

Resource Conservation and Recovery Act (RCRA) Hazardous Waste Model Permit Landfills Module

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When EPA releases a new or revised model permit module, it replaces the corresponding module, including the corresponding module in the 1988 Model RCRA Permit for Hazardous Waste Management Facilities (Draft).

MODULE XVI. LANDFILLS

{Permit Writer: This permit module contains conditions covering the unit-specific standards for landfills in 40 CFR part 264, subpart N.

Per 40 CFR 260.10, a landfill means a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.

The model permit conditions in this module reference federal regulations and guidance. Permit Writers should confirm their regulatory citations and their authority's guidance for each permit condition and replace (or add to) the federal citations with state analogous regulatory citations and/or references as applicable. When jointly issuing permits, the federal Permit Writer will issue the federal portion of the permit citing the federal regulations while the state Permit Writer will cite the state analogous regulatory citation in the state's jointly issued portion of the permit.

State Permit Writers need to add or revise permit conditions for State regulatory requirements that are broader in scope, more specific, or otherwise different than the federal requirements.

Permit Writers can insert the title(s) of their regulatory authority's appropriate official(s) for or in addition to instances where the module uses "Director." When jointly issuing permits, the federal Permit Writer will cite the EPA Region's appropriate official in the federal portion of the permit, and the state will cite the state's appropriate official in the state's portion of the permit

Information contained in the following documents provide additional guidance in drafting this Permit Module: [Ensuring and Determining Compliance with Land Disposal Restrictions Through RCRA Permits, Waste Analysis Plans and Inspection Sampling Practices Information Bulletin \(EPA 530-F-22-004\) dated April 2022](#); [Requirements for Hazardous Waste Landfill Design, Construction, and Closure \(EPA/625/4-89/022\)](#); [Final Covers on Hazardous Waste Landfills and Surface Impoundments \(EPA/530-SW-89-047\)](#); [OSWER Memorandum Re: Guidelines for Evaluating the Post-Closure Care Period for Hazardous Waste Disposal Facilities under Subtitle C of RCRA dated Dec 15, 2016](#); [Design, Construction, and Evaluation of Clay Liners for Waste Management Facilities \(EPA/530-SW-86-007\)](#); [Construction Quality Assurance for Hazardous Waste Land Disposal Facilities \(Draft\) \(EPA 530-SW-85-021\)](#); [Quality Assurance and Quality Control for Waste Containment Facilities \(Draft\) \(EPA/600/SR-193/182\)](#); [Quality Assurance and Quality Control for Waste Containment Facilities \(EPA/600/R-93/182\)](#); [U.S. EPA, 1991. Design](#)

and Construction of RCRA/CERCLA Final Covers. Report Number EPA/625/4-91/025. U.S. Environmental Protection Agency, Cincinnati, OH. May 1991; Review of Liner and Cap Regulations for Landfills (EPA/600/A-94/246); Action Leakage Rates for Leak Detection Systems (EPA 530-19-92-004); Fugitive Dust Control at TSCA PCB Cleanup Sites. November 2024. (EPA 530-R-24-005).}

XVI.A. APPLICABILITY

{Permit Writer: In general, a single landfill permit module should be used if one or more landfill units will be covered by the same permit for a given facility. However, it is acceptable to include two or more landfill modules (or sections in one module) if, at the Permit Writer's discretion, the landfill unit characteristics and permit conditions are sufficiently different to warrant multiple landfill modules (or sections within the landfill module).}

XVI.A.1. The Permittee is authorized to dispose of hazardous waste in the following landfill units for hazardous wastes generated onsite {and received from offsite} as described in Table XVI.1. and XVI.2. and subject to the conditions of this Permit. The location of the landfill units is provided in Figure {XXX} in Section {XXX} of the Approved Permit Application. Details regarding the design, construction, operation, and maintenance of the landfill units are provided in the Design and Engineering Report in Section {XXX} of the Approved Permit Application and included as Attachment {XXX} to this Permit. Waste management and operating procedures are described in Section {XXX} of the Approved Permit Application. Permit Conditions addressing the requirements in 40 CFR part 264, subpart F are included in Module VI, Groundwater Requirements of this Permit. [Refer to 40 CFR 264.300, 264.301, 270.13(h), 270.14(b), and 270.21(b).]

Table XVI.1. Permitted Landfill Units

Landfill Unit No.	Unit Type: Existing/New/ Other ¹	Type/Characteristic of Liner(s)	Description of Leachate Collection and Removal System	Special Requirements
<i>Example:</i> L-1	Existing	Synthetic Liner	Granular drainage blanket over primary geomembrane	N/A

¹For the purposes of this table, Existing landfill units are those described in 264.301(a); New landfill units are those described in 264.301(c); and Other landfill units are those described in 264.301(b), (d), (e), and (f).

