

US EPA ARCHIVE DOCUMENT

CHAPTER 3

SUBPART C OPERATING CRITERIA

**CHAPTER 3
SUBPART C**

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CHAPTER 3
SUBPART C
OPERATING CRITERIA

3.1 INTRODUCTION

The Solid Waste Disposal Facility Criteria contain a series of operating requirements pertaining to routine operation, management, and environmental monitoring at municipal solid waste landfill units (MSWLF units). The operating requirements pertain to new MSWLF units, existing MSWLF units, and lateral expansions of existing MSWLF units.

The operating requirements have been developed to ensure the safe daily operation and management at MSWLF units. The operating requirements include:

- The exclusion of hazardous waste;
- Cover material;
- Disease vector control;
- Explosive gases control;
- Air monitoring;
- Facility access;
- Run-on/run-off control systems;
- Surface water requirements;
- Liquid restrictions; and
- Recordkeeping requirements.

Any owner or operator of a MSWLF unit must comply with the operating requirements by October 9, 1993.

In specific cases, the operating requirements require compliance with other Federal laws. For example, surface water discharges from a MSWLF unit into the waters of the United States must be in conformance with applicable sections of the Clean Water Act. In addition, burning of municipal solid waste (MSW) is regulated under applicable sections of the Clean Air Act.

3.2 PROCEDURES FOR EXCLUDING THE RECEIPT OF HAZARDOUS WASTE 40 CFR §258.20

3.2.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes as defined in Part 261 of this title and polychlorinated biphenyls (PCB) wastes as defined in Part 761 of this title. This program must include, at a minimum:

(1) Random inspections of incoming loads unless the owner or operator takes other steps to ensure that incoming loads do not contain regulated hazardous wastes or PCB wastes;

(2) Records of any inspections;

(3) Training of facility personnel to recognize regulated hazardous waste and PCB wastes; and

(4) Notification of State Director of authorized States under Subtitle C of RCRA or the EPA Regional Administrator if in an unauthorized State if a regulated hazardous waste or PCB waste is discovered at the facility.

(b) For purposes of this section, regulated hazardous waste means a solid waste that is a hazardous waste, as defined in 40 CFR 261.3, that is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) or was not generated by a conditionally exempt small quantity generator as defined in §261.5 of this title.

3.2.2 Applicability

This regulation applies to all MSWLF units that receive wastes on or after October 9, 1993.

The owner or operator must develop a program to detect and prevent disposal of regulated hazardous wastes or PCB wastes at the MSWLF facility. Hazardous wastes may be gases, liquids, solids, or sludges that are listed or exhibit the characteristics described in 40 CFR Part 261. Household hazardous wastes are excluded from Subtitle C regulation, and wastes generated by conditionally exempt small quantity generators (CESQGs) are not considered regulated hazardous wastes for purposes of complying with §258.20; therefore, these wastes may be accepted for disposal at a MSWLF unit.

The MSWLF hazardous waste exclusion program should be capable of detecting and preventing disposal of PCB wastes. PCB wastes may be liquids or non-liquids (sludges or solids) and are defined at 40 CFR Section 761.60. PCB wastes do not include small capacitors found in fluorescent light ballast, white goods (e.g., washers, dryers, refrigerators) or other consumer electrical products (e.g., radio and television units).

The hazardous waste exclusion program is not intended to identify whether regulated hazardous waste or PCB waste was received at the MSWLF unit or facility prior to the effective date of the Criteria.

3.2.3 Technical Considerations

A solid waste is a regulated hazardous waste if it: (1) is listed in Subpart D of 40 CFR

Part 261 (termed a "listed" waste); (2) exhibits a characteristic of a hazardous waste as defined in Subpart C of 40 CFR Part 261; or (3) is a mixture of a listed hazardous waste and a non-hazardous solid waste. Characteristics of hazardous wastes as defined in Subpart C of 40 CFR Part 261 include ignitability, corrosivity, reactivity, and toxicity. The toxicity characteristic leaching procedure (TCLP) is the test method used to determine the mobility of organic and inorganic compounds present in liquid, solid, and multiphase wastes. The TCLP is presented in Appendix II of Part 261.

The MSWLF Criteria exclude CESQG waste (as defined in 40 CFR §261.5) from the definition of "regulated hazardous wastes." CESQG waste includes listed hazardous wastes or wastes that exhibit a characteristic of a hazardous waste that are generated in quantities no greater than 100 kg/month, or for acute hazardous waste, 1 kg/month. Under 40 CFR §261.5(f)(3)(iv) and (g)(3)(iv), conditionally exempt small quantity generator hazardous wastes may be disposed at facilities permitted, licensed, or registered by a State to manage municipal or industrial solid waste.

Other solid wastes are excluded from regulation as a hazardous waste under 40 CFR §261.4(b) and may be accepted for disposal at a MSWLF unit. Refer to §261.4(b) for a listing of these wastes.

PCBs are regulated under the Toxic Substances Control Act (TSCA), but PCB-containing wastes are considered hazardous wastes in some States. PCBs typically are not found in consumer wastes except for fluorescent ballast and small capacitors in white goods and electrical appliances.

These sources are not regulated under 40 CFR Part 761 and, therefore, are not part of the detection program required by §258.20. Commercial or industrial sources of PCB wastes that should be addressed by the program include:

- Mineral oil and dielectric fluids containing PCBs;
- Contaminated soil, dredged material, sewage sludge, rags, and other debris from a release of PCBs;
- Transformers and other electrical equipment containing dielectric fluids; and
- Hydraulic machines.

The owner or operator is required to implement a program to detect and exclude regulated hazardous wastes and PCBs from disposal in the landfill unit(s). This program must include elements for:

- Random inspections of incoming loads or other prevention methods;
- Maintenance of inspection records;
- Facility personnel training; and
- Notification to appropriate authorities if hazardous wastes or PCB wastes are detected.

Each of these program elements is discussed separately on the following pages.

Inspections

An inspection is typically a visual observation of the incoming waste loads by

an individual who is trained to identify regulated hazardous or PCB wastes that would not be acceptable for disposal at the MSWLF unit. An inspection is considered satisfactory if the inspector knows the nature of all materials received in the load and is able to discern whether the materials are potentially regulated hazardous wastes or PCB wastes.

Ideally, all loads should be screened; however, it is generally not practical to inspect in detail all incoming loads. Random inspections, therefore, can be used to provide a reasonable means to adequately control the receipt of inappropriate wastes. Random inspections are simply inspections made on less than every load.

The frequency of random inspections may be based on the type and quantity of wastes received daily, and the accuracy and confidence desired in conclusions drawn from inspection observations. Because statistical parameters are not provided in the regulation, a reasoned, knowledge-based approach may be taken. A random inspection program may take many forms such as inspecting every incoming load one day out of every month or inspecting one or more loads from transporters of wastes of unidentifiable nature each day. If these inspections indicate that unauthorized wastes are being brought to the MSWLF site, then the random inspection program should be modified to increase the frequency of inspections.

Inspection frequency also can vary depending on the nature of the waste. For example, wastes received predominantly from commercial or industrial sources may require more frequent inspections than wastes predominantly from households.

Inspection priority also can be given to haulers with unknown service areas, to loads brought to the facility in vehicles not typically used for disposal of municipal solid waste, and to loads transported by previous would-be offenders. For wastes of unidentifiable nature received from sources other than households (e.g., industrial or commercial establishments), the inspector should question the transporter about the source/composition of the materials.

Loads should be inspected prior to actual disposal of the waste at the working face of the landfill unit to provide the facility owner or operator the opportunity to refuse or accept the wastes. Inspections can be conducted on a tipping floor of a transfer station before transfer of the waste to the disposal facility. Inspections also may occur at the tipping floor located near the facility scale house, inside the site entrance, or near, or adjacent to, the working face of the landfill unit. An inspection flow chart to identify, accept, or refuse solid waste is provided as Figure 3-1.

Inspections of materials may be accomplished by discharging the vehicle load in an area designed to contain potentially hazardous wastes that may arrive at the facility. The waste should be carefully spread for observation using a front end loader or other piece of equipment. Personnel should be trained to identify suspicious wastes. Some indications of suspicious wastes are:

- Hazardous placards or marking;
- Liquids;
- Powders or dusts;

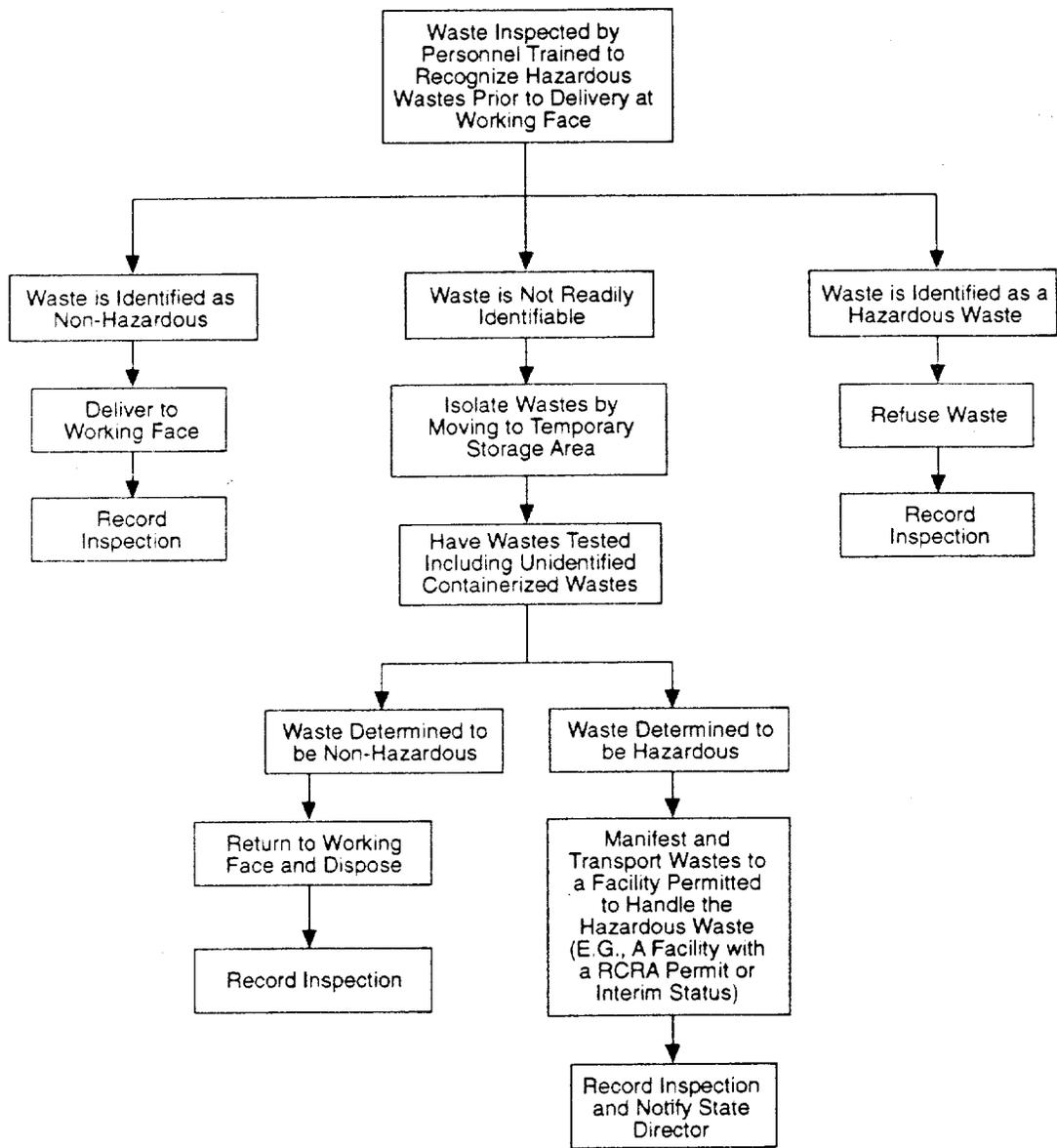


Figure 3-1
Hazardous Waste Inspection Decision Tree
Inspection Prior to Working Face

- Sludges;
- Bright or unusual colors;
- Drums or commercial size containers; or
- Chemical odors.

