Section 9: Landfill Operations

9.1 Introduction

Operations plan

Develop an operations plan that describes the facility's operation and maintenance and incorporates the facility's planned development and specific design elements.

Reference: OAR 340-94-040(11)(b)

Operations and maintenance manual

Once new landfill units or related facilities are constructed and activated, prepare a detailed operations and maintenance (O&M) manual. The O&M manual should incorporate pertinent information from the following sources:

- operations plan
- final design documents
- post-construction documents
- hands-on operating experience, and
- equipment manufacturers

How to respond

During the design phase of the project, prepare an operations plan that integrates the site development plan, the facility design elements, and the operational elements described in this subsection. Submit the plan to DEQ for review and approval.

Once the landfill unit and related facilities are constructed and activated, prepare the O&M manual. Incorporate the operations plan elements, construction documents, and equipment manufacturers and suppliers data. Prepare separate O&M manuals for complex systems, such as leachate treatment systems, landfill gas control systems. Make the O&M manual available to operating personnel and place a copy of the manual(s) in the facility operating record.

O&M manual content

The O&M manual should be a practical document intended for day-to-day use by on-site operations personnel that:

- reflects the scope and content of field operations
- provides clear and detailed direction to landfill operating personnel
- addresses all topics identified in the operations plan
- includes a detailed table of contents
- includes definitions of all technical terminology, and
- is assembled as a loose-leaf binder to facilitate periodic revisions

Updating operations documents

Update the operations plan and the O&M manual as necessary to reflect significant facility expansions or changes in site operations and equipment.

In this section

This section describes the operational elements that should be addressed in the operations plan, including:

- general operations
- disposal operations -- waste handling
- disposal operations -- management of working area
- special waste management
- ancillary operations
- inspection and maintenance
- operating record
- contingency
- incremental post-closure operations, and
- personnel

9.2 General Operations

Security

Establish security measures to prevent unauthorized entry, waste disposal, and unsafe scavenging practices.

Signs

For public-use landfills, post signs bearing the following information:

- facility name
- business address and telephone number of the facility owner/operator (person or municipality)
- an emergency telephone number
- hours of operation
- current permit number, and
- a list of general types of materials which will be accepted or not accepted

Access hours and controls

Establish operating hours and man-made or natural barriers to:

- discourage entry by unauthorized persons
- limit access to the site to times when an attendant is on duty
- prevent unauthorized vehicular traffic and illegal dumping of wastes, and
- protect human health and the environment.

Reference: OAR 340-94-040(9) and 340-94-040(11)(h)

Aesthetics

Screen the active landfill area from public view.

Access roads

Construct and maintain on-site access roads to minimize traffic hazards, dust and mud and to provide reasonable all-weather access. Specify the maximum sustained grade of an access road. Construct stream crossings using culverts or other structures that do not increase the potential for flooding or excessive soil erosion. Incorporate roadway design in the detailed engineering drawings and specifications (Section 7).

Open burning

Prevent uncontrolled and/or unauthorized open burning.

Endangered species	Establish operating procedures to prevent the harming, killing, capturing or collecting of any endangered or threatened species, or to the direct or indirect alteration of critical habitat for those species. Protect any such species.
Floodplain integrity	Determine if facilities are located in the 100-year floodplain. The facility must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste.
Sewage disposal	Manage on-site sewage in accordance with Department-approved plans.

9.3 Disposal Operations -- Waste Handling

Weighing	Install equipment for weighing incoming loads or establish procedures for estimating weight by volume of waste loads. Account for the amount of incoming waste.
Scavenging controls	Prevent uncontrolled and unauthorized removal of solid waste. Material recovery activities must not create adverse health or environmental impacts.
Waste acceptability procedures	Establish waste acceptance procedures that include the following elements: • A random inspection program at the facility for detecting and preventing the disposal of regulated hazardous wastes, polychlorinated biphenyl wastes or any other unacceptable wastes as specified in the permit or determined by the Department. • Waste screening to control prohibited waste and special wastes which require prior Department approval. • Procedures used wherever prohibited or special wastes could enter the facility, including the working face, transfer stations, direct haulers, and landfill scale houses. • Procedures for managing prohibited wastes detected in landfilled waste. • Measures to handle unusual peak waste loads which may exceed the facility's capacity. References: 40 CFR 258.20 describes the requirements for a random inspection program; OAR 340-93-040 defines prohibited wastes
Liquid wastes	Prevent the disposal of bulk or non-containerized liquid waste and meet the requirements of 40 CFR 258.28(b).
Out of state wastes	For imported wastes, establish procedures to follow prohibitions or restrictions.
Salvage	Recover salvage materials in a planned and controlled manner. Reference: OAR 340-94-040(11)(k)

