —

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

IMPORTANT NOTE: This form must be submitted through the office of the Regional Engineer **See back of form for instructions for completing this form.**

1. Owner (Applicant) — Under the Environmental Protection Act and the Regulations, this application is made by: —

.....
(Name)

.....

.....
(Address)

.....

.....

2. Type of disposal site — For the Reissue / Issue of a Certificate of Approval for a ..... Site

3. Site location — Located

.....

.....

.....

.....

IF APPLICATION IS FOR REISSUE, COMPLETE SECTIONS 4 AND 5 (A OR B)

4. Previous Certificate details — Certificate / Provisional Certificate of Approval: — for this site was issued on: — No. ..... 197.....

5. Changes.

(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed)

.....

.....

.....

.....

(B) No change in use, operation or ownership of the site has occurred since the date of the original application. ☐

IF APPLICATION IS FOR ISSUE, COMPLETE SECTIONS 6 AND 7.

6. Operator. — The site will be operated in conformity with the Environmental Protection Act and the regulations by: —

.....
(Name)

.....

.....
(Address)

.....

7. Additional information — The required supporting information to this application is attached. ☐

Dated this day of 19	Signature of Owner—Applicant

Ministry of the Environment

Ontario

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

FOR MINISTRY USE ONLY

File A —

FOR REGIONAL OFFICE USE

Authorities consulted: OBJECTION NO OBJECTION

Inspection Record Forms attached Yes ☐ No ☐

Number of Forms _____

Regional Engineer's Report attached ☐

	REQUIRED	AVAILABLE
Ground Water monitoring	Yes ☐ No ☐	Yes ☐ No ☐
Surface Water monitoring	Yes ☐ No ☐	Yes ☐ No ☐

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

1. Site Details

APPLICANT

SITE LOCATION

TOTAL AREA OF SITE _____ ACRES	TOTAL AREA TO BE UTILIZED FOR WASTE DISPOSAL _____ ACRES
ANTICIPATED LIFETIME _____ YEARS	DISTANCE TO NEAREST WATERCOURSE _____ FT.
DISTANCE TO NEAREST POTABLE WELL WATER SUPPLY _____ FT.	DEPTH OF WELL NOTED AT LEFT _____ FT.
DISTANCE TO DWELLING _____ FT.	DISTANCE TO PUBLIC ROAD MEASURED FROM WORKING AREA _____ FT.
DISTANCE TO CEMETERY _____ FT.	DEPTH FROM ORIGINAL SURFACE TO BOTTOM OF WASTE _____ FT.

DEPTH FROM ORIGINAL SURFACE TO TOP OF FILL _____ FT.

GROUND CONDITIONS ENCOUNTERED MEASURED FROM ORIGINAL SURFACE

_____ FROM _____ TO _____

_____ FROM _____ TO _____

_____ FROM _____ TO _____

_____ FROM _____ TO _____

DEPTH TO WATERTABLE BELOW SURFACE _____ FT.	ON(DATE) _____ 19 ____

GENERAL DESCRIPTION OF SITE (LOCATION, TOPOGRAPHY, ETC.)

PROPOSED USE OF LAND AFTER SITE FULLY UTILIZED

2. Wastes to be disposed of comprise

DOMESTIC	%	AGRICULTURAL WASTE	%
COMMERCIAL	%	HAZARDOUS WASTE	%
INDUSTRIAL WASTE	%	HAULED SEWAGE	%
HAULED LIQUID INDUSTRIAL WASTE	%	*OTHER	%

*DESCRIBE

ORIGIN AND COMPOSITION OF PRINCIPAL COMPONENTS OF WASTE (OTHER THAN DOMESTIC AND COMMERCIAL)

3. Quantities

TOTAL TONS PER DAY	TOTAL GALLONS PER DAY

ESTIMATED ☐ OR MEASURED ☐

SITE OPENED _____ DAYS FROM _____ TO _____

POPULATION SERVED

NAMES OF MUNICIPALITIES SERVED

OFFICIAL PLAN ☐ ZONING BY-LAW ☐

SITE LAND ZONED	ADJACENT LAND ZONED

EQUIPMENT OWNED ☐ RENTED ☐

4. The following documents are attached

PREPARED BY

DATED

SIGNATURE OF OWNER (APPLICANT)

Appendix 6.1.3

Ministry of the Environment

Ontario

FOR MINISTRY USE ONLY

File A —

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE MANAGEMENT SYSTEM

IMPORTANT NOTE: This form must be submitted through the office of the Regional Engineer **See back of form for instructions for completing this form.**

1. Owner (Applicant) — Under the Environmental Protection Act and the Regulations, this application is made by: —

.....(Name)

.....(Address)

.....

.....

Telephone No.....

2. Type of system — For the Reissue / Issue of a Certificate of Approval for a .....System

3. Municipalities and agencies served — Serving:-

.....

.....

.....

.....