The owner or operator should develop specific procedures to be followed when suspicious wastes are discovered. The procedure should include the following points:

- Segregate the wastes;
- Question the driver;
- Review the manifest (if applicable);
- Contact possible source;
- Call the appropriate State or Federal agencies;
- Use appropriate protective equipment;
- Contact laboratory support if required; and
- Notify a response agency if necessary.

Containers with contents that are not easily identifiable, such as unmarked 55-gallon drums, should be opened only by properly trained personnel. Because these drums could contain hazardous waste, they should be refused whenever possible. Upon verifying that the solid waste is acceptable, it may then be transferred to the working face for disposal.

Some facilities may consider it reasonable to test unidentified waste, store it, and see that

it is disposed of properly. Most facilities would not consider this reasonable.

Testing typically would include The Toxicity Characteristic Leaching Procedure (TCLP) and other tests for characteristics of hazardous wastes including corrosivity, ignitability, and reactivity. Wastes that are suspected of being hazardous should be handled and stored as a hazardous waste until a determination is made.

If the wastes temporarily stored at the site are determined to be hazardous, the owner or operator is responsible for the management of the waste. If the wastes are to be transported from the facility, the waste must be: (1) stored at the MSWLF facility in accordance with requirements of a hazardous waste generator, (2) manifested, (3) transported by a licensed transporter, and (4) sent to a permitted Treatment, Storage, or Disposal (TSD) facility for disposal. These requirements are discussed further in this section.

Alternative Methods for Detection and Prevention

While the regulations explicitly refer to inspections as an acceptable means of detecting regulated hazardous wastes and PCB wastes, preventing the disposal of these wastes may be accomplished through other methods. These methods may include receiving only household wastes and processed (shredded or baled) wastes that are screened for the presence of the excluded wastes prior to processing. A pre-acceptance agreement between the owner or operator and the waste hauler is another alternative method. An example of a pre-acceptance agreement is presented as Appendix I. The owner or operator should

keep any such agreements concerning these alternatives in the operating record.

Recordkeeping

A record should be kept of each inspection that is performed. These records should be included and maintained in the facility operating record. Larger facilities that take large amounts of industrial and commercial wastes may use more detailed procedures than smaller facilities that accept household wastes. Inspection records may include the following information:

- The date and time wastes were received for inspection;
- Source of the wastes;
- Vehicle and driver identification; and
- All observations made by the inspector.

The Director of an approved State may establish alternative recordkeeping locations and requirements.

Training

Owners or operators must ensure that personnel are trained to identify potential regulated hazardous waste and PCB wastes. These personnel could include supervisors, designated inspectors, equipment operators, and weigh station attendants who may encounter hazardous wastes. Documentation of training should be placed in the operating record for the facility in accordance with §258.29.

The training program should emphasize methods to identify containers and labels typical of hazardous waste and PCB waste.

Training also should address hazardous waste handling procedures, safety precautions, and recordkeeping requirements. This information is provided in training courses designed to comply with the Occupational Safety and Health Act (OSHA) under 29 CFR §1910.120. Information covered in these courses includes regulatory requirements under 40 CFR Parts 260 through 270, 29 CFR Part 1910, and related guidance documents that discuss such topics as: general hazardous waste management; identification of hazardous wastes; transportation of hazardous wastes; standards for hazardous waste treatment; storage and disposal facilities; and hazardous waste worker health and safety training and monitoring requirements.

Notification to Authorities and Proper Management of Wastes

If regulated quantities of hazardous wastes or PCB wastes are found at the landfill facility, the owner or operator must notify the proper authorities. Proper authorities are either the Director of a State authorized to implement the hazardous waste program under Subtitle C of RCRA, or the EPA Regional Administrator, in an unauthorized State.

If the owner or operator discovers regulated quantities of hazardous waste or PCB waste while it is still in the possession of the transporter, the owner or operator can refuse to accept the waste at the MSWLF facility, and the waste will remain the responsibility of the transporter. If the owner or operator is unable to identify the transporter who brought the hazardous waste, the owner or operator must ensure that the waste is managed in accordance

with all applicable Federal and State regulations.

Operators of MSWLF facilities should be prepared to handle hazardous wastes that are inadvertently received at the MSWLF facility. This may include having containers such as 55-gallon drums available on-site and retaining a list of names and telephone numbers of the nearest haulers licensed to transport hazardous waste.

Hazardous waste may be stored at the MSWLF facility for 90 days, provided that the following procedures required by 40 CFR §262.34, or applicable State requirements, are followed:

- The waste is placed in tanks or containers;
- The date of receipt of the waste is clearly marked and visible on each container;
- The container or tank is marked clearly with the words "Hazardous Waste";
- An employee is designated as the emergency coordinator who is responsible for coordinating all emergency response measures; and
- The name and telephone number of the emergency coordinator and the number of the fire department is posted next to the facility phone.

Extensions to store the waste beyond 90 days may be approved pursuant to 40 CFR 262.34.

If the owner or operator transports the wastes off-site, the owner or operator must comply with 40 CFR Part 262 or the

analogous State/Tribal requirements. The owner or operator is required to:

- Obtain an EPA identification number (EPA form 8700-12 may be used to apply for an EPA identification number; State or Regional personnel may be able to provide a provisional identification number over the telephone);
- Package the waste in accordance with Department of Transportation (DOT) regulations under 49 CFR Parts 173, 178, and 179 (The container must be labeled, marked, and display a placard in accordance with DOT regulations on hazardous wastes under 49 CFR Part 172); and
- Properly manifest the waste designating a permitted facility to treat, store, or dispose of the hazardous waste.

If the owner or operator decides to treat, store (for more than 90 days), or dispose of the hazardous waste on-site, he or she must comply with the applicable State or Federal requirements for hazardous waste treatment, storage, and disposal facilities. This may require a permit.

PCB wastes detected at a MSWLF facility must be stored and disposed of according to 40 CFR Part 761. The owner or operator is required to:

- Obtain an EPA PCB identification number;
- Properly store the PCB waste;
- Mark containers or items with the words "Caution: contains PCBs"; and

- Manifest the PCB waste for shipment to a permitted incinerator, chemical waste landfill, or high efficiency boiler (depending on the nature of the PCB waste) for disposal.

3.3 COVER MATERIAL REQUIREMENTS

40 CFR §258.21

3.3.1 Statement of Regulation

(a) Except as provided in paragraph (b) of this section, the owners or operators of all MSWLF units must cover disposed solid waste with six inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging.

(b) Alternative materials of an alternative thickness (other than at least six inches of earthen material) may be approved by the Director of an approved State if the owner or operator demonstrates that the alternative material and thickness control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment.

(c) The Director of an approved State may grant a temporary waiver from the requirement of paragraph (a) and (b) of this section if the owner or operator demonstrates that there are extreme seasonal climatic conditions that make meeting such requirements impractical.

3.3.2 Applicability

The regulation applies to all MSWLF units receiving waste after October 9, 1993. The regulation requires MSWLF unit owners and operators to cover wastes with a 6-inch layer of earthen material at the end of each operating day. More frequent application of soil may be required if the soil cover does not control:

- Disease vectors (e.g., birds, flies and other insects, rodents);
- Fires;
- Odors;
- Blowing litter; and
- Scavenging.

The Director of an approved State may allow an owner or operator to use alternative cover material of an alternative thickness or grant a temporary waiver of this requirement. An alternative material must not present a threat to human health and the environment, and must continue to control disease vectors, fires, odors, blowing litter, and scavenging. The only basis for a temporary waiver from the requirement to cover at the end of each operating day would be where extreme seasonal climatic conditions make compliance impractical.

3.3.3 Technical Considerations

Owners and operators of new MSWLF units, existing MSWLF units, and lateral expansions are required to cover solid waste at the end of each operating day with six inches of earthen material. This cover

material requirement is not related to the final cover required under §258.60.

The placement of six inches of cover controls disease vectors (birds, insects, or rodents that represent the principal transmission pathway of a human disease) by preventing egress from the waste and by preventing access to breeding environments or food sources. Covering also reduces exposure of combustible materials to ignition sources and may reduce the spread of fire if the disposed waste burns. Odors and blowing litter are reduced by eliminating the direct contact of wind and disposed waste. Similarly, scavenging is reduced by removing the waste from observation. Should these unwanted effects of inadequate cover persist, the owner or operator may increase the amount of soil used or apply it more frequently. Any soil type can meet the requirements of the regulation when placed in a six-inch layer.

Approved States may allow demonstrations of alternative daily cover materials. The rule does not specify the time frame for the demonstration; usually the State decides. A period of six months should be ample time for the owner or operator to make the demonstration. There are no numerical requirements for the alternative cover; rather, the alternative cover must control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment.

Demonstrations can be conducted in a variety of ways. Some suggested methods for demonstrating alternative covers are:

- 1) Side by side (six inches of earthen materials and alternative cover) test pads;
- 2) Full-scale demonstration; and
- 3) Short-term full-scale tests.

Alternative daily cover materials may include indigenous materials or commercially-available materials. Indigenous materials are those materials that would be disposed as waste; therefore, using these materials is an efficient use of landfill space. Examples of indigenous materials include (USEPA, 1992):

- Ash from municipal waste combustors and utility companies;
- Compost-based material;
- Foundry sand from the manufacturing process of discarding used dies;
- Yard waste such as lawn clippings, leaves, and tree branches;
- Sludge-based materials (i.e., sludge treated with lime and mixed with ash or soil);
- Construction and demolition debris (which has been processed to form a slurry);
- Shredded automobile tires;
- Discarded carpets; and
- Grit from municipal wastewater treatment plants.

Commercially developed alternatives have been on the market since the mid-1980s. Some of the commercial alternative materials require specially designed application equipment, while others use equipment generally available at most landfills. Some of the types of commercially available daily cover materials include (USEPA, 1992):

- Foam that usually is sprayed on the working face at the end of the day;
- Geosynthetic products such as a tarp or fabric panel that is applied at the end of the working day and removed at the beginning of the following working day; and
- Slurry products (e.g., fibers from recycled newspaper and wood chip slurry, clay slurry).

Other criteria to consider when selecting an alternative daily cover material include availability and suitability of the material, equipment requirements, and cost.

The temporary climatic waiver of the cover requirement is available only to owners or operators in approved States. The State Director may grant a waiver if the owner or operator demonstrates that meeting the requirements would be impractical due to extreme seasonal climatic conditions. Activities that may be affected by extreme seasonal climatic conditions include:

- Obtaining cover soil from a borrow pit;
- Transporting cover soil to the working face; or

- Spreading and compacting the soil to achieve the required functions.

Extremely cold conditions may prevent the efficient excavation of soil from a borrow pit or the spreading and compaction of the soil on the waste. Extremely wet conditions (e.g., prolonged rainfall, flooding) may prevent transporting cover soil to the working face and may make it impractical to excavate or spread and compact. The duration of waivers may be as short as one day for unusual rain storms, or as long as several months for extreme seasonal climatic conditions.

3.4 DISEASE VECTOR CONTROL **40 CFR §258.22**

3.4.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must prevent or control on-site populations of disease vectors using techniques appropriate for the protection of human health and the environment.

(b) For purposes of this section, disease vectors means any rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans.

3.4.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions, and new MSWLF units. The owner or operator is required to prevent or control on-site disease vector populations of rodents, flies, mosquitoes, or other animals, including other insects. The techniques that may be used in fulfilling this requirement must be appropriate for the

protection of human health and the environment.

3.4.3 Technical Considerations

Disease vectors such as rodents, birds, flies, and mosquitoes typically are attracted by putrescent waste and standing water, which act as a food source and breeding ground. Putrescent waste is solid waste that contains organic matter (such as food waste) capable of being decomposed by micro-organisms. A MSWLF facility typically accepts putrescent wastes.