Litter control

Control litter by establishing good waste compaction practices, a small working face, and physical controls (e.g., permanent and portable fences), and cleanup procedures to prevent on and off-site windblown litter accumulations.

Reference: OAR 340-94-040(11)(l)

Vector and bird control

Control or prevent on-site populations of flies, rodents, other disease vectors, and birds.

References: OAR 340-94-040(10); 40 CFR 258.10

Inclement weather operations

Develop procedures for inclement weather operation, including provisions for:

- all-weather roads, wet-weather, and alternate disposal areas
- operating in extreme dry weather conditions or when dust emissions are excessive
- operating during other severe climatic conditions such as severe winds or snow, and
- notifying customers when severe climatic conditions require closure of disposal facilities

Reference: OAR 340-94-040(11)(b)(D)

Leachate system

Establish operation and maintenance procedures for the leachate management system and if applicable, the alternative leachate disposal system, scheduling of key activities during landfill development. Prepare a separate, detailed O&M manual for complex leachate treatment systems. Address the topics in the table below, as applicable.

System component	Topics to be addressed
Leachate Collection	Leachate collection system operation and performance Leachate level measurement techniques, frequency, location, for normal and wet weather operations Measures to prevent clogging and physical damage of collection system components
Leachate Storage	Odor control Leachate level monitoring Prevention of leachate releases to the environment (such as overflows or leaks) Liner system maintenance

System component	Topics to be addressed
Leachate Treatment/ Disposal	Influent and effluent testing Treatment efficiencies Treatment process adjustments and monitoring

Landfill gas control

Manage landfill gas to prevent subsurface migration of methane.
Describe detailed operation and maintenance procedures for the landfill gas control system in the facility O&M manual. Prepare a separate O&M manual for complex gas control systems.

References: OAR 340-94-040(5) and 40 CFR 258.23

Surface water control

Establish measures to prevent stormwater run-on onto active portions of the landfill and to control runoff. Incorporate a copy of the storm water pollution control plan into the operations plan.

Reference: Clean Water Act Sections 208, 319, and 402 involving wetlands; NPDES requirements in 40 CFR 258.26 and 258.27

Groundwater control

Operate and maintain the groundwater control system and associated equipment. Groundwater control measures may include dewatering systems (e.g., under drains and wells) and barrier systems (e.g., slurry walls, geomembrane walls) accompanied by pumps, manholes, buried piping, catch basins, outlets, and other equipment requiring operation and maintenance.

9.4 Disposal Operations -- Management of Working Area

Compatibility

Landfill disposal operations should be compatible with engineered structures and environmental control and monitoring systems, and should be consistent with the Site Development Plan and other aspects of facility operations.

Waste unloading

Develop waste unloading procedures for incoming vehicles and inspection procedures to identify and isolate prohibited or unacceptable wastes. Establish the size of the refuse unloading area from the following:

- incoming waste quantities
- number, size, and type of delivery vehicles
- compacting equipment requirements, and
- litter control and other environmental considerations

First layer of fill

Establish precautions to protect the geomembrane liner when the first layer of waste is placed and compacted in lined disposal areas. The first operations layer should be "select waste". Consider the following factors in establishing appropriate safeguards:

- the thickness and physical characteristics of the initial waste layer
- the availability of desirable "select waste" materials
- the thickness and physical characteristics of the drainage and operations layers
- whether the landfill cell design incorporates special-purpose geosynthetic materials (e.g., geotextiles) for added protection of the liner, and
- the type of equipment used to place and compact the initial waste layer

Definition: “Select waste” includes household waste but not demolition or land-clearing debris or other materials that may damage the liner system

Leachate minimization

Minimize leachate generation with appropriate landfill development and operations techniques.