Example: L-2	New	Geomembrane Liner Composite Liner composed of HDPE FML over 3-ft CCL	Geocomposite drainage over primary GM	N/A
Example: L-3	Other (f)	Alternate composite liner (GM/GCL)	Side-slope geocomposite drains to perimeter toe trench and riser; single sump with auto-pump	N/A

Table XVI.2. Permitted Landfill Units and Allowable Hazardous Waste

Landfill Unit & Landfill Cell Designation	Total Capacity (cubic yards)	Net Disposal Volume Remaining (cubic yards)	Dimensions	Description of Allowable Hazardous Waste	Hazardous Waste Code	Action Leakage Rate
Example: South Cells 1 and 2	2,200 yd ³	1,000 yd ³	20 ft × 60 ft × 50 ft deep	Dust from steel furnace Lead smelting dust	K061 K069	20 gallons/ acre/day

XVI.B. PERMITTED WASTE

{Permit Writer: Per 40 CFR 268.7(c), a Facility that treats and/or land disposes hazardous waste must test the waste, or an extract of the waste or treatment residue developed using test method 1311 (the Toxicity Characteristic Leaching Procedure), according to the frequency specified in their Approved Waste Analysis Plan (as required by 40 CFR 264.13(b)) to assure they are meeting the land disposal restriction (LDR) treatment standards as provided for in 40 CFR 268.40 – 268.49. The Permit Writer should carefully review the Waste Analysis Plan to ensure that it: (1) describes the site- and waste-specific procedures the facility will carry out to obtain a detailed chemical and physical analysis of the wastes to be disposed of at the facility, as provided by 40 CFR 264.13, and (2) addresses all of the elements of a well-designed and operated treatment system, as provided for in 40 CFR 270.30(e), 270.32(b)(1) and (2). These elements can include minimum mixing times; thorough mixing methods or equipment; treatability studies on each waste; process control samples collected pre-treatment and/or in-treatment that correlate with successful treatment; as well as appropriate pre-treatment analysis to help identify incoming waste variability that may require adjustment to waste mixtures or other aspects of the treatment process to ensure successful treatment, and to identify any waste constituents that may interfere with the treatment process. This information should be incorporated into Permit Conditions, as provided by 40 CFR 270.32(b)(1)-(2).

Additional guidance regarding LDR compliance can be found in the following EPA guidance document: [Ensuring and Determining Compliance with Land Disposal Restrictions Through RCRA Permits, Waste Analysis Plans and Inspection Sampling Practices Information Bulletin \(EPA 530-F-22-004\)](#) dated April 2022.}

XVI.B.1. The Permittee shall only dispose of the hazardous wastes and amounts in the designated landfill units at the Facility as identified in Table XVI.2. of this module, and subject to the terms of this Permit.

XVI.B.2. The Permittee must test all waste, prior to placement, in accordance with the 40 CFR part 268.7(b) and (c) and as specified in the Approved Waste Analysis Plan provided in Section {XXX} of the Approved Permit Application. [Refer to 40 CFR parts 268.7(b) and (c), and 264.13.]

XVI.B.3. The Permittee is prohibited from disposing of any hazardous waste that is not allowed under Permit Condition XVI.B.1. of this module and that does not meet all applicable testing and treatment standards as described in Permit Condition XVI.B.2. of this module in accordance with 40 CFR part 268, Subpart D.

XVI.B.4. If a waste is designated as hazardous waste by the state in which it was generated, the Permittee must manage the waste as hazardous waste. This must be done in accordance with the terms of this permit, upon acceptance, when brought to the facility and during storage and/or treatment while at the facility. Waste originally designated as hazardous waste in its state of origin must be manifested as hazardous waste when shipped offsite, unless it has been treated at the facility and is demonstrated to be non-hazardous through subsequent waste determination.

XVI.C. DESIGN AND OPERATING REQUIREMENTS

{Permit Writer: See below for general considerations on design and operating requirements and alternative requirements, exemptions, or waivers.}

General design and operating requirement considerations:

- *Landfill units which construction commenced after January 29, 1992, lateral expansion of landfill units which construction commenced after July 29, 1992, and replacement of existing landfill units that commenced use after July 29, 1992, must comply with the minimum technological requirements mandated by RCRA §3004(o)(1)(A) and (o)(4), i.e., have double liner system with the upper liner consisting of a flexible membrane liner (FML) and a lower composite bottom liner that consists of at least two components (FML over 3 feet (91 cm) of compacted soil material with a hydraulic conductivity of no more*

than 1×10^{-7} cm/sec), leachate collection and removal systems, and a leak detection system.