IF APPLICATION IS FOR REISSUE, COMPLETE SECTIONS 4 AND 5 (A OR B)

4. Previous certificate details — Certificate / Provisional Certificate of Approval: — for this system was issued on: — No. ....197....

5. Changes in system.

(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed): —

.....

.....

.....

.....

.....

(B) No change in the use, operation or ownership of the system has occurred since the date of the original application. ☐

IF APPLICATION IS FOR ISSUE, COMPLETE SECTIONS 6, 7, 8 AND 9

6. Waste disposal sites forming part of the system — The system includes: — .....Waste Disposal Sites

Applications for Approval attached: — ☐ Number.....

Certificates of Approval previously issued Nos.

.....

7. Other facilities — Other facilities forming part of this system include: —

.....

.....

Continued on attached sheet

8. Operator — The facilities described in Item 7 will be operated in conformity with the Environmental Protection Act by: —

.....(Name)

.....(Address)

.....

.....

9. Additional information — The required supporting information to this application is attached. ☐

Dated this.....day of.....19.....

.....

Signature of Applicant

Ministry of the Environment

Ontario

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

FOR MINISTRY USE ONLY

File A —

FOR REGIONAL OFFICE USE

Authorities consulted: OBJECTION NO OBJECTION

Inspection Record Forms attached Yes ☐ No ☐

Number of Forms _____

Regional Engineer's Report attached ☐

	REQUIRED	AVAILABLE
Ground Water monitoring	Yes ☐ No ☐	Yes ☐ No ☐
Surface Water monitoring	Yes ☐ No ☐	Yes ☐ No ☐

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

1. Site Details

APPLICANT

SITE LOCATION

TOTAL AREA OF SITE _____ ACRES	TOTAL AREA TO BE UTILIZED FOR WASTE DISPOSAL _____ ACRES
ANTICIPATED LIFETIME _____ YEARS	DISTANCE TO NEAREST WATERCOURSE _____ FT.
DISTANCE TO NEAREST POTABLE WELL WATER SUPPLY _____ FT.	DEPTH OF WELL NOTED AT LEFT _____ FT.
DISTANCE TO DWELLING _____ FT.	DISTANCE TO PUBLIC ROAD MEASURED FROM WORKING AREA _____ FT.
DISTANCE TO CEMETERY _____ FT.	DEPTH FROM ORIGINAL SURFACE TO BOTTOM OF WASTE _____ FT.

DEPTH FROM ORIGINAL SURFACE TO TOP OF FILL _____ FT.

GROUND CONDITIONS ENCOUNTERED MEASURED FROM ORIGINAL SURFACE

_____ FROM _____ TO _____

_____ FROM _____ TO _____

_____ FROM _____ TO _____

_____ FROM _____ TO _____

DEPTH TO WATERTABLE BELOW SURFACE _____ FT.	ON(DATE) _____ 19 ___

GENERAL DESCRIPTION OF SITE (LOCATION, TOPOGRAPHY, ETC.)

PROPOSED USE OF LAND AFTER SITE FULLY UTILIZED

2. Wastes to be disposed of comprise

DOMESTIC	%	AGRICULTURAL WASTE	%
COMMERCIAL	%	HAZARDOUS WASTE	%
INDUSTRIAL WASTE	%	HAULED SEWAGE	%
HAULED LIQUID INDUSTRIAL WASTE	%	*OTHER	%

*DESCRIBE

ORIGIN AND COMPOSITION OF PRINCIPAL COMPONENTS OF WASTE (OTHER THAN DOMESTIC AND COMMERCIAL)

3. Quantities

TOTAL TONS PER DAY	TOTAL GALLONS PER DAY

ESTIMATED ☐ OR MEASURED ☐

SITE OPENED _____ DAYS FROM _____ TO _____

POPULATION SERVED

NAMES OF MUNICIPALITIES SERVED

OFFICIAL PLAN ☐ ZONING BY-LAW ☐

SITE LAND ZONED	ADJACENT LAND ZONED

EQUIPMENT OWNED ☐ RENTED ☐

4. The following documents are attached

PREPARED BY

DATED

SIGNATURE OF OWNER (APPLICANT)

Appendix 6.1.5

Ministry of the Environment

Ontario

FOR HEADOFFICE USE	
File	A
Issue	
Re-issue	
Up-grade	

RECOMMENDATION OF REGIONAL ENGINEER

NOTE: This form shall be submitted by the Regional Engineer to Head Office along with the application form and all supporting information.

APPLICANT

FOR THE WASTE DISPOSAL SITE ☐

LOCATED AT

FOR THE WASTE MANAGEMENT SYSTEM ☐

SERVING

DATE APPLICATION RECEIVED

FILE A

ISSUE Certificate of Approval ☐ Provisional Certificate of Approval ☐

PROVISION CERTIFICATE TO EXPIRE ON

CONDITIONS

CIRCULATE TO

REASONS FOR CIRCULATION

Refuse Application ☐ Revoke ☐ Suspend ☐ Refuse to re-issue ☐ Cert. No.