Active face

Specify the nominal size of the active working face, and establish compatible waste unloading and filling procedures. Consider the following in determining the size of the working face:

- The width of the working face should only be wide enough to accommodate waste unloading and compaction equipment operation
- The cell height and length should be selected based on the daily volume of refuse received, and
- Cell end slopes should be kept as steep as possible (20 to 30 degrees)

Compaction

Establish procedures for waste spreading and compaction including layer thickness, maximum lift height, daily cell configuration and slopes, compaction equipment and compactive effort (i.e., minimum number of compactor passes over each layer of waste), and the intended density of solid waste.

Recommendation: The Department recommends that waste be spread in thin (about 1-foot-thick) layers and compacted with 3 to 5 passes of the compactor on slopes of about 3 horizontal to 1 vertical. The most effective compaction occurs with the compactor operating on a level surface.

Benefits of compaction

Proper compaction of solid waste at landfills can provide several important benefits including:

- conserving landfill space
- minimizing and controlling litter
- reducing daily cover efforts and cost
- reducing total and differential settlement of the waste and associated closure and post-closure costs, and
- creating a more aesthetic operation

Daily cover

Place "daily cover" on all exposed solid waste at the end of each operating day, or more often if necessary to control problems such as fly propagation, blowing litter, vectors, and fires. Place at least six inches of earthen material on exposed solid waste at the end of each working day, unless alternative cover designs or procedures are approved by the Department.

Reference: 40 CFR 258.21 describes requirements for daily cover

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Alternative daily cover

Alternative cover materials must provide the same level of control as earthen material. Example alternative covers include the following materials:

- Geosynthetic tarps (e.g., geotextiles and geomembranes)
- Spray-on foams
- Slurry products
- Inert waste materials (e.g., shredded tires, foundry sands)

Specifications should be established for cover material type, minimum thickness and frequency of application. Cover material sources and stockpile requirements should be identified.

Reference: 40 CFR 258.21(b) or (c), and OAR 340-94-040(8) describe the requirements for obtaining approval of alternate daily cover

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Intermediate cover

Place "intermediate cover" on the top and side slopes of an advancing lift which will not receive additional waste for at least two months. Design the intermediate cover to control surface water infiltration, disease vectors, fires, odors, blowing litter and scavenging. Intermediate cover should consist of at least one foot of compacted low-permeability soil. A geomembrane cover may also be required in areas where average annual rainfall exceeds 25 inches.

Interim cover

Place “interim cover” on segments of the landfill that reach final elevations before final cover installation. During the rainy season, place interim cover immediately after a cell reaches final elevations. Design the interim cover to minimize surface water infiltration, and potentially to serve as part of the foundation for the final cover system. Develop specifications for the interim cover's configuration, material properties (e.g. permeability), thickness, installation schedule and techniques, and raw-material sources.

9.5 Special Waste Management

Special waste management plan

Develop a Special Waste Management Plan including procedures for special waste acceptance, characterization, handling, storage, recordkeeping and disposal.

Contents

The plan should include the following elements:

- an analysis of special waste management alternatives
- a rationale for the proposed disposal alternative
- the physical and chemical characteristics of each waste
- the proposed (EPA and DEQ-approved) procedures for waste sampling, testing, and analysis
- an evaluation of whether the waste is compatible with the landfill (or other impoundment) liner and leachate management systems
- procedures to document and record daily and annual waste quantities (weight or volume), and waste sources and generating processes

Potential hazards

The table below descries the potential hazards associated with some wastes that may require special handling for disposal.