- *The leak detection system is located between the upper FML and the lower FML. This zone should be cut off from groundwater incursion by both the design of the liner system and by the elevation of the bottom of the liner. If the groundwater can rise above the bottom elevation of the bottom liner, then an external system should be engineered to draw down the groundwater in these areas so that the groundwater is below the bottom liner elevation. In areas of high groundwater table, the suitability of the site for landfill cells should be considered.*
- *If sacrificial barrier liners will be mandated to provide UV or other protection to a side slope liner system, then Permit Condition XVI.C.10. should be included in the module. If not applicable, remove this Permit Condition and adjust the numbering.*
- *If intermediate berms will be mandated to temporarily divide landfill cells, then the Permit Condition XVI.C.11. should be included in this module. If not applicable, remove this Permit Condition and adjust the numbering.*
- *If macro-encapsulated wastes will be allowed for disposal under this Permit, then Permit Condition XVI.C.12. should be included in this module. If not applicable, remove this Permit Condition and adjust the numbering.*
- *Temporary Cover is typically intended to provide operational benefits, such as stabilizing the waste containers that have been delivered, minimizing the amount of precipitation that gets into the landfill, or for the separation of specific manifested waste deliveries that have been packaged in containers that require isolation from other wastes to maintain containment integrity. The Facility Operations Plan in the Approved Permit Application should include details such as when temporary cover is required, cover composition, application, and duration of use, dependent on Facility Operations Plan and each landfill's needs. For example, in areas with high precipitation volumes, a temporary cover may be considered to help prevent increased volumes of leachate formation.*

Alternative requirements, exemptions, or waivers:

- *Alternative requirements, exemptions, or waivers that can be established by the Director are discussed in 40 CFR 264.301(b), (d), (e), and (f). Any item warranting exemption or waiver must be detailed in the Approved Permit Application, and the Director would have had to provide approval prior to preparation of this Permit. Additionally, all exemptions or waivers must be incorporated as permit conditions.*
- *For example, per 40 CFR 264.301(e), if a Permittee has a monofill and is granted an exemption from the double liner requirement specified in 40 CFR 264.301(c), then a Permit Condition should be added which states that "The Permittee must design, construct, operate, and maintain the monofill in accordance with the plans and specifications outlined in Section {XXX} of the Approved Permit Application, Monofill*

Alternative Plan, the requirements in the exemption approval issued by the Director and the following Permit Conditions {XXX} in this module.”

- *The Permit Writer should confirm there are no permit conditions, exemptions or variances that are less stringent than the Federal RCRA Program per 40 CFR 271.3(b)(2) and 271.4.}*

XVI.C.1. The Permittee must design, construct, operate, and maintain all landfill units covered under Permit Condition XVI.B.1. of this module in a manner that prevents the migration of hazardous constituents into adjacent subsurface soil or groundwater, surface water at any time during the active life (including the closure period), in accordance with the design and operating requirements of this module and in compliance with 40 CFR 264.301.

XVI.C.2 The Permittee must design, install, operate and maintain the liner, leachate collection and removal system immediately above the liner, and the stormwater run-on and run-off management system as specified in the Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application, in compliance with 40 CFR 264.301, and based on guidance provided in [Requirements for Hazardous Waste Landfill Design, Construction, and Closure \(EPA/625/4-89/022\)](#).

XVI.C.3. The Permittee must ensure that the liner of all landfill units is: (1) constructed of materials with appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, stress from installation, and stress from daily operation; (2) placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and (3) installed to cover all surrounding earth likely to be in contact with the waste or leachate.

{Permit Writer: In addition to Condition XVI.C.3, Condition XVI.C.3.a applies to: (1) all landfill units which construction commenced after January 29, 1992, (2) lateral expansion of landfill units which construction commenced after July 29, 1992, and (3) replacement of existing landfill units that commenced use after July 29, 1992. Note that both Condition XVI.C.3. and Condition XVI.C.3.a would apply in this case. These units are listed as “New” in Table XVI.1. For existing units constructed before the aforementioned dates, only Condition XVI.C.3 applies. The liner and leachate collection and removal system requirements for units built prior to 1992 are described in 40 CFR 264.301(a).}

XVI.C.3.a. The Permittee must design, install, operate and maintain a liner system that includes a top liner that prevents the migration of hazardous constituents through such liner, and a composite bottom liner that consists of at least two components.

XVI.C.3.a.i. The upper component of the composite bottom liner must be made of {XXX} flexible membrane liner(s) (FMLs) for each cell to prevent the migration of hazardous constituents into this component. Each liner of the upper component must be a minimum of {XXX} mil thick and a maximum of {XXX} mil, as described in Table XVI.3. of this module and Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(c)(1).

XVI.C.3.a.ii. The lower component of the composite bottom liner must be designed and constructed of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur. The lower component must be constructed of at least 3 feet (91 cm) of compacted soil material with a hydraulic conductivity of no more than 1×10^{-7} cm/sec, as described in Table XVI.3. of this module and Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(c)(1).