Application of cover at the end of each operating day generally is sufficient to control disease vectors; however, other vector control alternatives may be required. These alternatives could include: reducing the size of the working face; other operational modifications (e.g., increasing cover thickness, changing cover type, density, placement frequency, and grading); repellents, insecticides or rodenticides; composting or processing of organic wastes prior to disposal; and predatory or reproductive control of insect, bird, and animal populations. Additional methods to control birds are discussed in Chapter 2 (Airport Safety).

Mosquitoes, for example, are attracted by standing water found at MSWLFs, which can provide a potential breeding ground after only three days. Water generally collects in surface depressions, open containers, exposed tires, ponds resulting from soil excavation, leachate storage ponds, and siltation basins. Landfill operations that minimize standing water and that use an insecticide spraying program ordinarily are effective in controlling mosquitoes.

Vectors may reach the landfill facility not only from areas adjacent to the landfill, but through other modes conducive to harborage and breeding of disease vectors. Such modes may include residential and commercial route collection vehicles and transfer stations. These transport modes and areas also should be included in the disease vector control program if disease vectors at the landfill facility become a problem. Keeping the collection vehicles and transfer stations covered; emptying and cleaning the collection vehicles and transfer stations; using repellents, insecticides, or rodenticides; and reproductive control are all measures available to reduce disease vectors in these areas.

3.5 EXPLOSIVE GASES CONTROL **40 CFR §258.23**

3.5.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must ensure that:

(1) The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and

(2) The concentration of methane gas does not exceed the LEL for methane at the facility property boundary.

(b) Owners or operators of all MSWLF units must implement a routine methane monitoring program to ensure that the standards of paragraph (a) of this section are met.

(1) The type and frequency of monitoring must be determined based on the following factors:

- (i) Soil conditions;
- (ii) The hydrogeologic conditions surrounding the facility;
- (iii) The hydraulic conditions surrounding the facility; and
- (iv) The location of facility structures and property boundaries.

(2) The minimum frequency of monitoring shall be quarterly.

(c) If methane gas levels exceeding the limits specified in paragraph (a) of this section are detected, the owner or operator must:

(1) Immediately take all necessary steps to ensure protection of human health and notify the State Director;

(2) Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

(3) Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the State Director that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.

(4) The Director of an approved State may establish alternative schedules for demonstrating compliance with paragraphs (2) and (3).

(d) For purposes of this section, lower explosive limit (LEL) means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25°C and atmospheric pressure.

3.5.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions, and new MSWLF units. The accumulation of methane in MSWLF structures can potentially result in fire and explosions that can endanger employees, users of the disposal site, and occupants of nearby structures, or cause damage to landfill containment structures. These hazards are preventable through monitoring and through corrective action should methane gas levels exceed specified limits in the facility structures (excluding gas control or recovery system components), or at the facility property boundary. MSWLF facility owners and operators must comply with the following requirements:

- Monitor at least quarterly;
- Take immediate steps to protect human health in the event of methane gas levels exceeding 25% of the lower explosive limit (LEL) in facility structures, such as evacuating the building;
- Notify the State Director if methane levels exceed 25% of the LEL in facility structures or exceed the LEL at the facility property boundary;

- Within 7 days of detection, place in the operating record documentation that methane gas concentrations exceeded the criteria, along with a description of immediate actions taken to protect human health; and
- Within 60 days of detection, implement a remediation plan for the methane gas releases, notify the State Director, and place a copy of the remediation plan in the operating record.

The compliance schedule for monitoring and responding to methane levels that exceed the criteria of this regulation can be changed by the Director of an approved State.

3.5.3 Technical Considerations

To implement an appropriate routine methane monitoring program to demonstrate compliance with allowable methane concentrations, the characteristics of landfill gas production and migration at a site should be understood. Landfill gases are the result of microbial decomposition of solid waste. Gases produced include methane (CH₄), carbon dioxide (CO₂), and lesser amounts of other gases (e.g., hydrogen, volatile organic compounds, and hydrogen sulfide). Methane gas, the principal component of natural gas, is generally the primary concern in evaluating landfill gas generation because it is odorless and highly combustible. Typically, hydrogen gas is present at much lower concentrations. Hydrogen forms as decomposition progresses from the acid production phase to the methanogenic phase. While hydrogen is explosive and is occasionally detected in landfill gas, it readily reacts to form methane or hydrogen sulfide. Hydrogen sulfide is toxic and is

readily identified by its "rotten egg" smell at a threshold concentration near 5 ppb.

Landfill gas production rates vary spatially within a landfill unit as a result of pockets of elevated microbial activity but, due to partial pressure gradients, differences in gas composition are reduced as the gases commingle within and outside the landfill unit. Although methane gas is lighter than air and carbon dioxide is heavier, these gases are concurrently produced at the microbial level and will not separate by their individual density. The gases will remain mixed and will migrate according to the density gradients between the landfill gas and the surrounding gases (i.e., a mixture of methane and carbon dioxide in a landfill unit or in surrounding soil will not separate by rising and sinking respectively, but will migrate as a mass in accordance with the density of the mixture and other gradients such as temperature and partial pressure).

When undergoing vigorous microbial production, gas pressures on the order of 1 to 3 inches of water relative to atmospheric pressure are common at landfill facilities, with much higher pressures occasionally reported. A barometric pressure change of 2 inches of mercury is equivalent to 27.2 inches of water. Relative gauge pressures at a particular landfill unit or portion of a landfill unit, the ability of site conditions to contain landfill gas, barometric pressure variations, and the microbial gas production rate control pressure-induced landfill gas migration. Negative gas pressures are commonly observed and are believed to occur as a result of the delayed response within a landfill unit to the passage of a high pressure system outside the landfill unit. Barometric highs will tend to introduce atmospheric oxygen into surface soils in

shallow portions of the landfill unit, which may alter microbial activity, particularly methane production and gas composition.

Migration of landfill gas is caused by concentration gradients, pressure gradients, and density gradients. The direction in which landfill gas will migrate is controlled by the driving gradients and gas permeability of the porous material through which it is migrating. Generally, landfill gas will migrate through the path of least resistance.

Coarse, porous soils such as sand and gravel will allow greater lateral migration or transport of gases than finer-grained soils. Generally, resistance to landfill gas flow increases as moisture content increases and, therefore, an effective barrier to gas flow can be created under saturated conditions. Thus, readily drained soil conditions, such as sands and gravels above the water table, may provide a preferred flowpath, but unless finer-grained soils are fully saturated, landfill gases also can migrate in a "semi-saturated" zone. Figure 3-2 illustrates the potential effects of surrounding geology on gas migration.

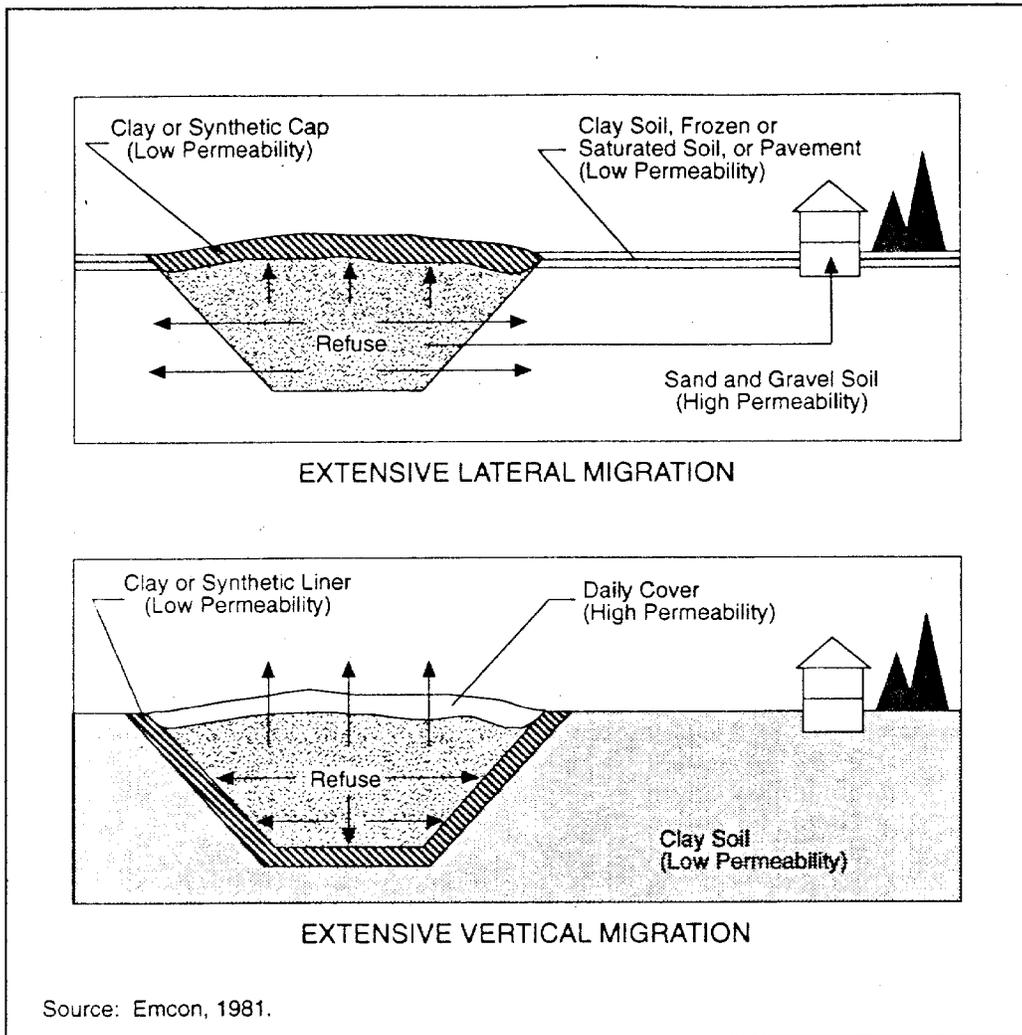
While geomembranes may not eliminate landfill gas migration, landfill gas in a closed MSWLF unit will tend to migrate laterally if the final cover contains a geomembrane and if the side slopes of the landfill do not contain an effective gas barrier. Lateral gas migration is more common in older facilities that lack appropriate gas control systems. The degree of lateral migration in older facilities also may depend on the type of natural soils surrounding the facility.

Stressed vegetation may indicate gas migration. Landfill gas present in the soil atmosphere tends to make the soil anaerobic by displacing the oxygen, thereby asphyxiating the roots of plants. Generally, the higher the concentration of combustible gas and/or carbon dioxide and the lower the amount of oxygen, the greater the extent of damage to vegetation (Flowers, et. al, 1982).

Gas Monitoring

The owner or operator of a MSWLF unit/facility must implement a routine methane monitoring program to comply with the lower explosive limit (LEL) requirements for methane. Methane is explosive when present in the range of 5 to 15 percent by volume in air. When present in air at concentrations greater than 15 percent, the mixture will not explode. This 15 percent threshold is the Upper Explosive Limit (UEL). The UEL is the maximum concentration of a gas or vapor above which the substance will not explode when exposed to a source of ignition. The explosive hazard range is between the LEL and the UEL. Note, however, that methane concentrations above the UEL remain a significant concern; fire and asphyxiation can still occur at these levels. In addition, even a minor dilution of the methane by increased ventilation can bring the mixture back into the explosive range.

To demonstrate compliance, the owner/operator would sample air within facility structures where gas may accumulate and in soil at the property boundary. Other monitoring methods may include: (1) sampling gases from probes within the landfill unit or from within the leachate collection system; or (2) sampling gases



Source: Emcon, 1981.

Figure 3-2
Potential Effects of
Surrounding Geology on Gas Migration

from monitoring probes installed in soil between the landfill unit and either the property boundary or structures where gas migration may pose a danger. A typical gas monitoring probe installation is depicted in Figure 3-3.