REASONS

DATE | SIGNED Regional Engineer | REGION

MOE 1421 7774

Ontario

Ministry of the Environment —

Certificate No.

CERTIFICATE OF APPROVAL
FOR A
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Certificate of Approval is issued to:

for the Site

located

subject to the following conditions:

This Certificate expires on the ..... day of ....., 19 .....

Dated this ..... day of ....., 19 .....

.....
DIRECTOR,

MOE 14-205

6.9 Appenix 6.1.7

Ontario

Ministry of the Environment —

Provisional Certificate No.

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

for the Site.

located

subject to the following conditions:

This Provisional Certificate expires on the ..... day of ....., 19....

Dated this ..... day of ....., 19.....

DIRECTOR,

MOE 14-201

6.10 Appendix 6.1.8

Ontario

Ministry of the Environment —

Certificate No.

CERTIFICATE OF APPROVAL
FOR A
WASTE MANAGEMENT SYSTEM

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Certificate of Approval is issued to:

for the Waste Management System serving

and including the approved waste disposal sites and facilities listed below.

SITE CERTIFICATE No.	EXPIRY DATE

and

subject to the following conditions:

This Certificate expires on the ..... day of ....., 19.....

Dated this ..... day of ....., 19.....

.....
DIRECTOR,

6.11 Appendix 6.1.9

MOE 14-206

Ontario

Provisional Certificate No.

Ministry of the Environment —

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE MANAGEMENT SYSTEM

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

for the Waste Management System serving

and including the approved or provisionally approved waste disposal sites and facilities listed below.

SITE CERTIFICATE No. EXPIRY DATE

and

subject to the following conditions:

This Provisional Certificate expires on the ..... day of ....., 19.....

Dated this ..... day of ....., 19.....

DIRECTOR,

MOE 14-200

6.12

Appendix 6.1.10

ASSESSMENT OF LANDFILL SITES PROPOSAL

Purpose of Assessment

1. A sanitary landfill site is essentially a project which requires planning and the application of sound engineering techniques. The application of these principles and techniques can insure acceptable and economical waste disposal practices that will not harm the environment. The assessment of a proposal for a landfill site provides a basis for establishing the Ministry position to be taken at a public hearing and/or for issuing a Certificate of Approval or a Provisional Certificate of Approval.

2. Assessment of a proposal requires a careful analysis of the information submitted by the owner (as discussed in Appendix 2.1.1 to Chapter 2 Article 1 and Chapter 6 Article 1) a review of Ministry files and records to obtain background information on the site and a physical inspection of the proposed location. The information gathered forms a basis for future inspections.

PROCEDURES

3. Office Review

Before carrying out an inspection of the site, the environmental officer should make a preliminary assessment of the proposal based on the plan submitted and information available from Ministry sources.

(a) Evaluation of Plan. In reviewing the plan the environmental officer should evaluate the following points in the proposal:

(i) The estimated quantities and types of waste to be handled.

(ii) Size of site and estimated life of site.

(iii) Site plan illustrating design of site, screening, controls for leachate and gas production.

(iv) Locations where waste is generated in relation to haul distance, access roads.

(v) Landfill method to be employed, availability or source of soil cover, personnel and equipment to be employed.

(b) Having assessed the Plan

The environmental offier obtains additional information from files, records and other sources. These include:

(i) Office records of area soil and water conditions, topography and other sites. Topographic and soils maps provide data on contours, drainage patterns and soils condition, which can be compared to those in the proposal. While well records provide information on water table, advice from a hydrogeologist may be necessary on geological factors and ground-water level. Appendix 6.2.1 outlines guidelines for evaluating sites with respect to water resources.

(ii) Official plans, zoning by-laws, to determine if the proposal conforms.

(iii) Local health and municipal authorities, Ministry of Natural Resources and conservation authorities.

4. Site Inspection

(a) The purpose of the site inspection is to confirm the information provided in the proposal and that obtained in the office review, as well as to obtain additional information. During the inspection by the environmental officer, the owner or his representative should be present.

(b) In any waste disposal site proposal, soil conditions drainage patterns and groundwater level are of particular importance. If information on soil conditions and depth to high water table is inadequate, the applicant should be required to dig inspection pits at least five feet deep (measured from the proposed level of the bottom of the refuse). To assess the effect of the groundwater table and the geology of the area, a visit by a hydrogeologist may be necessary. In some cases his evaluation may result in a recommendation that a monitoring well system is required. See Appendix 6.2.2.

(c) Other factors which must be considered during a site inspection include:

(i) Land use adjacent to proposed site.

(ii) Proximity of surface water bodies, potable water supplies, cemeteries.

(iii) Means of screening the site from public view.

5. Evaluation and Reporting

(a) Evaluation of the data obtained during the office review and site inspection must lead to a recommendation to:-

(i) approve the proposal

OR

(ii) approve the proposal conditionally or subject to the applicant changing the plan

OR

(iii) disapprove the proposal.