{Permit Writer: Condition XVI.C.4. below only applies to: (1) all landfill units which construction commenced on or before January 29, 1992, (2) lateral expansion of landfill units which construction commenced on or before July 29, 1992, and (3) replacement of existing landfill units that commenced use on or before July 29, 1992. These units are listed as "Existing" in Table XVI.1.}

XVI.C.4. The Permittee must design, construct, operate, and maintain a leachate collection and removal system immediately above the top liner to collect and remove leachate from each landfill unit as specified in the Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application and the Facility Operations Plan in Section {XXX} of the Approved Permit Application. The leachate collection and removal system must satisfy the construction and operating requirements of Table XVI.3. of this module and Section {XXX} of the Approved Permit Application to ensure that the leachate depth over the liner does not exceed 30 cm (one foot). The leachate collection and removal system must be: (1) constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated; (2) of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and by any equipment used at the landfill; and (3) designed and operated to function without clogging through the scheduled closure of the landfill.

{OR}

{Permit Writer: Condition XVI.C.4. below applies to: (1) all landfill units which construction commenced after January 29, 1992, (2) lateral expansion of landfill units which construction commenced after July 29, 1992, and (3) replacement of existing landfill units that commenced use after July 29, 1992. These units are listed as “New” in Table XVI.1. The differences between this and the previous condition are: (1) the timeline in which the leachate collection and removal system must be operated (i.e., “through the scheduled closure of the landfill” as opposed to “during the active life and post-closure care period”); and (2) the leak detection system requirements. Conditions XVI.C.5 to XVI.C.8 only apply to 1) landfill units which construction commenced after January 29, 1992, (2) lateral expansion of landfill units which construction commenced after July 29, 1992, and (3) replacement of existing landfill units that commenced use after July 29, 1992.}

XVI.C.4. The Permittee must design, construct, operate, and maintain a leachate collection and removal system immediately above the top liner to collect and remove leachate from each landfill unit, and a leachate collection system (with leak detection) between the two layers during the active life and the post-closure care period as specified in the Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application and the Facility Operations Plan in Section {XXX} of the Approved Permit Application. The leachate collection and removal system must satisfy the construction and operating requirements of Table XVI.2. of this module and Section {XXX} of the Approved Permit Application to ensure that the leachate depth over the liner does not exceed 30 cm (one foot). The leachate collection and removal system must be: (1) constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated; (2) of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and by any equipment used at the landfill; and (3) designed and operated to function without clogging during the active life and post-closure care period.

XVI.C.5. The Permittee must design, construct, operate, and maintain the leachate collection system between the liners as a leak detection system to detect, collect, and remove liquids that have passed through the upper liner and upper sumps at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate during the active life and post-closure care period and to minimize the head on the bottom liner in accordance with 40 CFR 264.301(c)(2) – (4), as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application, and as described in Table XVI.2. of this module.

XVI.C.6. The Permittee must collect and remove pumpable liquids in the leak detection system sumps to minimize the head on the bottom liner in accordance with 40 CFR 264.301(c)(4).

XVI.C.7. The Permittee must manage collected leachate as specified in the Approved {Leachate Management Plan} provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(c)(4).

XVI.C.8. If the leak detection system is not located completely above the seasonal high-water table, the Permittee must demonstrate that the operation of the leak detection system will not be adversely affected by the presence of ground water in accordance with Section {XXX} of the Approved Permit Application and 40 CFR 264.301(c)(5).

Table XVI.3. Construction and Operating Requirements

Landfill and/or Landfill Cell Designation	Leachate Collection and Removal System (Above Top Liner)		Leak Detection System (Above Bottom Liner)		Sumps and Liquid Removal Methods
	Maximum Leachate Depth Allowed Over Top Liner	Top Liner Material	Bottom Slope	Composite Bottom Liner Drainage Materials	
<i>Example:</i> South Cells 1 and 2	30.5 centimeters (1 foot)	Flexible membrane liner constructed from {material, e.g., high-density polyethylene (HDPE)}	$\geq 1\%$ & $\leq 2\%$	Upper Component: Flexible membrane liner constructed from {material, e.g., high-density polyethylene (HDPE)} Lower Component: {XX} feet of {compacted soil material} with hydraulic conductivity of {XX} cm/sec	Submersible pump in riser pipe

XVI.C.9. The Permittee must design, construct, operate, and maintain a run-on control system capable of preventing stormwater surface flow onto the active portion of the landfill during peak discharge from at least a 25-year storm as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(g).

XVI.C.10. The Permittee must design, construct, operate, and maintain a run-off management system to collect and control at least the water volume resulting from a 24-hour, 25-year storm as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(h).

XVI.C.11. After each storm, the Permittee must empty or otherwise manage expeditiously all collection and holding facilities (e.g., tanks or basins) associated with run-on and run-off control systems to maintain design capacity of the system specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.301(i).