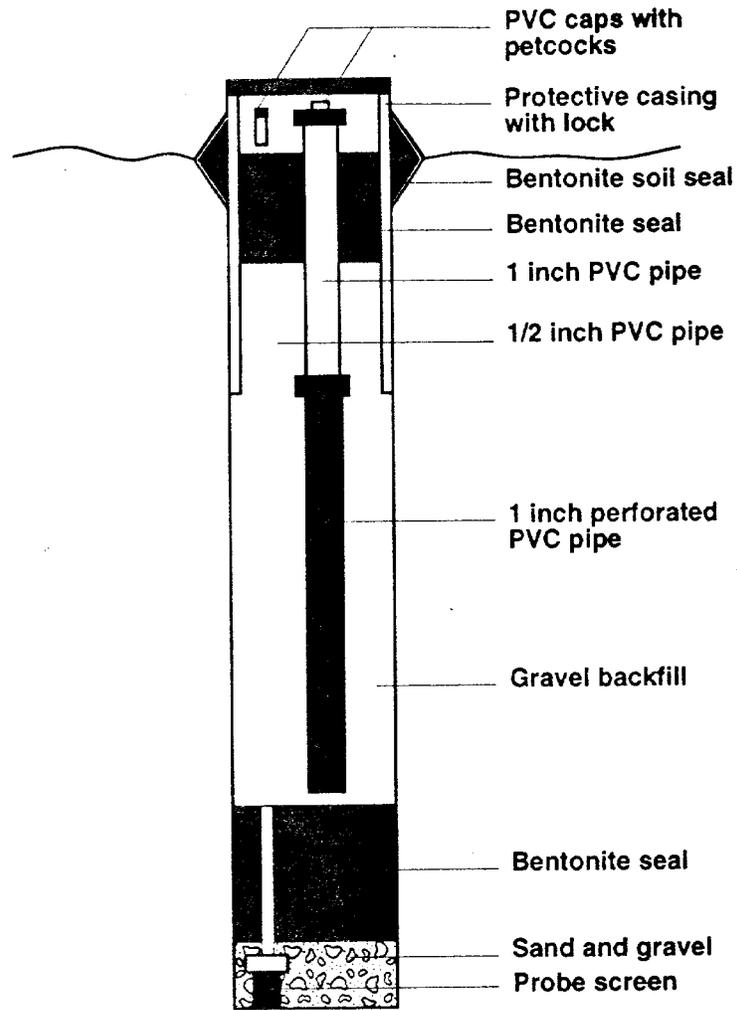
Although not required by the regulations, collection of data such as water presence and level, gas probe pressure, ambient temperature, barometric pressure, and the occurrence of precipitation during sampling, provides useful information in assessing monitoring results. For example, falling barometric pressure may cause increased subsurface (gas) pressures and corresponding increased methane content as gas more readily migrates from the landfill. Gas probe pressure can be measured using a portable gauge capable of measuring both vacuum and pressure in the range of zero to five inches of water pressure (or other suitable ranges for pressure conditions); this pressure should be measured prior to methane measurement or sample collection in the gas probe. A representative sample of formation (subsurface) gases can be collected directly from the probe. Purging typically is not necessary due to the small volume of the probe. A water trap is recommended to protect instrumentation that is connected directly to the gas probe. After measurements are obtained, the gas probe should be capped to reduce the effects of venting or barometric pressure variations on gas composition in the vicinity of the probe.

The frequency of monitoring should be sufficient to detect landfill gas migration based on subsurface conditions and changing landfill conditions such as partial or complete capping, landfill expansion, gas migration control system operation or failure, construction of new or replacement

structures, and changes in landscaping or land use practices. The rate of landfill gas migration as a result of these anticipated changes and the site-specific conditions provides the basis for establishing monitoring frequency. Monitoring is to be conducted at least quarterly.

The number and location of gas probes is also site-specific and highly dependent on subsurface conditions, land use, and location and design of facility structures. Monitoring for gas migration should be within the more permeable strata. Multiple or nested probes are useful in defining the vertical configuration of the migration pathway. Structures with basements or crawl spaces are more susceptible to landfill gas infiltration. Elevated structures are typically not at risk.

Measurements are usually made in the field with a portable methane meter, explosimeter, or organic vapor analyzer. Gas samples also may be collected in glass or metal containers for laboratory analysis. Instruments with scales of measure in "percent of LEL" can be calibrated and used to detect the presence of methane. Instruments of the hot-wire Wheatstone bridge type (i.e., catalytic combustion) directly measure combustibility of the gas mixture withdrawn from the probe. The thermal conductivity type meter is susceptible to interference as the relative gas composition and, therefore, the thermal conductivity, changes. Field instruments should be calibrated prior to measurements and should be rechecked after each day's monitoring activity.



Source: Warzyn Inc.

Figure 3-3
Typical Gas Monitoring Probe

Laboratory measurements with organic vapor analyzers or gas chromatographs may be used to confirm the identity and concentrations of gas.

In addition to measuring gas composition, other indications of gas migration may be observed. These include odor (generally described as either a "sweet" or a rotten egg (H₂S) odor), vegetation damage, septic soil, and audible or visual venting of gases, especially in standing water. Exposure to some gases can cause headaches and nausea.

If methane concentrations are in excess of 25 percent of the LEL in facility structures or exceed the LEL at the property boundary, the danger of explosion is imminent. Immediate action must be taken to protect human health from potentially explosive conditions. All personnel should be evacuated from the area immediately. Venting the building upon exit (e.g., leaving the door open) is desirable but should not replace evacuation procedures.

Owners and operators in unapproved States have 60 days after exceeding the methane level to prepare and implement a remediation plan. The remediation plan should describe the nature and extent of the methane problem as well as a proposed remedy.

To comply with this 60-day schedule, an investigation of subsurface conditions may be needed in the vicinity of the monitoring probe where the criterion was exceeded. The objectives of this investigation should be to describe the frequency and lateral and vertical extent of excessive methane migration (that which exceeds the criterion). Such an investigation also may yield additional characterization of unsaturated

soil within the area of concern. The investigation should consider possible causes of the increase in gas concentrations such as landfill operational procedures, gas control system failure or upset, climatic conditions, or closure activity. Based on the extent and nature of the excessive methane migration, a remedial action should be described, if the exceedance is persistent, that can be implemented within the prescribed schedule. The sixty-day schedule does not address the protection of human health and the environment. The owner or operator still must take all steps necessary to ensure protection of human health, including interim measures.

Landfill Gas Control Systems

Landfill gas may vent naturally or be purposely vented to the atmosphere by vertical and/or lateral migration controls. Systems used to control or prevent gas migration are categorized as either passive or active systems. Passive systems provide preferential flowpaths by means of natural pressure, concentration, and density gradients. Passive systems are primarily effective in controlling convective flow and have limited success controlling diffusive flow. Active systems are effective in controlling both types of flow. Active systems use mechanical equipment to direct or control landfill gas by providing negative or positive pressure gradients. Suitability of the systems is based on the design and age of the landfill unit, and on the soil, hydrogeologic, and hydraulic conditions of the facility and surrounding environment. Because of these variables, both systems have had varying degrees of success.

Passive systems may be used in conjunction with active systems. An example of this

may be the use of a low-permeability passive system for the closed portion of a landfill unit (for remedial purposes) and the installation of an active system in the active portion of the landfill unit (for future use).

Selection of construction materials for either type of gas control system should consider the elevated temperature conditions within a landfill unit as compared to the ambient air or soil conditions in which gas control system components are constructed. Because ambient conditions are typically cooler, water containing corrosive and possibly toxic waste constituents may be expected to condense. This condensate should be considered in selecting construction materials. Provisions for managing this condensate should be incorporated to prevent accumulation and possible failure of the collection system. The condensate can be returned to the landfill unit if the landfill is designed with a composite liner and leachate collection system per §258.40(a)(2). See Chapter 4 for information regarding design. See Section 3.10 of this Chapter for information regarding liquids in landfills.

Additional provisions (under the Clean Air Act) were proposed on May 30, 1991 (56 FR 24468), that would require the owners/operators of certain landfill facilities to install gas collection and control systems to reduce the emissions of nonmethane organic compounds (NMOCs). The proposed rule amends 40 CFR Parts 51, 52, and 60. For new municipal solid waste landfill units (those for which construction was begun after May 30, 1991), and for those units that have a design capacity greater than 111,000 tons, a gas collection and control system must be installed if emissions evaluations indicate that the NMOC emissions rate is

150 megagrams per year (167 tons per year) or greater. Allowable control systems include open and enclosed flares, and on-site or off-site facilities that process the gas for subsequent sale or use. EPA believes that, depending on landfill design, active collection systems may be more cost-effective than passive systems in ensuring that the system effectively captures the gas that is generated within the landfill unit. The provisions for new landfill units are self-implementing and will be effective upon promulgation of the rule.

In addition to the emissions standards for new municipal solid waste landfill units, the regulations proposed on May 30, 1991 establish guidelines for State programs for reducing NMOC emissions from certain existing municipal landfill units. These provisions apply to landfill units for which construction was commenced before May 30, 1991, and that have accepted waste since November 8, 1987 or that have remaining capacity. Essentially, the State must require the same kinds of collection and control systems for landfill units that meet the size criteria and emissions levels outlined above for new landfill units. The requirements for existing facilities will be effective after the State revises its State Implementation Plan and receives approval from EPA.

The rule is scheduled to be promulgated in late 1993; the cutoff numbers for landfill size and emission quantity may be revised in the final rule. EPA expects that the new regulations will affect less than 9% of the municipal landfill facilities in the U.S.

Passive Systems

Passive gas control systems rely on natural pressure and convection mechanisms to vent landfill gas to the atmosphere. Passive systems typically use "high-permeability" or "low-permeability" techniques, either singularly or in combination at a site. High-permeability systems use conduits such as ditches, trenches, vent wells, or perforated vent pipes surrounded by coarse soil to vent landfill gas to the surface and the atmosphere. Low-permeability systems block lateral migration through barriers such as synthetic membranes and high moisture-containing fine-grained soils.

Passive systems may be incorporated into a landfill design or may be used for remedial or corrective purposes at both closed and active landfills. They may be installed within a landfill unit along the perimeter, or between the landfill and the disposal facility property boundary. A detailed discussion of passive systems for remedial or corrective purposes may be found in U.S. EPA (1985).

A passive system may be incorporated into the final cover system of a landfill closure design and may consist of perforated gas collection pipes, high permeability soils, or high transmissivity geosynthetics located just below the low-permeability gas and hydraulic barrier or infiltration layer in the cover system. These systems may be connected to vent pipes that vent gas through the cover system or that are connected to header pipes located along the perimeter of the landfill unit. Figure 3-4 illustrates a passive system. The landfill gas collection system also may be connected with the leachate collection system to vent gases in the headspace of leachate collection pipes.

Some problems have been associated with passive systems. For example, snow and dirt may accumulate in vent pipes, preventing gas from venting. Vent pipes at the surface are susceptible to clogging by vandalism. Biological clogging of the system is also more common in passive systems.

Active Systems

Active gas control systems use mechanical means to remove landfill gas and consist of either positive pressure (air injection) or negative pressure (extraction) systems. Positive pressure systems induce a pressure greater than the pressure of the migrating gas and drive the gas out of the soil and/or back to the landfill unit in a controlled manner. Negative pressure systems extract gas from a landfill by using a blower to pull gas out of the landfill. Negative pressure systems are more commonly used because they are more effective and offer more flexibility in controlling gas migration. The gas may be recovered for energy conversion, treated, or combusted in a flare system. Typical components of a flare system are shown in Figure 3-5. Negative pressure systems may be used as either perimeter gas control systems or interior gas collection/recovery systems. For more information regarding negative pressure gas control systems, refer to U.S. EPA (1985).