(b) The prompt preparation and submission of a report is essential. The conclusion and recommendations recorded in the report must be supported by the data and other information. This is of particular importance to the approving authority when conditional approval or rejection of the proposal is recommended.

GUIDELINES FOR EVELUATING SANITARY LANDFILL SITES

1. General - Information useful in evaluating the suitability of sanitary landfill sites with respect to water resources is assembled below. The information is based on hydrologic principles and general geographic and hydrologic conditions in Ontario. The following are general guidelines for landfill site selection as well as the requirements for detailed studies.

2. Considerations - The leachate from wastes that enter the ground may appear in ground-water aquifers and eventually in streams or other points of ground-water discharge. If such discharges lead to unsatisfactory water quality, it may be necessary to intercept them and provide for treatment and/or collection and disposal. Observation wells should be installed near the site to monitor any changes in ground-water quality so that early decisions can be made to halt disposal and/or provide for the correction of adverse environmental effects.

SITE FACTORS

3. Hydrologic

a) Precipitation and Runoff - Precipitation, surface runoff across a site and ground-water, flowing through or into a site, cause the generation of leachate which can spread beyond the boundaries of the site.

b) Surface Water - The receiving water body in the discharge zone should have adequate capacity at critical low flow periods to dilute any impaired discharge so that the ecological balance is not upset and users of the water are not adversely affected.

c) Hydrogeology - The presence of a major potable aquifer near a site should preclude its use without engineering works to collect and treat leachate. Under certain hydrogeologic conditions, there is little hazard of polluting ground and surface waters. These include:

(i) the absence of significant aquifers;
(ii) the presence of thick, fine-grained overburden materials and a thick, unsaturated zone;
(iii) location near, but not within, a ground-water discharge zone;
(iv) Slight to moderate permeable deposits to allow some infiltration of the leachate, stablization during percolation, and reduction of ponding or excessive surface runoff.

Some of the above hydrogeologic considerations represent compromises designed to afford protection is sought for only one of these water sources, only certain favourable conditions must be met.

4. Geographic

(a) Ground-Water Users - There should be no users of ground-water between the site and the discharge zone for ground-water moving beneath the site that will be adversely affected by leachate migration. Alternate adequate sources of water supply must be available for down gradient water users in the event that the prediction model for pollutat migration fails.

(b) Land Forms - Flood plains and areas subject to intensive erosion are unsuitable sites.

HYDROGEOLOGY REPORT

5. The report should contain a description of the effects of the operation on the ground-water regime and any related surface-water regime. The detail or degree of description will be dependent on:

a) magnitude and type of operation;

b) location of operation relative to local residences and ground-water users;

c) susceptibility to contamination and significance of local water-bearing formations and related streams;

d) significance of effects.

6. Depending on the above the report should contain:

a) detailed comments on the surficial geology of the study area with an accompanying map of the deposits;

b) comments on the availability, suitability and use of cover material should be outlined along with such characteristics as permeability and exchange capacity;

c) an outline of the bedrock geology where applicable including a description of the major rock types and their structure. Stress should be laid upon any known faulting and fracturing in the rock and the relationship to percolate movement. Maps and cross-sections would assist in the presentation of this information, if practicable.

d) a map locating wells and aquifers in the study area. The map should also indicate the proximity of surface water users to the proposed landfill.

e) a determination of the depth and elevation of the water table or potentiometric surface for each aquifer and an outline of local and regional ground-water and surface-water flow directions. Comments on the volumes and velocities of flow should be included if practicable;

f) an estimate of the amount of water and leachate expected to flow through and immediately under the landfill operation;

g) an outline of the natural quality of ground-water and surface water in the area and the anticipated quality changes due to the land-fill operation;

h) an outline of a program to install and sample monitor wells in the study area. Such wells should be sampled prior to and after land filling operations begin to determine any ground-water quality changes. These wells should be constructed in such a manner that they can be pumped to obtain representative samples;

i) an assessment of the acceptability of the proposed landfilling operation, its impact on the ground-water and surface-water environments and the necessity to treat leachate.

GUIDELINES FOR THE DESIGN OF MONITORING WELLS FOR SANITARY LANDFILL SITES

General

1. There should be flexibilty to design for the purposes of economy and the need to deal with specific conditions determined by a large number of variables. These include, depth and gradient of the water table, physical properties of the subsurface materials, nature of the disposed material and the type of information desired. For example, near a ground-water discharge area there is an upward movement of ground-water flow and shallow monitor wells may suffice. In a ground-water recharge area, there is a downward movement to ground-water flow and the monitoring of several depths may be required. Because of these potential complexities, the number and location of monitoring wells at each site should be determined by qualified ground-water personnel.

2. Basically, monitoring wells should be similar in construction to water supply wells in that they include a protective casing, a screening device, a sanitary seal and are developed to an essentially sand-free condition.