XVI.C.12. The Permittee must prevent wind dispersal of any particulate matter from the landfill unit(s) as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application and as required by {Director} in accordance with 40 CFR 264.301(j).

XVI.C.13. The Permittee must manage all precipitation that falls into a landfill and contacts hazardous waste or other disposed materials (e.g., non-hazardous waste, daily cover materials) as hazardous waste leachate. Any precipitation that is collected prior to contact with hazardous waste or other disposed materials may be managed in accordance with the applicable requirements of the Permittee's Approved NPDES Discharge Permit issued by the {Director}. [Refer to 40 CFR 261.3(a)(2)(iv).]

XVI.C.14. The Permittee must install and manage temporary cover on landfill cells as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application in accordance with 40 CFR 264.301(j).

*{Permit Writer: Conditions XVI.C.15 through XVI.C.18 **may** be added to the permit, as applicable and as determined necessary by the Director on a site-specific basis. For example, granular soil filter or "sand windows" may be appropriate where native soil used in operations has very low permeability to allow the leachate collection system to operate effectively. (Per 40 CFR 264.301(k), the Director will specify in the permit all design and operating practices that are necessary to ensure compliance with 40 CFR*

264.301. Additionally, under 40 CFR 270.32(b)(2), the Director may include the terms and conditions deemed necessary to protect human health and the environment. “Standard Division Practice (SDP)” means the Permittee’s formally controlled engineering and operating specification for macro-encapsulation devices used at the facility.}}

XVI.C.15. The Permittee must install {indicate type of system required for leachate collection and removal, e.g., Granular Soil Filter/Sand Windows, Granular Soil (Gravel) Drainage, Perforated Collector Pipe, Geonet Drainage, Geotextile Filter} in the protective soil layer above the liner system of each landfill cell and within {XX feet of the leachate collection sump, beginning with {insert details on the system}}, which allow leachate and liquids to pass through the protective soil layer into the underlying leachate collection and removal system. The {insert primary leachate collection and removal system} must be designed, spaced, constructed, operated, and maintained as specified in the Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application.

XVI.C.16. The Permittee must remove all sacrificial barrier liners (which provide UV or other protection to the side slope liner system), sand window covers, and other similar materials immediately prior to covering the affected area(s) with wastes or other materials (e.g., soil, chalk), as specified in the Approved Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application. The Permittee may leave in place sacrificial liners consisting of materials that do not impede water/leachate movement toward the permanent liner/leachate collection system(s) (e.g., woven or nonwoven geo-fabrics and geo-textiles).

XVI.C.17. Where necessary to temporarily divide individual landfill cells during the initial stages of disposal within the cell, the Permittee must construct, operate, and remove intermediate berms as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application. The entire bottom lift of each intermediate berm must be completely removed prior to placement of waste on the open side of the berm.

XVI.C.18. The Permittee must manage macro-encapsulated wastes in the landfill as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application as well as in accordance with the Standard Division Practice (SDP) specifications and instructions for each macro-encapsulation device. All macro-encapsulation units (devices) must comply with the following requirements:

XVI.C.18.a. All macro-encapsulation units must be filled to at least 90% of their capacity, with all void spaces filled to the maximum extent practicable.

XVI.C.18.b. All macro-encapsulation units must be sealed prior to placement in the landfill.

XVI.C.18.c. All macro-encapsulation units must be handled so as to prevent breaking, puncturing, tearing, unsealing, or otherwise compromising the integrity of the outer containment of the device.

XVI.C.18.d. The Permittee must visually inspect all macro-encapsulation units after placement in the landfill prior to covering with waste or other materials.

XVI.C.18.e. In the event a macro-encapsulation unit is broken, punctured, torn, unsealed, or otherwise damaged before or during placement, or as a result of disposal, excavation, or other activities in the landfill, the Permittee must remove and retreat any spilled material and must repair the macro-encapsulation unit prior to covering with waste or other material. If a repair can be accomplished without removing the macro-encapsulation unit from the landfill, the repair may be performed within the landfill unit. If a macro-encapsulation unit is unrepairable, the waste may be transferred into another macro-encapsulation unit while within the landfill unit.

{Permit Writer: Conditions XVI.D. below applies to permittees with landfill units subject to 40 CFR 264.301(c) and (d). Units subject to 264.301(c) are listed as "New" in Table XVI.1, and units subject to 264.301(d) are listed as "Other (d)" in Table XVI.1. Per 40 CFR 264.302(a), the Director shall approve an action leakage rate for each landfill unit subject to 40 CFR 264.301(c) or (d), which must include an adequate safety margin to allow for uncertainties in the design, construction, operation, and location of the leakage detection system, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the leakage detection system, and proposed response actions. (Refer to 264.302(a) for more details). The Director would have had to provide approval prior to preparation of this Permit.}

XVI.D. ACTION LEAKAGE RATE

XVI.D.1. The Permittee must design, construct, operate, and maintain the liner and leachate collection system to meet the action leakage rate requirements approved by the {Director} as specified in Table XVI.3. of this module and as specified in the Approved Detailed Plans and Engineering Report provided in Section {XXX} of the Approved Permit Application, and in accordance with 40 CFR 264.302(a). The action leakage rate is the maximum design flow rate that the leak detection system can remove without the fluid head on the bottom liner exceeding 1 foot (30 centimeters).