An active gas extraction well is depicted in Figure 3-6. Gas extraction wells may be installed within the landfill waste or, as depicted in Figure 3-7A and Figure 3-7B, perimeter extraction trenches could be used. One possible configuration of an interior gas collection/recovery system is illustrated in

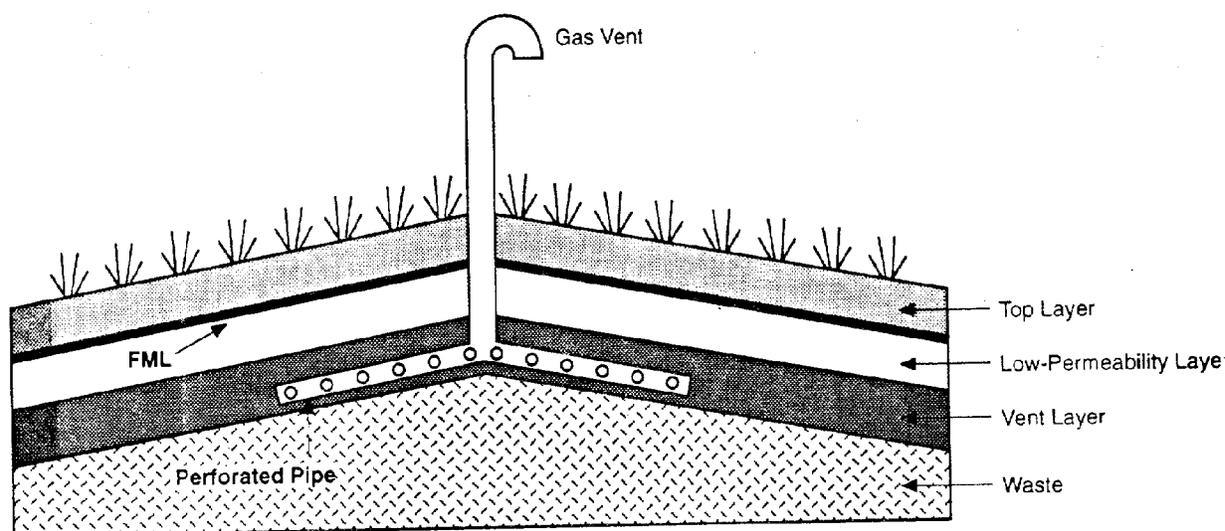


Figure 3-4
Passive Gas Control System
(Venting to Atmosphere)

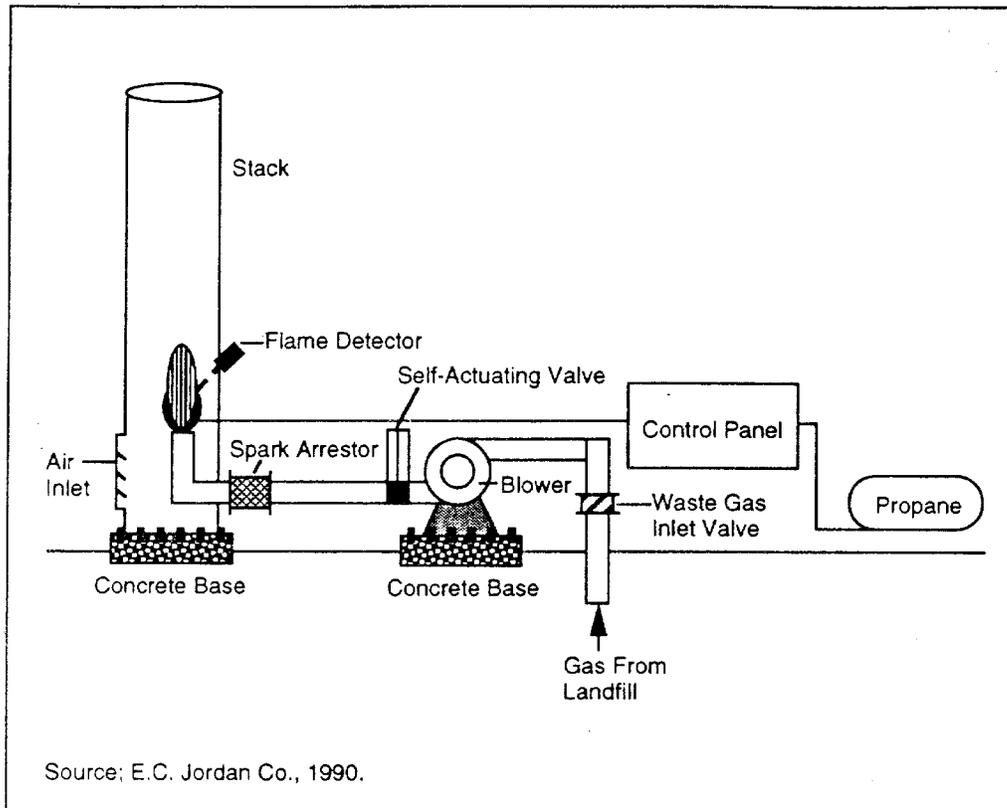
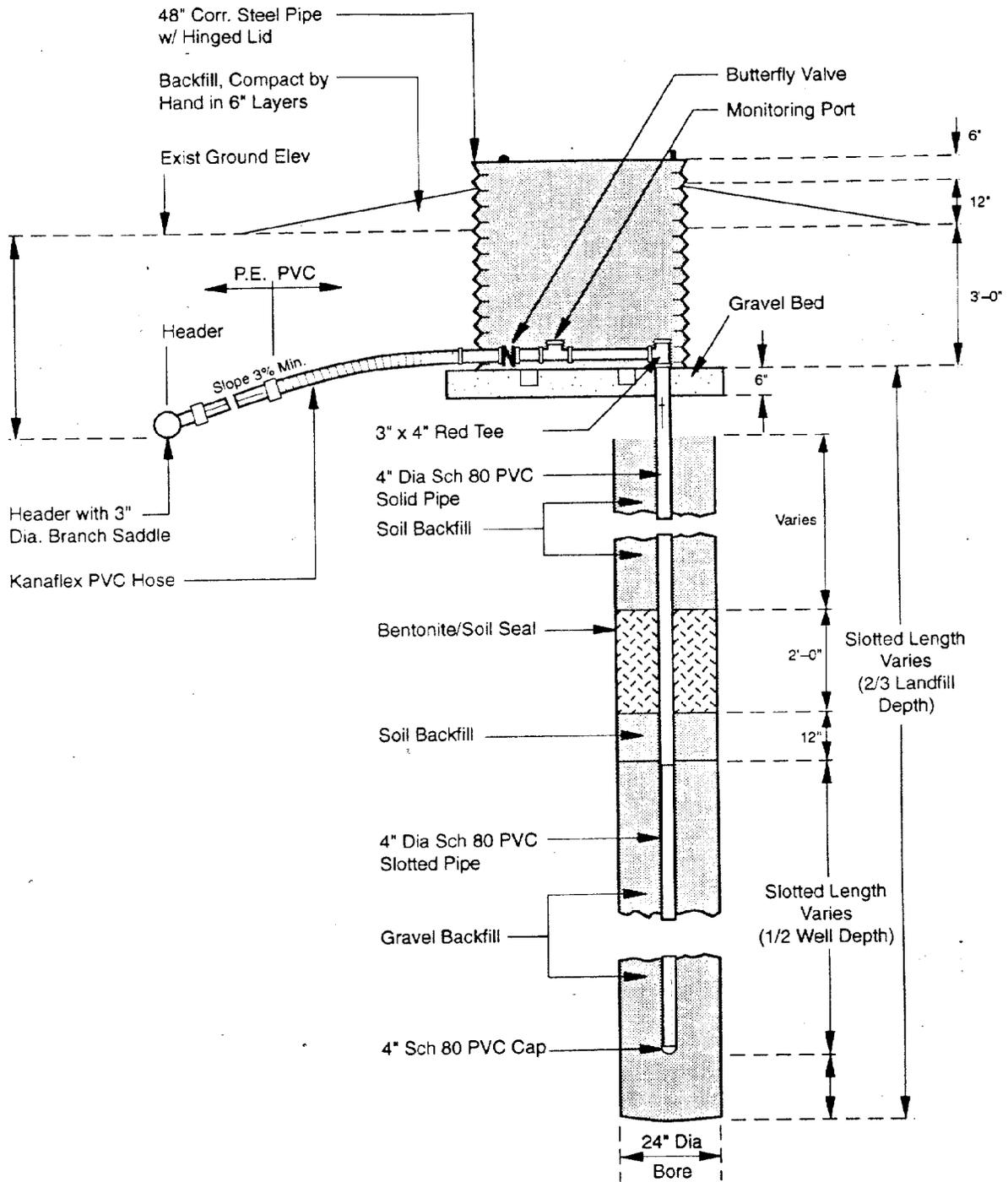