Protective Casing

3. Plastic (ABS and PVC) and steel casings are commercially available. Both types have certain drawbacks. Steel casings may result in iron contamination of samples as well as conduciveness to increased bacterial breeding that, over a period of time, may plug the screen. The plastic casings are known to contain trace amounts of phenols which would introduce errors when monitoring for this parameter in a sanitary landfill.

4. Monitor wells constructed very near a landfill should be constructed of plastic to resist corrosion. Steel casings have the obvious advantage of strength. The use of casings with a minimum inside diameter of 4 inches is recommended. This size would facilitate sample recovery by pumping and well development.

Screening

5. The type of screening required for a monitoring well is also dependent upon several variables. Two types are commercially availability stainless steel and plastic. Selection would depend primarily on the nature of disposed wastes. Design specifications can be modified for either variety to suite the existing geological conditions. However, it is recommended that for all wells, the screen should be installed at least three feet below the lowest seasonal level of the water table. The length of screening can be adjusted to suit the amount of aquifer to be monitored and its permeability. Particle size analysis of aquifer material would determine the size of mesh for the screened portion of the well.

Sanitary Seal

6. To prevent down-hole contamination in monitoring wells from surface infiltration, it is recommended that grouting procedures be adopted. Cement or clay (usually bentonite variety) can be used for ground-surface enclosures of the casing as well as hydraulically sealing off both ends of the screen when monitoring a specific section of aquifer. The well casing should extend at least 3 feet above the surface exposure of the grout to allow easy identification and minimize down-hole contamination.

Well Development

7. All monitoring wells must be developed soon after installation to allow easy flow of sediment-free water from the aquifer to the well. Since most, if not all, instances of monitoring wells occur in relatively permeable sites initial overpumping will probably be adequate as a method of development. Submersible pumps (suited for casings with a 4" I.D.) could be employed in this regard. Compressed air may be used as an alternative method.

Sampling Techniques

8. Samples are obtained using normal water sampling techniques. It is essential that samples be taken from the screened portion of the casing to avoid sampling of stagnant water in the casing. An alternative method is to pump out the stagnant water before sampling but this can be a time consuming process if there are a number of monitoring wells. Down-hole brass samplers should be used with caution as metal contamination may occur.

Testing Parameters

9. In selecting specific test parameters to determine leachate components, the type of wastes being disposed of at the site must be considered. For this purpose, they may be grouped as

(a) Domestic refuse
(b) Sludge (Sewage)
(c) Commercial and industrial wastes (solids)
(d) Liquid wastes.

Leachate Components

10. Below is a list of the components of a typical leachate which may be derived from a sanitary landfill and which are usually investigated in related monitoring programs:

Alkalinity ($CACu_3$)	Nitrogen - NH_3)
BOD (5 day)	Nitrogen - Kjeldahl
Calcium	Nitrogen - NO_3
COD	Potassium
Copper	Sodium
Chloride	Sulfate
Hardeness ($CaCO_3$)	TDS
Iron - Total	TSS
Lead	Total Phosphate
Magnesium	Zinc
Manganese	pH

When examinging alkalinity, Calcium, Magnesium and other metals, if sediment is contained in the sample, it should be filtered prior to analysis.

INSPECTIONS OF OPERATIONAL LANDFILL SITES

General

1. A program of inspection of waste disposal landfill sites should be carried out on a continuing basis. The purpose of these inspections is to:-

(a) Maintain a dialogue between site operators, owners and the Ministry staff.

(b) Establish and maintain a high level of efficiency of operation, reducing environmental problems.

(c) Keep up-to-date records for statistical and information purposes.

(d) Recommend renewal of Certificates of Approval.

There may be occasions when special inspections are required. These may include gas production investigations, waste surveys and proposals for disposal of special waste.

Procedures

2. Prior to carrying out a physical inspection of the site operation, the environmental officer should review existing records including the application for a Certificate of Approval and previous inspection reports. Any condtions attached to the Approval should be carefully noted.

3. Inspections must be complete, cursory examination only encourages poor operations. The environmental officer should first walk the perimeter of the site to determine problems related to run-off, leachate and littering. Examination of the site should consider conditions resulting from:

(a) Access roads including litter control.
(b) Signing
(c) On site roads.
(d) Littering.
(e) Blowing paper control.
(f) Site operations including compaction cover.

Reporting

4. Attached as Appendix 6.3.1 is a guide to a site inspection report which is completed by the environmental officer *during* the visit. A copy of the report, when typed, or a letter summarizing the findings, is forwarded to the licensee.

5. If the inspection results in the requirement for corrective action, the environmental officer must meet with the owner to discuss and obtain agreement on the action to be taken and the date by which these measures are to be completed. If corrective measures are not undertaken or completed in accordance with the agreed schedule, recommendation should be made to higher authority on actions to be taken under Part II or PartV of the Environmental Protection Act 1971. These might include a recommendation to impose new conditions on the Certificate, to revoke the license, to issue a control order.