XVI.D.2. The Permittee must determine whether the action leakage rate has been exceeded by using the monitoring data collected in accordance with Permit Condition XVI.E. of this module and converting the {weekly/monthly} flow rate to an average daily flow rate (gallons per acre per day) for each sump. The average daily flow rate for each sump must be calculated weekly during the active life and closure period, and monthly during the post-closure care period as specified in Permit Condition XVI.E.5. of this module. [Refer to 40 CFR 264.302(b).]

{Permit Writer: Condition XVI.E. below applies to permittees with landfill units subject to 40 CFR 264.301(c) and (d). Units subject to 264.301(c) are listed as “New” in Table XVI.1, and units subject to 264.301(d) are listed as “Other (d)” in Table XVI.1.}

XVI.E. CONSTRUCTION QUALITY ASSURANCE

XVI.E.1. The Permittee must develop and implement a Construction Quality Assurance (CQA) program for the landfill units. The CQA program must ensure that constructed landfill units meet or exceed the design criteria and specifications in this Permit. The program must be developed and implemented by a CQA officer who is a registered professional engineer. [Refer to 40 CFR 264.19(a)(1).]

XVI.E.2. The CQA program must address the following components, {indicate the components that are applicable to the landfill unit(s): foundations, dikes, low-permeability soil liners, geomembranes (flexible membrane liners), leachate collection and removal systems, leak detection systems, and final cover systems}. [Refer to 40 CFR 264.19(a)(2).]

XVI.E.3. The Permittee must develop and implement a CQA plan that identifies the steps that will be used to monitor and document the quality of materials and the condition and manner of their installation. The CQA plan must include:

XVI.E.3.a. Identification of applicable units and construction methods, and key personnel in the development and implementation of the CQA plan and qualifications of the CQA officer. Description of inspection and sampling activities for all the components in Permit Condition XVI.E.2, including, observations and tests, sampling size and locations, frequency of testing, data evaluation procedures, acceptance and rejection criteria for materials, plans for implementing corrective measures plans, data or other information to be retained in the operating record under 40 CFR 264.73. [Refer to 40 CFR 264.19(b).]

XVI.E.3.d. Observations, inspections, tests, and measurements sufficient to ensure:

XVI.E.3.d.i. Structural stability and integrity of all components in Permit Condition XVI.E.2;

XVI.E.3.d.ii. Proper construction and installation of all components of the liners, leachate collection and removal system, leak detection system, and final cover system, according to the specification of this Permit and good engineering practices;

XVI.E.3.d.iii. Conformity of all materials used with design and material specifications under 40 CFR 264.301. [Refer to 40 CFR 264.19(c)(1).]

XVI.E.3.e. Test fills for compacted soil liners, using the same compaction methods as in the full-scale unit(s), to ensure that the liners are constructed to meet the hydraulic conductivity requirements of 40 CFR 264.301(c)(1)(i)(B) in the field. The Permittee must verify compliance with the hydraulic conductivity requirements by using in-situ testing on the constructed test fill. The {Director} may accept an alternative demonstration, in lieu of a test fill, where data are sufficient to show that a constructed soil liner will meet the hydraulic conductivity requirements of 40 CFR 264.301(c)(1)(i)(B) in the field. [Refer to 40 CFR 264.19(c)(2).]

XVI.E.6. The Permittee must submit a certification to the {Director}, either by certified mail or hand delivery, signed by the CQA officer. This certification must confirm the successful execution of the CQA plan; compliance with the specifications of this Permit, the Approved Permit Application, and 40 CFR 264.301 (c) or (d); as well as the completion of the {Director's} inspection procedure required by 40 CFR 270.30(l)(2)(ii). Submission of this certification is required for authorization to receive waste in the landfill unit(s). [Refer to 40 CFR 264.19(d).]

XVI.F. MONITORING AND INSPECTION REQUIREMENTS

XVI.F.1. The Permittee must inspect and monitor all landfills in accordance with the Approved Inspection Plan in Section {XXX} of the Approved Permit Application and 40 CFR 264.303 as specified in Permit Conditions XVI.E.2. through XVI.E.6. of this module.