Figure 3-5. Example Schematic Diagram of a Ground-based Landfill Gas Flare



Source: CH2M Hill, 1992

Figure 3-6 Example of a Gas Extraction Well

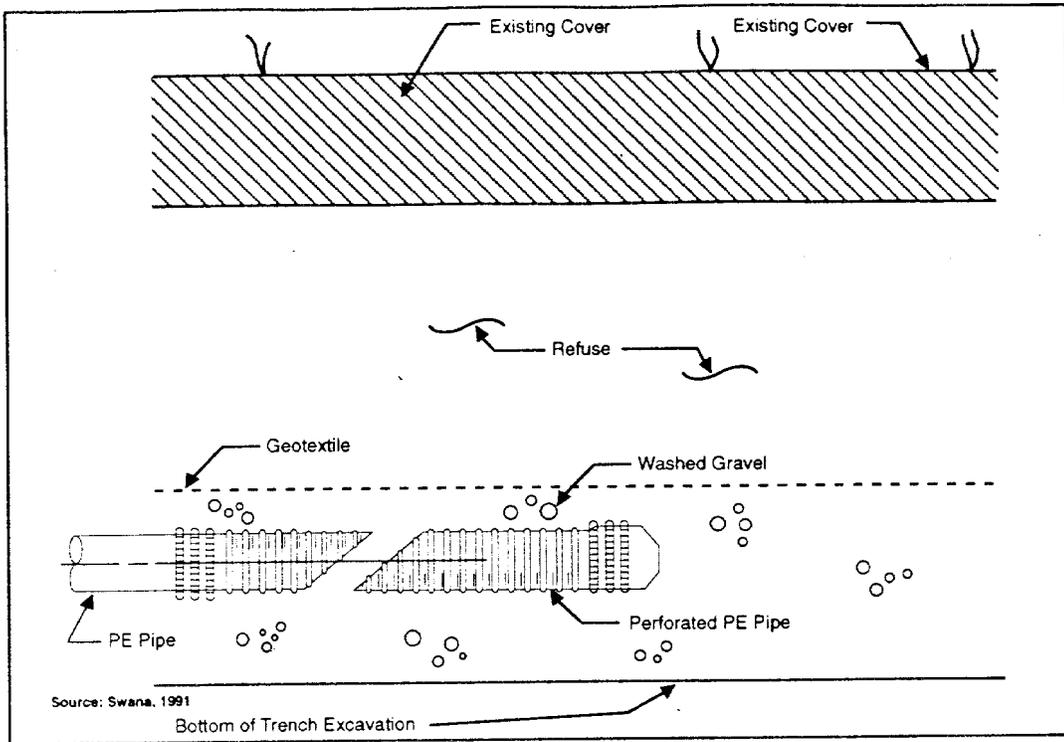


Figure 3-7A. Perimeter Extraction Trench System

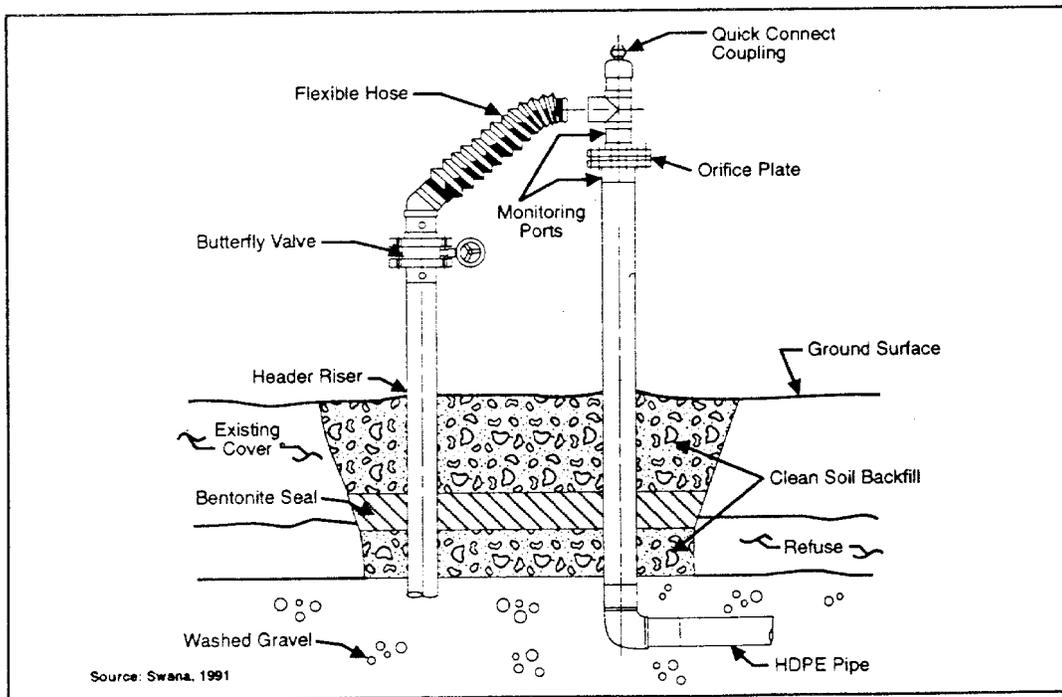


Figure 3-7B. Perimeter Extraction Trench System

Figure 3-8. The performance of active systems is not as sensitive to freezing or saturation of cover soils as that of passive systems. Although active gas systems are more effective in withdrawing gas from the landfill, capital, operation, and maintenance costs of such systems will be higher and these costs can be expected to continue throughout the post-closure period. At some future time, owners and operators may wish to convert active gas controls into passive systems when gas production diminishes. The conversion option and its environmental effect (i.e., gas release causing odors and health and safety concerns) should be addressed in the original design.

There are many benefits to recovering landfill gas. Landfill gas recovery systems can reduce landfill gas odor and migration, can reduce the danger of explosion and fire, and may be used as a source of revenue that may help to reduce the cost of closure. Landfill gas can be used with a minimal amount of treatment or can be upgraded to pipeline standards (SWANA, 1992). An upgraded gas is one which has had the carbon dioxide and other noncombustible constituents removed.

Raw landfill gas may be used for heating small facilities and water, and may require removal of only water and particulates for this application. A slightly upgraded gas can be used for both water and space heating as well as lighting, electrical generation, cogeneration, and as a fuel for industrial boilers-burners. Landfill gas also may be processed to pipeline quality to be sold to utility companies and may even be used to fuel conventional vehicles. The amount of upgrading and use of landfill gas is dependent on the landfill size.

3.6 AIR CRITERIA **40 CFR §258.24**

3.6.1 Statement of Regulation

(a) Owners or operators of all MSWLFs must ensure that the units do not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to section 110 of the Clean Air Act, as amended.

(b) Open burning of solid waste, except for the infrequent burning of agricultural wastes, silvicultural wastes, land-clearing debris, diseased trees, or debris from emergency clean-up operations, is prohibited at all MSWLF units.

3.6.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions to existing MSWLF units, and new MSWLF units. Routine open burning of municipal solid waste is prohibited. Infrequent burning of agricultural and silvicultural wastes, diseased trees, or debris from land clearing or emergency clean-up operations is allowed when in compliance with any applicable requirements developed under a State Implementation Plan (SIP) of the Clean Air Act. Agricultural waste does not include empty pesticide containers or waste pesticides.

3.6.3 Technical Considerations

Air pollution control requirements are developed under a SIP, which is developed by the State and approved by the EPA Administrator. The owner or operator of a

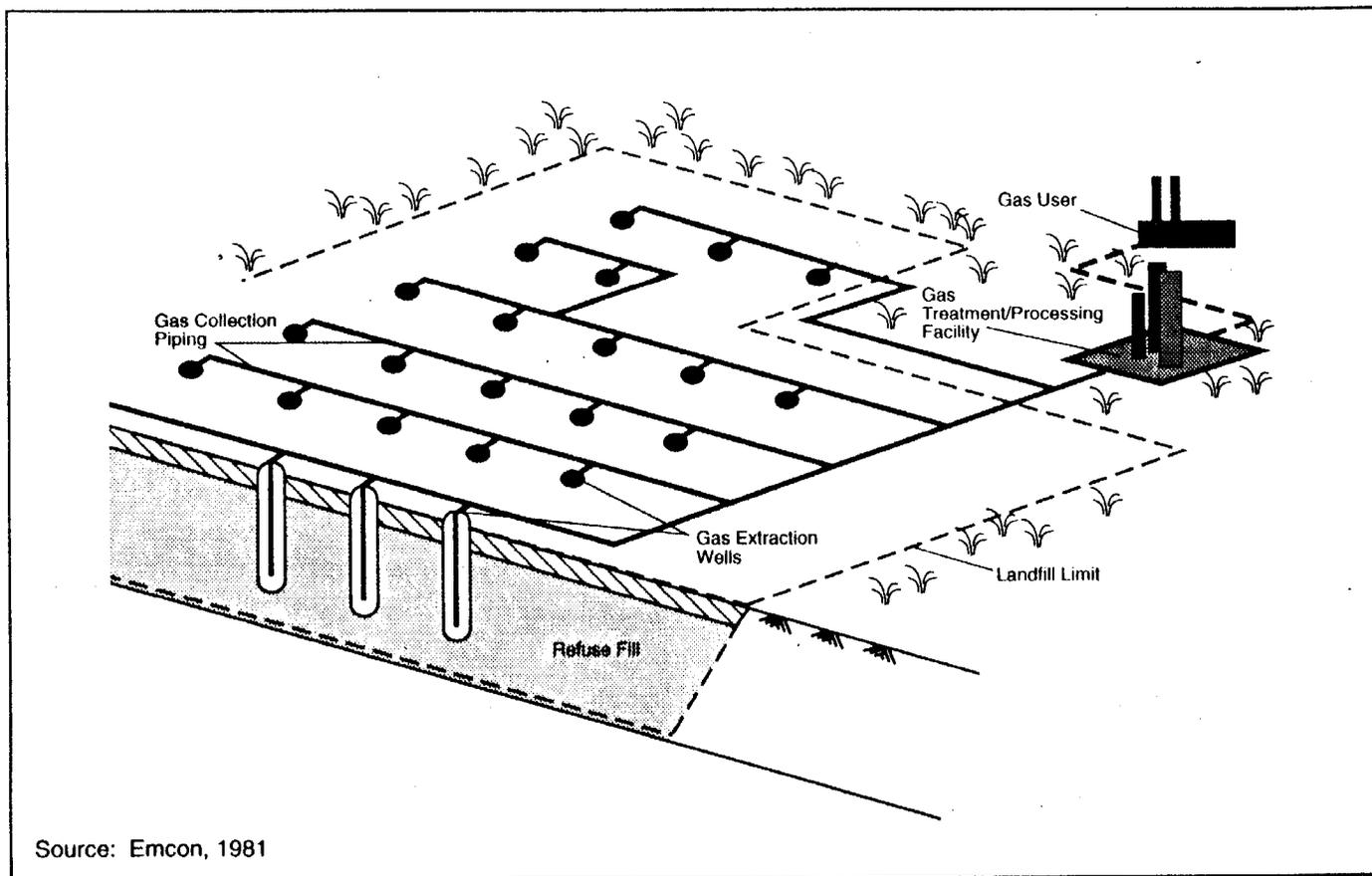


Figure 3-8
Example of an Interior Gas Collection/Recovery System

MSWLF unit should consult the State or local agency responsible for air pollution control to ascertain that the burning of wastes complies with applicable requirements developed under the SIP. The SIP may include variances, permits, or exemptions for burning agricultural wastes, silvicultural wastes, land-clearing debris, diseased trees, or debris from emergency clean-up operations. Routine burning of wastes is banned in all cases, and the SIP may limit burning of waste such as agricultural wastes to certain hours of the day; days of the year; designated burn areas; specific types of incinerators; atmospheric conditions; and distance from working face, public thoroughfares, buildings, and residences.

Requirements under the SIP also may include notifying applicable State or local agencies whose permits may: (1) restrict times when limited burning of waste may occur; (2) specify periods when sufficient fire protection is deemed to be available; or (3) limit burning to certain areas.

Open burning is defined under §258.2 as the combustion of solid waste: (1) without control of combustion air to maintain adequate temperature for efficient combustion; (2) without containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and (3) without the control of the emission of the combustion products. Trench or pit burners, and air curtain destructors are considered open burning units because the particulate emissions are similar to particulate emissions from open burning, and these devices do not control the emission of combustion products.

[Note: The Agency plans to issue regulations under the Clean Air Act to control landfill gas emissions from large MSWLF units in 1993. These regulations are found at 40 CFR Parts 51, 52, and 60.]

3.7 ACCESS REQUIREMENT 40 CFR §258.25

3.7.1 Statement of Regulation

Owners or operators of all MSWLF units must control public access and prevent unauthorized vehicular traffic and illegal dumping of wastes by using artificial barriers, natural barriers, or both, as appropriate to protect human health and the environment.

3.7.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions, and new MSWLF units. The owner or operator is required to prevent public access to the landfill facility, except under controlled conditions during hours when wastes are being received.

3.7.3 Technical Considerations

Owners and operators are required to control public access to prevent illegal dumping, public exposures to hazards at MSWLF units, and unauthorized vehicular traffic. Frequently, unauthorized persons are unfamiliar with the hazards associated with landfill facilities, and consequences of uncontrolled access may include injury and even death. Potential hazards are related to inability of equipment operators to see unauthorized individuals during operation of equipment and haul vehicles; direct exposure to waste (e.g., sharp objects and pathogens);

inadvertent or deliberate fires; and earth-moving activities.

Acceptable measures used to limit access of unauthorized persons to the disposal facility include gates and fences, trees, hedges, berms, ditches, and embankments. Chain link, barbed wire added to chain link, and open farm-type fencing are examples of fencing that may be used. Access to facilities should be controlled through gates that can be locked when the site is unsupervised. Gates may be the only additional measure needed at remote facilities.

3.8 RUN-ON/RUN-OFF CONTROL SYSTEMS 40 CFR §258.26

3.8.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must design, construct, and maintain:

(1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm;

(2) A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

(b) Run-off from the active portion of the landfill unit must be handled in accordance with §258.27(a) of this Part.

3.8.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions, and new MSWLF units. The owner or operator is required to prevent run-on onto the active portion of the landfill units and to collect and control run-off from the active portion for a 24-hour, 25-year storm. Management of run-off must comply with the point and non-point source discharge requirements of the Clean Water Act.

3.8.3 Technical Considerations

If stormwater enters the landfill unit and contacts waste (including water within daily cover), the stormwater becomes leachate and must be managed as leachate. The purpose of a run-on control system is to collect and redirect surface waters to minimize the amount of surface water entering the landfill unit. Run-on control can be accomplished by constructing berms and swales above the filling area that will collect and redirect the water to stormwater control structures.

As stated above, stormwater that does enter the landfill unit should be managed as leachate. Run-off control systems are designed to collect and control this run-off from the active portion of the landfill, including run-off from areas that have received daily cover, which may have contacted waste materials. Run-off control can be accomplished through stormwater conveyance structures that divert this run-off/leachate to the leachate storage device.