Ontario

MINISTRY OF THE ENVIRONMENT 6.27

Chapter 6
Article 3
Appendix 6.3.1.

FILE No.
DATE

Re: _____

On _____ the above waste disposal site was inspected by

_____ of the District Office_____.The following observations were made:

	YES	NO
1. Site Open		
2. Refuse being deposited at time of inspection		
3. Access Controlled		
4. Site Supervised		
5. Adequate Signs Posted		
6. Site open in accordance with posted signs		
7. Covering Equipment on Site		
8. Burning		
9. Scavenging		
10. Operating According to Conditions on Certificate of Approval		

	SATIS FACTORY	UNSATIS FACTORY
11. Compaction of Refuse		
12. Cover of Refuse		
13. Housekeeping of 1) Site		
2) Adjacent Property		
14. Working Face		
15. Number of Dumping Areas		
16. Segregation of Refuse		
17. Segregated Material Disposal		
18. Rodent and Vector Control		
19. Means of Controlling Litter		

Operation Discussed with _____ _____ _____
(NAME) (POSITION)

COMMENTS

RECOMMENDATIONS

Action Taken

PREPARED BY	APPROVED BY

NOTES
ON
COMPLETION OF REPORT

OBSERVATIONS

1. Site Open - A "yes" or a "no" answer is provided for landfill sites. This item is not normally applicable to dump sites.

2. Refuse Being Deposited at Time of Inspection
This information provides useful background data when read in conjunction with other comments by the environmental officer.

3. Access Controlled - At landfill sites (but not at dumps) there should be a lockable gate and a fence restricting vehicular access. A gate and a fence may be desirable at some dump sites.

4. Site Supervised - Is there some one present who is in charge of the site and is he providing adequate supervision?

5. Adequate Signs Posted - Are there signs indicating dumping areas and site operating and safety procedures?

6. Site Open in Accordance with Posted Signs -
Signs should be posted at the entrance indicating the site owner, hours of operation, and the types of refuse that are not accepted. Is the site being operated in accordance with the signs?

7. Covering Equipment on Site - self-explanatory

8. Burning - If burning is taking place at the time of inspection, what type of wastes are being burned? If permissable wastes are being burned is the fire sufficiently remote from the other wastes and are they being burned in a safe manner? If unauthorized waste such as putrescibles or tires are burning, has there been any attempt to extinguish the fire? Is there a smoke violation?

9. Scavenging - Scavenging is not permitted, as it disrupts the orderly operations and creates health hazards.

10. Operating According to the Conditions on the Certificate of Approval - Operations are required to be carried out in accordance with any conditions or restrictions placed on the site. These are stated on the Certificate of Approval. For municipal sites, the Clerk will have a copy of the Certificate.

11. Compaction of Refuse - An assessment of the effectiveness of compaction is required.

12. Cover of Refuse - All wastes must be covered with at least 6" of cover material on a regular basis as required by the Ministry or by the Certificate. Both the top of the cell and the open face should be covered. After a site or part of it has been closed an additional 2 feet minimum of compacted cover is required.

13. Housekeeping

(a) Site - If segregation of wastes is practiced, are the areas distinct from each other? This is important not only from the aesthetic point of view, but facilitates reclamation and leads to more economic use of cover material. Is the site littered? Are there other problems?

(b) Adjacent Property - Is the adjacent property affected by the disposal site? e.g. blowing paper, solid wastes, bags of refuse, leachate, etc.

14. Working Face - The smaller the population the smaller the face length should be. If the height and the slope are too great to permit adequate coverage and compaction, they should be reduced. A slope of 1 vertical to 3 horizontal is normally safe for equipment to work on, even under adverse weather conditions.

15. Number of Dumping Areas - The number of dumping areas depends on the types of refuse being segregated. Putrescible wastes, wood wastes, bulky wastes, tires and other items may be in separate areas.

16. Segregation of Refuse - Segregated wastes should be accumulated in separate and distinct areas. Burning of clean dry wood wastes is only permitted in an area remote from the other wastes.

17. Segregated Material Disposal - Have wastes accumulated in excessive amounts? Segregated wastes should be covered, burned or removed before there are unduly large amounts.

18. Rodent and Vector Control - Rodent, fly and other infestations must be immediately controlled by a program carried out by a licensed exterminator. Rodent control, on a regular basis, is required by the regulations.

19. Means of Controlling Litter - Usually litter problems arise because of unsatisfactory coverage. The trench method provides better control than the area method. Portable fences can also help.

COMMENTS

20. If observations by the environmental officer indicate areas where operation must be corrected, additional information should be provided in the "Comments" section of the report. This then forms the basis for recommendations on corrective measures or actions.

RECOMMENDATIONS

21. The section should include recommendations on:

    (a) Details of what corrective measures all required to eliminate present and avoid future violations.
    (b) Renewal of Certificate of Approval with or without additional conditions.
    (c) Non renewal or cancellation of Certificate of Approval.