XVI.F.2. The Permittee must inspect liners and cover systems (membranes, sheets, or coatings) for uniformity, damage, and imperfections (e.g., holes, cracks, thin spots or foreign material) during construction or installation as specified in the Approved Construction Quality Assurance Plan and Construction Inspection Plan provided in Sections {XXX} and {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.303(a). The inspection must be documented in the Facility operating record in accordance with Permit Conditions I.J.2 and Permit Condition II.E. of this Permit and must, at a minimum, address the following inspections:

XVI.F.2.a. Synthetic liners and covers must be inspected immediately after construction or installation to ensure tight seams and joints and the absence of tears, punctures, or blisters.

XVI.F.2.b. Soil-based and admixed liners and covers must be inspected immediately after construction or installation for imperfections, including lenses, cracks, channels, root holes, or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.

XVI.F.3. The Permittee must inspect and document the inspections of all constructed systems immediately before covering to ensure that the subject system has not been compromised (e.g., rips, tears, UV degradation, silting of sand or fabrics), as specified in the Approved Construction Quality Assurance Plan and Construction Inspection Plan provided in Sections {XXX} and {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.303(a).

XVI.F.4. While the landfill is in operation, the Permittee must inspect and document the inspections of the constructed landfill units and systems weekly and after storms, as specified in the Approved Inspection Plan provided in Section {XXX} of the Approved Permit Application, to detect evidence of any of the following in accordance with 40 CFR 264.303(b)(1) - (3):

XVI.F.4.a. Deterioration, malfunctions, or improper operation of run-on and run-off control systems.

XVI.F.4.b. Proper functioning of wind dispersal control systems, where present.

XVI.F.4.c. The presence of leachate in collection and removal systems and proper functioning of the systems, where present.

{Permit Writer: Conditions XVI.F.5. below applies to permittees with landfill units subject to 40 CFR 264.301(c) and (d) and no other type of landfill unit. Units subject to 264.301(c) are listed as "New" in Table XVI.1, and units subject to 264.301(d) are listed as "Other (d)" in Table XVI.1.}

XVI.F.5. The Permittee must measure and record, at least weekly, the amount of liquids removed from each leak detection system sump and each leachate detection sump during the active life and closure period of each landfill unit in accordance with 40 CFR 264.303(c)(1). This information must be maintained in the Facility operating record.

{OR}

{Permit Writer: Conditions XVI.F.5. below applies to permittees with landfill units subject to 40 CFR 264.301(c) and (d) as well as other type(s) of landfill unit. Units subject to 264.301(c) are listed as "New" in Table XVI.1.; units subject to 264.301(d) are listed as "Other (d)" in Table XVI.1.; units subject to 264.301(a) are listed as "Existing" in Table XVI.1.; and units subject to 264.301(b), (e), or (f) are listed as "Other (b)," "Other (e)," or "Other(f)," respectively, in Table XVI.1.}

XVI.F.5. For Landfill Unit {XXX} in Table XVI.1., the Permittee must measure and record, at least weekly, the amount of liquids removed from each leak detection system sump and each leachate detection sump during the active life and closure period of each landfill unit in accordance with 40 CFR 264.303(c)(1). This information must be maintained in the Facility operating record.

XVI.F.6. After the final cover is installed, the Permittee must record the amount of liquids removed from each leak detection system sump at least monthly. If the liquid level in the sump stays below the pump operating level for two consecutive months, the Permittee must record the amount of liquids in the sumps at least quarterly. If the liquid level in the sump stays below the pump operating level for two consecutive quarters, the Permittee must record the amount of liquids in the sumps at least semi-annually. If at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semi-annual recording schedules, the Permittee must return to monthly recording of amounts of liquids removed from each sump until the liquid level again stays below the pump operating level for two consecutive months. "Pump operating level" is a liquid level proposed by the Permittee and approved by the {Director} based on pump activation level, sump dimensions, and level that avoids backup into the drainage layer and minimizes head in the sump. [Refer to 40 CFR 264.303(c)(2)-(3).]

XVI.F.7. Within {XXX} calendar days of an inspection identifying damage or a containment deficiency, as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application, the Permittee must notify the {Director} in writing by {specify US Mail, email, or other method} detailing the degraded or failed condition that was identified during inspection in accordance with Permit Conditions I.F.9. and I.H. of this Permit. The Permittee must respond to the degraded or failed condition as specified in Permit Condition XVI.G. of this module. [Refer to 40 CFR 270.30(k) and (l)(10).]

XVI.F.8. The Permittee must remedy any deterioration or malfunction discovered by an inspection, as required by 40 CFR 264.15(c). Records of all inspection must be kept, as required by 40 CFR 264.15(d) and in accordance with the General Inspection Requirements Permit Condition II.E of this Permit.

XVI.G. RESPONSE ACTION

{Permit Writer: Conditions XVI.G. below applies to permittees with landfill units subject to 40 CFR 264.301(c) and (d) and no other type of landfill unit. Units subject to 264.301(c) are listed as “New” in Table XVI.1, and units subject to 264.301(d) are listed as “Other (d)” in Table XVI.1. Deviations from or changes to the Response Action Plan of the Approved Permit Application must be approved through a Permit modification.}

XVI.G.1. The Permittee must comply with required response actions as specified in the Approved Response Action Plan provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.304.