Potential hazard	Example waste
personnel safety hazards	asbestos
odor and vector problems	large dead animals
excessive leachate generation	sewage sludge
excessive settlement in the landfill	yard debris
puncturing or tearing the landfill liner	construction and demolition debris
fire hazards	tire chips
increasing the toxicity of landfill leachate	cleanup materials contaminated with hazardous substances

Reference: OAR 340-94-040(11)(b)(J)

Examples: special wastes

Special wastes include but are not limited to, the following specific items:

- asbestos
- treated infectious waste
- large animal carcasses
- hazardous-substance contaminated cleanup materials
- septage
- sewage sludges and grit
- industrial waste sludges
- industrial solid wastes
- ash
- construction and demolition waste, and
- over 25 gallons of petroleum-bearing wastes such as used oil filters, oil-absorbent materials, tank bottoms or oil sludges

9.6 Ancillary Operations

Recycling

Provide a place and opportunity for collecting source separated recyclable material. Specify the procedures to be followed in accepting recyclable materials at the facility.

Reference: OAR 340-93-160

Truck washing

Design truck washing facilities to reuse or recycle the waste water, or to discharge it to a sanitary sewer or leachate treatment system. Describe the following:

- truck washing facilities and the circumstances for their use, and
- methods for managing wash water

Required permits: Discharges to the land or to waters of the state require a National Pollutant Discharge Elimination System (NPDES) or a Water Pollution Control Facilities (WPCF) permit. The type of permit will be determined on a site-specific basis by the Department's Water Quality staff.

Operations equipment

Acquire and maintain adequate operations equipment. Select equipment for its type, important physical and mechanical specifications (i.e., ground pressure, length of compactor wheel cleats),. identify any operating restrictions (e.g., preventing compacting equipment contact with the liner), quantity and purpose. Maintain standby equipment for use in the event of breakdown or maintenance of primary equipment.

Note: The equipment types should be consistent with facility design, construction, and operational criteria

Electrical distribution system

Maintain the electrical distribution system at the facility to ensure proper function of metering points, transformers, disconnects, breakers, connections, and other power-system appurtenances.

9.7 Inspection and Maintenance

Schedule

Develop detailed inspection and maintenance procedures and a schedule for all facility components and items which require periodic inspection. Describe the activities to be conducted on a regularly scheduled basis.

Inspection form

Develop a standard inspection form to guide implementation and reporting. Form use should help maintain procedural and informational consistency.

Preventive program

Establish a preventative inspection and maintenance program schedule for all equipment and facilities including those in the table below.

Equipment/facility	Examples
personnel safety equipment	fire extinguishers
operating equipment	scrapers, dozers, compactors, loaders
support facilities	scale house, scales, public receiving area, administrative buildings
environmental control systems	landfill gas collection system, leachate collection and treatment systems sedimentation basins, cover system, liner system
environmental monitoring systems	groundwater monitoring wells, landfill gas monitoring probes, leachate monitoring sumps
transportation system	access roads, directional signs

9.8 Operating Record

Regulatory reference

Establish and maintain an operating record. Develop procedures to describe how the operating record will be established and maintained.

Reference: 40 CFR 258.29

Location

Retain the operating record near the facility or in an alternative location approved by the Department. Specify the location in the operations plan.

Content

Include the following information in the Operating Record:

Content	Regulatory source
Any required location restriction demonstrations (airport safety, floodplains, seismic impact zones or unstable areas)	40 CFR Part 258 Subpart B
Inspection records, training procedures and notification procedures included in the facility's hazardous waste screening program	40 CFR Part 258.20
Gas monitoring results and any required gas remediation plans	40 CFR Part 258.23
Documentation that the landfill meets design criteria if leachate or gas condensate is placed in the facility	40 CFR Part 258.40(a)(2)
Any demonstration, certification, finding, monitoring, testing, or analytical data (groundwater monitoring including detection and assessment monitoring, selection of a remedy and implementation of a corrective action program)	40 CFR Part 258 Subpart E
Closure and post-closure care plans and any monitoring, testing or analytical data	40 CFR Part 258 Subpart F
Any cost estimates and financial assurance documentation	40 CFR Part 258 Subpart G; OAR 340-94-140
For a landfill claiming the small community exemption, any information required by that paragraph to demonstrate compliance with the small community exemption	40 CFR Part 258.1(f)(2)