ACTION TAKEN

22. Under this section the environmental officer will record the results of his discussion with the site owner including the details of the program of corrective actions to be undertaken.

C H A P T E R 7

G L O S S A R Y O F T E R M S

Article 1 Definition of Types of Waste Disposal Sites

Article 2 Definition of Common Terms

7.1

DEFINITION OF WASTE DISPOSAL SITES

1. In Section 28 (e) of the Environmental Protection Act, 1971, waste disposal sites are defined as any lands, or lands covered by water upon, into or through which, or building or structure in which, waste is deposited on or processed and any machinery or equipment or operation required for the treatment or disposal of waste. Regulation 824 defines specific types of waste disposal sites. For completeness these are defined below.

Composting Sites

2. Composting means the aerobic decomposition of organic matter by bacterial action for the production of stabilized humus. One of the advantages claimed for proper compositing is that microorganisms such as salmonella, etc. are destroyed.

Derelict Motor Vehicle Sites

3. This is a site in which three or more derelict motor vehicles are not enclosed in permanent buildings. A "derelict" motor vehicle is one which is inoperable and has a market value as a means of transportation that is less than the cost of repairs required to put it in operating condition.

Dump Sites

4. A dump is a waste disposal site where waste is deposited without cover material being applied at regular intervals. In practice, most dumps have modifying conditions which up-grade them into sub-standard landfills. Cover is usually required, by modifying conditions on the Provisional Certificate of Approval on a regular basis depending upon the population served and the locality. Section 13, Sub-section 2 of Regulation 824 details the locations where dumps may be established and shall not be established. Section 12 provides the regulations for their location and operation.

Grinding Sites

5. Grinding means the treatment of waste by uniformly reducing waste to particles of controlled maximum size. A substantial volume reduction is often achieved by this type of process, which is important in transportation, burying and reclamation. Grinding is an important feature of many reclamation sites since it also facilitates the mechanical separation of the waste constituents into marketable fractions. One other advantage claimed is odour reduction. In parts of the United States insect and rodent problems are said not to be experienced when ground garbage is landfilled without the application of cover material.

Incineration Sites

6. Incineration means the treatment of waste by controlled burning, including measures for limiting air pollution, to reduce the volume of waste and to leave it in more stable form for disposal.

Individual Waste Management Site

7. While this phrase does not appear in the Act or Regulations, Section 29 of the Act provides that the storage or disposal by any person of his domestic wastes on his own property is exempted from the provisions of the Act and Regulations unless the Ministry is of the opinion, based upon reasonable and probable grounds, that such storage or disposal is or is likely to create a nuisance.

Landfilling Sites

8. Landfilling means the disposal of waste by deposit, under controlled conditions, on land or on land covered by water and includes compaction of the waste into a cell and covering the waste with cover material at regular intervals. Variations of this type of site will be described in depth by other speakers. Section 10 of Regulation 824 describes the conditions necessary to develop and operate a landfill site.

On Site Incinerators

9. These are incinerators located in buildings or structures used principally for functions other than waste management, e.g. for the production of energy in the form of heat, electricity, gas or hydraulic power. These sites are exempted from the Environmental Protection Act. A pit where brush or wood wastes are burnt does not come within this category of waste disposal site.

On Site Garbage Grinders

10. These are grinders which are used for the treatment of waste that is subsequently discharged as raw sewage and which are located in buildings or structures used principally for functions other than waste management. These sites are exempted from the Environmental Protection Act.

Organic Soil Conditioning Sites

11. On these sites processed organic waste is incorporated into soil to improve its characteristics for crop or ground cover growth. Processed organic waste means waste that is predominantly organic in composition and has been treated by aerobic or anaerobic digestion, or other means of stabilization, and includes sewage residue from sewage works that are subject to the provisions of the Ontario Water Resources Act. This material is often known as digested sewage sludge. Night soil is not a processed material. Solid residues from crops at canning stations and cheese factories may be "processed organic wastes".

Packing and Baling Sites

12. Packing and Baling means the treatment of wastes by its compression into blocks or bales and binding or sheathing the blocks with wire, metal, plastic or other material.

Transfer Stations

13. These are locations used for the purpose of transferring waste from a collection vehicle to another carrier for transfer to another waste disposal site. Transfer Stations may be used in conjunction with any of the preceding types of site.

Wells

14. In certain cases, especially in Western Ontario, wells of adequate depth, usually 2000 feet or greater, which allow the brines to penetrate to the lower portions of the earth's crust may be used for waste disposal purposes.

DEFINITION OF COMMON TERMS

Access Road
This is a road that leads from a public road to a waste disposal site.

Aerobic Decomposition
Decomposition in the presence of oxygen.

Anaerobic Decomposition
Decomposition in the absence of oxygen.

Aquifer
Ground water moving principally in a horizontal direction through porous underground strata such as gravel.

Bulky Wastes
Items not normally landfilled in a main disposal face, e.g. appliances, furniture, vehicles, trees, stumps, etc.