After a landfill unit has been closed with a final cover, stormwater run-off from this unit can be managed as stormwater and not leachate. Therefore, waters running off the final cover system of closed areas may not

require treatment and generally can be combined with run-on waters. For landfills with steep side slopes, a bench system may provide the best solution for run-off control. A bench creates a break in the slope where the velocity of the stormwater run-off is expected to become erosive. The bench converts sheet flow run-off into channel flow. Benches typically are spaced 30 to 50 feet apart up the slope. An alternative to benches is a system of downchutes whereby stormwater is collected off the top of the landfill and conveyed down the slope through a pipe or channel. Caution should be taken not to construct downchutes with heavy material because of possible subsidence. Corrugated metal pipes or plastic-lined channels are examples of lightweight materials that can be used for downchute construction.

Run-on and run-off must be managed in accordance with the requirements of the Clean Water Act including, but not limited to, the National Pollutant Discharge Elimination System (NPDES). [See Section 3.9 of this chapter for further information on compliance with the Clean Water Act.]

Run-on and run-off control systems must be designed based on a 24-hour, 25-year storm. Information on the 24-hour, 25-year recurring storm can be obtained from Technical Paper 40 "Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years", prepared by the Weather Bureau under the Department of Commerce. Alternatively, local meteorological data can be analyzed to estimate the criterion storm. To estimate run-on, the local watershed should be identified and evaluated to document the basis for run-on design flows.

The Soil Conservation Service (SCS) Method and/or the Rational Method are generally adequate for estimating storm flows for designing run-on and/or run-off control systems. The SCS method estimates run-off volume from accumulated rainfall and then applies the run-off volume to a simplified triangular unit hydrograph for peak discharge estimation and total run-off hydrograph. A discussion of the development and use of this method is available from the U. S. Department of Agriculture, Soil Conservation Service (1986).

The Rational Method approximates the majority of surface water discharge supplied by the watershed upstream from the facility. The Rational Method generally is used for areas of less than 200 acres. A discussion of the Rational Method may be found in U.S. EPA (1988).

Run-on/run-off control structures, both temporary and permanent, may be incorporated into the system design. Other structures (not mentioned above) most frequently used for run-on/run-off control are waterways, seepage ditches, seepage basins, and sedimentation basins. U.S. EPA (1985) provides an in-depth discussion for each of these structures.

3.9 SURFACE WATER REQUIREMENTS **40 CFR §258.27**

3.9.1 Statement of Regulation

MSWLF units shall not:

- (a) Cause a discharge of pollutants into waters of the United States, including**

wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to section 402.

(b) Cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or State-wide water quality management plan that has been approved under section 208 or 319 of the Clean Water Act, as amended.

3.9.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions, and new MSWLF units. The owner or operator is required to comply with the Clean Water Act for any discharges to surface water or wetlands.

3.9.3 Technical Considerations

The owner or operator of a MSWLF facility should determine if the facility is in conformance with applicable requirements of water quality plans developed under Sections 208 and 319 of the Clean Water Act, and the National Pollutant Discharge Elimination System (NPDES) requirements under Section 402 of the Clean Water Act. The EPA and approved States have jurisdiction over discharge of pollutants (other than dredge and fill materials) in waters of the United States including wetlands. MSWLF units discharging pollutants or disposing of fill material into waters of the United States require a Section 402 (NPDES) permit. Discharge of dredge and fill material into waters of the United States is under the jurisdiction of the U.S. Army Corps of Engineers.

A MSWLF unit(s) that has a point source discharge must have a NPDES permit. Point source discharges for landfills include, but are not limited to: (1) the release of leachate from a leachate collection or on-site treatment system into the waters of the United States; (2) disposal of solid waste into waters of the United States; or (3) release of surface water (stormwater) run-off which is directed by a run-off control system into the waters of the United States. Leachate that is piped or trucked off-site to a treatment facility is not regarded as a point source discharge.

The Clean Water Act (CWA) provides clarifications of terms such as point source, waters of the United States, pollutants, and discharge of pollutants.

Owners/operators also should be aware that there are regulations promulgated pursuant to the CWA regarding stormwater discharges from landfill facilities. These regulations require stormwater discharge permit applications to be submitted by certain landfills that accept or have accepted specific types of industrial waste. See 40 CFR Section 122.26(a)-(c), which originally appeared in the Federal Register on November 16, 1990 (55 FR 47990).

In addition, EPA codified several provisions pursuant to the Intermodal Surface Transportation Efficiency Act of 1991 into the NPDES regulations. These regulations only affect the deadlines for submitting permit applications for stormwater discharges, and they apply to both uncontrolled and controlled sanitary landfills. "Uncontrolled sanitary landfills" are defined as landfills or open dumps that do not meet the requirements for run-on or run-off controls that are found in the

MSWLF Criteria, Section 258.25. "Controlled sanitary landfills" are those that do meet the run-on and run-off requirements. The NPDES regulations specify that **uncontrolled** sanitary landfills owned or operated by municipalities of less than 100,000 (population) must submit a NPDES permit application for their stormwater discharge or obtain coverage under a general permit. For **controlled** sanitary landfills owned or operated by a municipality with a population less than 100,000, there is no requirement to submit a stormwater discharge permit application (before October 1, 1992) unless a permit is required under Section 402(p)(2)(A) or (E) of the Clean Water Act. Other deadlines are set for municipalities with a population less than 250,000 that own or operate a municipal landfill. For further information contact the Stormwater Hotline (703) 821-4823. See the April 2, 1992 Federal Register (57 FR 11394), 40 CFR 122.26.

3.10 LIQUIDS RESTRICTIONS **40 CFR §258.28**

3.10.1 Statement of Regulation

(a) **Bulk or noncontainerized liquid waste may not be placed in MSWLF units unless:**

(1) **The waste is household waste other than septic waste; or**

(2) **The waste is leachate or gas condensate derived from the MSWLF unit and the MSWLF unit, whether it is an existing or new unit, is designed with a composite liner and leachate collection system as described in §258.40 (a)(2) of**

this part. The owner or operator must place the demonstration in the operating record and notify the State Director that it has been placed in the operating record.

(b) **Containers holding liquid waste may not be placed in a MSWLF unit unless:**

(1) **The container is a small container similar in size to that normally found in household waste;**

(2) **The container is designed to hold liquids for use other than storage; or**

(3) **The waste is household waste.**

(c) **For purposes of this section:**

(1) **Liquid waste means any waste material that is determined to contain "free liquids" as defined by Method 9095 (Paint Filter Liquids Test), as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" (EPA Pub. No. SW-846).**

(2) **Gas condensate means the liquid generated as a result of gas recovery process(es) at the MSWLF unit.**

3.10.2 Applicability

The regulation applies to new MSWLF units, existing MSWLF units, and lateral expansions of existing MSWLF units. The owner or operator is prohibited from placing bulk or non-containerized liquid waste, or containerized liquid waste into the MSWLF unit. Liquids from households are exempt. Tank trucks of wastes are not exempt.

3.10.3 Technical Considerations

The restriction of bulk or containerized liquids is intended to control a source of liquids that may become a source of leachate. Liquid waste refers to any waste material that is determined to contain free liquids as defined by SW-846 (U.S. EPA, 1987) Method 9095 - Paint Filter Liquids Test. The paint filter test is performed by placing a 100 milliliter sample of waste in a conical, 400 micron paint filter. The waste is considered a liquid waste if any liquid from the waste passes through the filter within five minutes. The apparatus used for performing the paint filter test is illustrated in Figure 3-9.

If the waste is considered a liquid waste, absorbent materials may be added to render a "solid" material (i.e., waste/absorbent mixture that no longer fails the paint filter liquids test). One common waste stream that may contain a significant quantity of liquid is sludge. Sludge is a mixture of water and solids that has been concentrated from, and produced during, water and wastewater treatment. Sludges may be produced as a result of providing municipal services (e.g., potable water supply, sewage treatment, storm drain maintenance) or commercial or industrial operations. Sewage sludge is a mixture of organic and inorganic solids and water, removed from wastewater containing domestic sewage. Sludge disposal is acceptable provided the sludge passes the paint filter test.

[NOTE: Additional Federal regulations restricting the use and disposal of sewage sludge were published on February 19, 1993 in the Federal Register (58 FR 9248). These regulations, however, do not establish additional treatment standards or other

special management requirements for sewage sludge that is codisposed with solid waste.]

Owners and operators of MSWLF units may return leachate and gas condensate generated from a gas recovery process to the MSWLF, provided the MSWLF unit has been designed and constructed with a composite liner and leachate collection system in compliance with 40 CFR §258.40(a)(2). Approved States may allow leachate and landfill gas condensate recirculation in MSWLF units with alternative designs.

Recirculating leachate or landfill gas concentrate may require demonstrating that the added volume of liquid will not increase the depth of leachate on the liner to more than 30 cm.

Returning gas condensate to the landfill unit may represent a reasonable long-term solution for relatively small volumes of condensate. Gas condensate recirculation can be accomplished by pumping the condensate through pump stations at the gas recovery system and into dedicated drain fields (buried pipe) atop the landfill, or into other discharge points (e.g., wells).

Because gas condensate may be odorous, spray systems for recirculation are not used unless combined with leachate recirculation systems.

Leachate recirculation to a MSWLF unit has been used as a measure for managing leachate or as a means of controlling and managing liquid and solid waste decomposition. Leachate recirculation can be accomplished in the same manner as recirculation of landfill gas condensate. Because of the larger volume, however, discharge points may not be as effective as drainfields. In some cases, discharge points

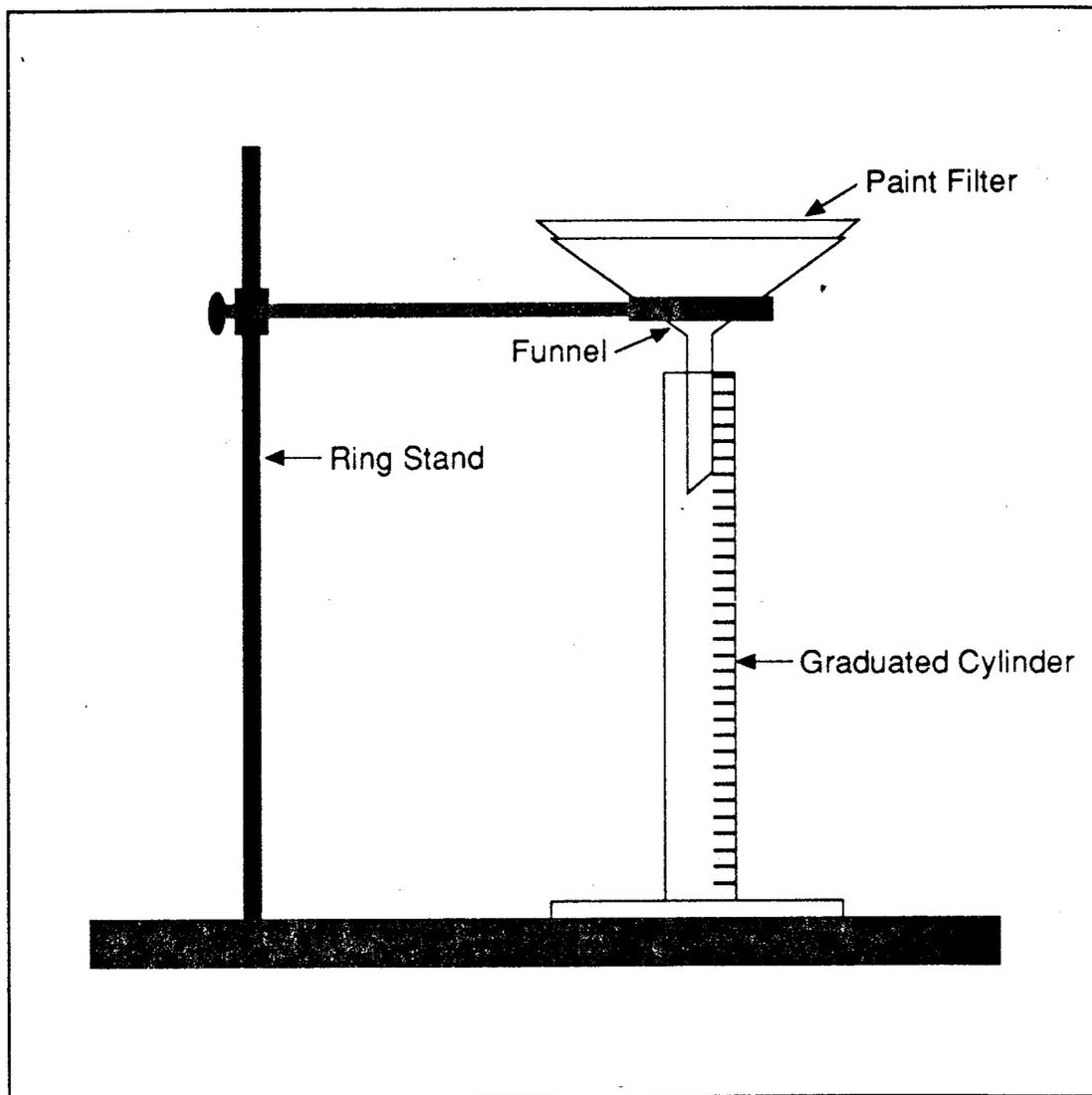


Figure 3-9. Paint Filter Test Apparatus

have been a source of odor. In addition, a discharge point may not allow for dissipation of the leachate. (For additional information regarding the effectiveness of using leachate recirculation to enhance the rate of organic degradation, see (Reinhart and Carson, 1993).)