9.9 Contingency

Contingency plan scenarios

Develop a contingency plan that includes procedures for responding to the following scenarios:

- on-site personal injuries
- leachate releases
- surface water or groundwater contamination
- landfill gas migration and associated fire and explosion hazards
- liquid spills
- fires (e.g., equipment fires, "hot load" fires, disposal site fires, building fires)
- explosions, accidents, and other emergencies
- detection of leachate in any secondary leachate collection and removal system
- leachate storage facility at or above capacity
- tank and surface impoundment spills or leakage, and
- storms and inclement weather

Notification list

Create an emergency notification list in the contingency plan (e.g., contact person, address, telephone number) and procedures for:

- emergency assessment
- communication
- identification of emergency response organization
- identification of community, civil authorities and regulatory personnel, and
- reporting.

Layout map

Prepare a site layout map showing:

- facilities
- fire hydrant locations
- individual building floor plans showing locations of fire extinguishers, first aid kits and stations, exits and communication equipment, and
- other relevant site features

Fire prevention and control

Establish comprehensive procedures for fire prevention and control of equipment and solid waste fires.

Equipment fire prevention

Equipment fires generally are started by an electrical failure or fluid leak and oil and grease that spreads on the machine and on nearby refuse. Preventative maintenance on the machines will reduce the potential for leakage of flammable fluids. Routine cleaning of equipment will further contribute to fire prevention. Furnish a fire extinguisher with each piece of equipment. Consider automatic fire control systems for dozers and compactors.

Solid waste fire prevention

Landfills fires can be started by "hot loads," spontaneous combustion, unknown combustible materials subjected to sparks, and by equipment fires. On-site personnel must always be on the lookout for "hot loads" and flammable materials. Subsurface fires resulting from spontaneous combustion can be difficult to locate and extinguish. Extinguish near-surface fires by covering the area with dirt. If the fire is deep, excavating the burning material may be necessary. Follow appropriate personnel safety precautions in all of these situations. Inaccessible fires require a different strategy. Extinguish these fires by cooling the burning mass in-place, or reduce available oxygen by closing cracks and fissures, or by adjusting the gas control system operations.

9.10 Incremental Post-Closure Operations

Continuous closure

Landfill development is a continuous construction and operations activity. As areas are prepared to receive future waste, active areas are being filled and completed areas are closed. At large landfills this cycle may be repeated many times prior to final facility closure.

Relation to other plans

The site development plan provides for phased construction, operations, and closure. Final facility closure and post-closure are addressed in the closure, post-closure, and financial assurance plans.

Beginning of post-closure

The 30-year post-closure care period starts after final facility closure, not after each incremental closure. Incremental closure may involve one or more landfill modules. Final facility closure and the "worst-case closure" scenario (Subtitle D closure) involve the cessation of landfill operations.

Reference: OAR 340-94-130; Section 11 of this guidance

Inspection and maintenance

Establish routine inspection and maintenance procedures for completed landfill modules and activities to protect the integrity of the final cover system and other closure-related facilities.

Inspection and repair components

Establish procedures and a schedule for inspection, repair, and closed modules. The following critical components should be addressed:

- final cover
- surface water drainage system
- erosion and sedimentation control system
- landfill gas monitoring and control system
- leachate collection and removal system
- access control (e.g., security fence, gates, locks), and
- access roads (for inspection and maintenance)

9.11 Personnel

Operations staff

Establish an adequate operations staff and systematic qualifications, responsibilities and duties, and lines of authority.

Training topics

Train operations personnel in landfill development, construction and operation, as applicable. Training should emphasize the following:

- how to inspect waste loads and identify hazardous waste or PCB waste containers and labels
- hazardous waste handling procedures
- safety precautions, employee protective clothing and equipment, health
- first aid, 40 hour OSHA, and emergency procedures
- landfill operational practices
- record keeping, and
- permit requirements and regulatory compliance

Documentation

Place training documentation in the operating record.

Reference: 40 CFR Part 258.29

9.12 Additional Resources

References

U.S. EPA “Solid Waste Disposal Facility Criteria - Technical Manual”, October 9, 1993