Cell
This term, when used in respect of a landfill site, means a deposit of waste that has been sealed by cover material, so that no waste deposited in the cell is exposed to the atmosphere, after grading and compacting.

Commerical Refuse
Non-putrescible solid wastes originating from commercial operations.

Contaminant
This term means any solid, liquid, gas, odour, heat, sound, vibration, raidation, or combination of any of them resulting directly or indirectly from the activities of man which may

a. Impair the quality of the environment for any use that can be made of it.

b. Cause injury or damage to property or to plant or animal life.

c. Cause harm or material discomfort to any person, or

d. Render any property or plant or animal life unfit for use by man.

Cover Material

This means soil or other material approved for sealing in landfilling.

Drainage (Natural)

The overland and stream flow of water.

Garbage

Putrescible wastes including rejected food wastes.

Green Belt

A buffer zone of parkland which prevents the public from seeing objects or activities which may appear objectionable.

Groundwater

That portion of the sub-surface water in the zone of saturation below the water table, which fully saturates where the pore spaces of the rock or soil are fully saturated. It behaves in response to gravitation.

Groundwater Run-Off

That part of the groundwater which is discharged to the surface of the ground or into a stream channel as springs or seepage water.

Hydrology

The science dealing with the properties, distribution and flow of water on or in the earth.

Impermeable

Resistant to flow of or penetration by water or other liquids.

Individual Collection Systems

This is the collection of his own domestic wastes by a householder and the transportation of such wastes to a waste disposal site by the householder. These systems are exempted from the Act and Regulations.

Industrial Refuse

Solid wastes resulting from industrial processes and manufacturing operations.

Integrity and Continuity of Cover Materials

The quality of cover materials which include durability, impermeability which prevent exposure to vision, animals and water.

Inert Fill

This is earth or rock fill that contains no putrescible materials or soluble or decomposable chemical substances.

Leachate

Liquid emanating from a disposal site that contains dissolved, suspended chemical and microbiological contaminants from solid wastes.

Marine Craft Waste Disposal Systems

These are waste disposal systems operated by a person or municipality for the receiving of waste from marine craft for deposit in holding tanks. They are exempt from the provisions of this Act and Regulation.

Methane

An odourless, colourless, non-poisonous gas, explosive when mixed with air or oxygen in certain proportions.

Municipal Waste Management System

This is a waste management system or any part thereof, of which municipality is the owner.

Natural Environment

This is air, land and water, or any combination or part thereof.

On-Site Road

This is a road for the movement of vehicles and equipment within a waste disposal site.

Open Burning

Uncontrolled burning of solid wastes in the open or in a dump or landfill.

Operator

This is the person in occupation or having a charge, management or control of a waste management system or a waste disposal site.

Owner

The term "owner" includes:

a. A person that is responsible for the establishment or operator of a waste management system or waste disposal site, or
b. The person that owns the land in or on which a waste disposal site is located.

Perched Water Table

The top of a zone of saturation that lies on an impermeable layer, but above the level of the general water table in the area. It is generally near the surface and frequently supplies a hillside spring.

Permeable

Permitting flow of water or other liquids.

Person

This term includes a municipality, a corporation on behalf of Her Majesty in right of Ontario, and an agent of any of them.

Person Responsible

Means the owner, or the person in occupation of having the charge, management or control of a source of contaminant.

Pest

Any injurious, noxious or troublesome plant or animal life other than man and includes any injurious, noxious or troublesome organic function of a plant or animal.

Pollution

The presence in a body of water, soil or air of substances of such character and in such quantities that the natural qualities of the water, soil or air is degraded, its usefulness is impaired or it is rendered offensive to the senses of sight, taste, hearing or smell.

Potable Water

Water that is bacteriologically and chemically safe for human comsumption.

Putrescible

Capable of being decomposed by micro-organisms with sufficient rapidity as to cause nuisance from odours and gases.

Scavenging

This is the uncontrolled removal of reusable material from waste at a waste disposal site.

Sheeps Foot Roller

A roller that consists of a steel drum fitted with projecting feet, usually conical in form.

Source of Contaminant

This means anything that adds to,emits or discharges into the natural environment any contaminant.

Vector

A living insect or other arthropod, or animal (not human) which transmits infectious disease from one human or animal to another.

Vermin

Carrier of disease germs, bacteria or viruses, such as rodents, mosquitoes, flies, lice and fleas which transmit such infectious elements to humans.

Waste Disposal Systems

These are defined in the Environmental Protection Act, 1971, Section 28 (f), as all facilities, equipment and operations for the complete management of waste, including the collection, handling, transportation, storage, processing and disposal thereof, and may include one or more waste disposal sites.

Watershed

Total land area above a given point on a stream or water-course that contributes run-off to that point.

Weather Conditions, Normal

The weather conditions which may reasonably be expected to occur at a particular location at any time during the year for a considerable number of years.

White Goods

Derelict or abandoned appliance bodies.

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