3.11 RECORDKEEPING REQUIREMENTS 40 CFR §258.29

3.11.1 Statement of Regulation

(a) The owner or operator of a MSWLF unit must record and retain near the facility in an operating record, or in an alternative location approved by the Director of an approved state, the following information as it becomes available:

(1) Any location restriction demonstration required under Subpart B of this part;

(2) Inspection records, training procedures, and notification procedures required in §258.20 of this Part;

(3) Gas monitoring results from monitoring and any remediation plans required by §258.23 of this Part;

(4) Any MSWLF unit design documentation for placement of leachate or gas condensate in a MSWLF unit as required under §258.28 (a)(2) of this Part;

(5) Any demonstration, certification, finding, monitoring, testing, or analytical data required by Subpart E of this Part;

(6) Closure and post-closure care plans and any monitoring, testing, or analytical data as required by §§258.60 and 258.61 of this Part; and

(7) Any cost estimates and financial assurance documentation required by Subpart G of this Part.

(8) Any information demonstrating compliance with small community exemption as required by §258.1(f)(2).

(b) The owner/operator must notify the State Director when the documents from paragraph (a) of this section have been placed or added to the operating record, and all information contained in the operating record must be furnished upon request to the State Director or be made available at all reasonable times for inspection by the State Director.

(c) The Director of an approved State can set alternative schedules for recordkeeping and notification requirements as specified in paragraphs (a) and (b), except for the notification requirements in §258.10(b) and §258.55(g)(1)(iii).

3.11.2 Applicability

The regulation applies to existing MSWLF units, lateral expansions of existing MSWLF units, and new MSWLF units. The recordkeeping requirements are intended to be self-implementing so that owners/ operators in unapproved States can comply without State or EPA involvement. The owner or operator is required to maintain records of demonstrations, inspections, monitoring results, design documents, plans, operational

procedures, notices, cost estimates, and financial assurance documentation.

3.11.3 Technical Considerations

The operating record should be maintained in a single location. The location may be at the facility, at corporate headquarters, or at city hall, but should be near the facility. Records should be maintained throughout the life of the facility, including the post-closure care period. Upon placement of each required document in the operating record, the State Director should be notified. The Director of an approved State may establish alternative requirements for recordkeeping, including using the State permit file for recordkeeping.

Recordkeeping at the landfill facility should include the following:

(a) Location restriction demonstrations: Demonstrations are required for any location restrictions under Subpart B. The location restrictions apply to:

- Airports;
- Floodplains;
- Wetla
- Fault areas;
- Seismic impact zones; and
- Unstable areas.

(b) Inspection records, training procedures, and notification procedures: Inspection records should include:

- Date and time wastes were received during the inspection;
- Names of the transporter and the driver;
- Source of the wastes;
- Vehicle identification numbers; and
- All observations made by the inspector.

Training records should include procedures used to train personnel on hazardous waste and on PCB waste recognition. Notification to EPA, State, and local agencies should be documented.

(c) Gas monitoring results and any remediation plans: If gas levels exceed 25 percent of the LEL for methane in any facility structures or exceed the LEL for methane at the facility boundary, the owner or operator must place in the operating record, within seven days, the methane gas levels detected, and a description of the steps taken to protect human health. Within 60 days of detection, the owner or operator must place a copy of the remediation plan used for gas releases in the operating record.

(d) MSWLF unit design documentation for placement of leachate or gas condensate in a MSWLF unit: If leachate and/or gas condensate are recirculated into the MSWLF unit, documentation of a composite liner and a leachate collection system capable of maintaining a maximum of 30 cm of leachate head in the MSWLF unit must be placed in the operating record.

(e) Demonstration, certification, monitoring, testing, or analytical finding required by the ground-water criteria:

Documents to be placed in the operating record include:

- Documentation of design, installation, development, and decommission of any monitoring wells, piezometers, and other measurement, sampling, and analytical devices;
- Certification by a qualified ground-water scientist of the number, spacing, and depths of the monitoring systems;
- Documentation of sampling and analysis programs and statistical procedures;
- Notice of finding a statistically significant increase over background for one or more of the constituents listed in Appendix I of Part 258 (or alternative list in approved States) at any monitoring well at the waste management unit boundary (States with inadequate program) or the relevant point of compliance (approved States);
- Certification by a qualified ground-water scientist that an error in sampling, analysis, statistical evaluation, or natural variation in ground water caused an increase (false positive) of Appendix I constituents, or that a source other than the MSWLF unit caused the contamination (if appropriate);
- A notice identifying any Appendix II (Part 258) constituents that have been detected in ground water and their concentrations;

- A notice identifying the Part 258 Appendix II constituents that have exceeded the ground-water protection standard;
- A certification by a qualified ground-water scientist that a source other than the MSWLF unit caused the contamination or an error in sampling, analysis, statistical evaluation, or natural ground-water variation caused a statistically significant increase (false positive) in Appendix II (Part 258) constituents (if applicable);
- The remedies selected to remediate ground-water contamination; and
- Certification of remediation completion.

(f) Closure and post-closure plans and any monitoring, testing, or analytical data associated with these plans:

The landfill facility owner or operator is required to place a copy of the closure plan, post-closure plan, and a notice of intent to close the facility in the operating record. Monitoring, testing, or analytical data associated with closure and post-closure information generated from ground-water and landfill gas monitoring must be placed in the operating record. A copy of the notation on the deed to the MSWLF facility property, as required following closure, along with certification and verification that closure and post-closure activities have been completed in accordance with their respective plans, also must be placed in the operating record.

(g) Estimates and financial assurance documentation required: The following documents must be placed in the operating record:

- An estimate of the cost of hiring a third party to close the largest area of all MSWLF units that will require final cover;
- Justification for the reduction of the closure cost estimate and the amount of financial assurance (if appropriate);
- A cost estimate of hiring a third party to conduct post-closure care;
- The justification for the reduction of the post-closure cost estimate and financial assurance (if appropriate);
- An estimate and financial assurance for the cost of a third party to conduct corrective action, if necessary; and
- A copy of the financial assurance mechanisms.

3.12 FURTHER INFORMATION

3.12.1 References

Flower, et al., (1982). "Vegetation Kills in Landfill Environs"; Franklin B. Flower, Ida A. Leone, Edward F. Gilman and John J. Arthur; Cook College, Rutgers University; New Brunswick, New Jersey 08903.

Reinhart, D.R., and D. Carson, (1993). "Experiences with Full-Scale Application of Landfill Bioreactor Technology," Thirty-First Annual Solid Waste Exposition of the Solid Waste Association of North America, August 2-5, 1993.

SWANA, (1992). "A Compilation of Landfill Gas Field Practices and Procedures"; Landfill Gas Division of the Solid Waste Association of North America (SWANA); March 1992.

U.S. Department of Agriculture Soil Conservation Service, (1986). "Urban Hydrology for Small Watersheds"; PB87-101580.

U.S. Department of Commerce, Weather Bureau, "Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years."

U.S. EPA, (1985). "Handbook - Remedial Action at Waste Disposal Sites"; EPA/625/6-85/006; U.S. EPA, Office of Research and Development; Cincinnati, Ohio 45268.

U.S. EPA, (1986). "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods"; Third Edition as amended by Updates I and II. U.S. EPA SW-846; Office of Solid Waste and Emergency Response; Washington, D.C.

U.S. EPA, (1988). "Guide to Technical Resources for the Design of Land Disposal Facilities"; EPA/625/6-88/018; U.S. EPA; Risk Reduction Engineering Laboratory and Center for Environmental Research Information; Cincinnati, Ohio 45268.

U.S. EPA, (1992). "Alternative Daily Cover Materials for Municipal Solid Waste Landfills;" U.S. EPA Region IX; San Francisco, California 94105.

3.12.2 Addresses

Solid Waste Association of North America (SWANA/GRCDA)
P.O. Box 7219
Silver Spring, MD 20910
(301) 585-2898

APPENDIX I

Special Waste Acceptance Agreement

Code# _____

Special Waste Acceptance Application

Generator Name: _____ Originating Division: _____
 Address: _____ Disposal Facility: _____
 Telephone: () _____ Location: _____
 Generator Contact: _____ Waste Quantities: _____ Units: Cubic Yds. Tons
 General Material Description: _____ Frequency of Receipt: Daily Weekly Monthly One Time
 Other _____

Process Generating Waste: _____
 Physical Properties: Physical State at 70°F: Solid Semisolid Liquid Density: _____ #/CY Color: _____
 Viscosity: Low Medium High Flash Point: _____ °F Odor: Yes No
 Water Content: _____ % by Weight Paint Filter Test: Passed Failed
 Reactive: No Yes With _____
 Waste pH: _____ Infectious: Yes No

Chemical Properties: (Concentrations in mg/l)

(TCLP)	Arsenic _____	m-Cresol _____	Hexachlorobenzene _____	Pyridine _____
	Barium _____	p-Cresol _____	Hexachlorobutadiene _____	Selenium _____
	Benzene _____	Cresol _____	Hexachloroethane _____	Silver _____
	Cadmium _____	2,4-D _____	Lead _____	Tetrachloroethylene _____
	Carbon Tetrachloride _____	1,4 Dichlorobenzene _____	Lindane _____	Toxaphene _____
	Chlordane _____	1,2 Dichloroethane _____	Mercury _____	Trichloroethylene _____
	Chlorobenzene _____	1,1-Dichloroethylene _____	Methoxychlor _____	2,4,5-Trichlorophenol _____
	Chloroform _____	2,4-Dinitrotoluene _____	Methyl Ethyl Ketone _____	2,4,6-Trichlorophenol _____
	Chromium _____	Endrin _____	Nitrobenzene _____	2,4,5-TP (Silvex) _____
	o-Cresol _____	Heptachlor _____	Pentachlorophenol _____	Vinyl Chloride _____

Other (list): _____
 Other Information: Delivery Method: Bulk Other: _____
 Regulatory Agency Approval Received: Yes No Permit Number: _____
 Material Safety Data Sheet Provided: Yes No

GENERATOR CERTIFICATION
 To the best of my knowledge, the information provided above is accurate and the material is not classified as a hazardous waste in accordance with current regulations.
 Authorized Representative
 Signature _____
 Name _____
 Title _____
 Date _____

FOR OFFICE USE ONLY

Conditions for Acceptance _____

1. Originating Division Manager _____ Date _____
 2. Disposal Facility Manager _____ Date _____
 3. District Manager _____ Date _____
 4. Regional Engineer _____ Date _____

Recertification Frequency: BI Annual Annual Semi Annual

First Page to Owner/Operator; Second Page to Customer; Third Page to Laboratory

Appendix I. Example Special Waste Acceptance Agreement