XVI.G.2. The Permittee must maintain the current version of the Response Action Plan in the Facility operating record as specified in Permit Condition I. J. of this Permit.

XVI.G.3. The Permittee must train all personnel required to respond under the Response Action Plan on their responsibilities and approved response actions in accordance with the Permit Conditions in II.F. (Personnel Training) and 40 CFR 264.16(a)-(e).

XVI.G.4. The Permittee must obtain approval from the {Director} prior to deviating from or modifying the Response Action Plan as specified in I.B.2. of this Permit.

XVI.G.5. If the flow rate into the leak detection system exceeds the action leakage rate(s) set forth in Table XVI.2. of this module, the Permittee must respond as specified in the Approved Response Action Plan provided in Section {XXX} of the Approved Permit Application in accordance with 40 CFR 264.304(a) - (c) and Permit Condition XVI.F.1. of this Module. At a minimum, the Permittee must do the following:

XVI.G.5.a. Notify the {Director} in writing of the exceedance within seven days of the exceedance determination. The notification must be submitted in accordance with Permit Conditions I.F.9. and I.H. of this Permit. [Refer to 40 CFR 264.304(b)(1) and 270.30(l)(10).]

XVI.G.5.b. Submit a preliminary written assessment to the {Director} within 14 days of the exceedance determination as to the amount of liquids; likely sources of liquids; possible location, size, and cause of any leaks; and short-term actions taken and planned. [Refer to 40 CFR 264.304(b)(2).]

XVI.G.5.c. Determine to the extent practicable the location, size, and cause of any leak. [Refer to 40 CFR 264.304(b)(3).]

XVI.G.5.d. Determine whether waste receipt should cease or be curtailed; whether any waste should be removed from the unit for inspection, repairs, or controls; and whether or not the unit should be closed. [Refer to 40 CFR 264.304(b)(4).]

XVI.G.5.e. Determine any other short-term and longer-term actions to be taken to mitigate or stop any leaks. [Refer to 40 CFR 264.304(b)(5).]

XVI.G.5.f. Within 30 days after the notification that the action leakage rate has been exceeded, submit to the {Director} the results of the analyses specified in Conditions XVI.G.5.c., XVI.G.5.d., and XVI.G.5.e. of this module; the results of actions taken; and actions planned. Monthly thereafter, as long as the flow rate in the leak detection system exceeds the action leakage rate, the Permittee must submit to the {Director} a written report summarizing the results of any remedial actions taken and actions planned. [Refer to 40 CFR 264.304(b)(6).]

XVI.G.5.g. The monthly report must be prepared and submitted in accordance with Permit Condition I.E.9.b. of this Permit and, in accordance with 40 CFR 264.304(c)(1), the report must include the following at a minimum:

XVI.F.5.g.i. Assessment of the source(s) of liquids and amounts by source.

XVI.F.5.g.ii. Fingerprint, hazardous constituent, or other analyses of the liquids in the leak detection system to identify the source(s) of liquids, possible location(s) of any leaks, and the hazard and mobility of the liquid.

XVI.F.5.g.iii. Assessment of the seriousness of any leaks in terms of potential for escaping into the environment.

[Refer to 40 CFR 264.304(c)(1)(i) – (iii).]

XVI.G.5.h. The Permittee may alternatively provide documentation to the {Director} stating why the assessments requirement in Permit Conditions XVI.G.5.c., XVI.G.5.d. and XVI.G.5.e. of this module are not necessary in accordance with 40 CFR 264.304(c)(2). This documentation should be submitted to the {Director} as specified in Permit Conditions I.F.9. and I.H. of this Permit.

XVI.H. SURVEYING AND RECORDKEEPING

XVI.H.1. The Permittee must conduct a {specify frequency} topographic survey of the surface of active landfill units as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application.

XVI.H.2. The Permittee must maintain the following items in the Facility operating record as in accordance with 40 CFR 264.309 and 264.73:

XVI.H.2.a. A map with the exact location and dimensions (including depth and top and bottom elevations) of each cell with respect to permanently surveyed benchmarks.

XVI.H.2.b. The types of waste in each cell and the approximate location of each hazardous waste shipment within each cell.

XVI.I. CLOSURE AND POST-CLOSURE CARE

{Permit Writer: General closure and post-closure care requirements are included in the Permit Conditions of the Module VIII, Closure, and Module IX, Post Closure of the Permit. The Permit Writer should review and ensure appropriate and accurate cross-references to the Permit Conditions in other modules.}

XVI.I.1. Upon final closure of the landfill or any individual unit or cell, the Permittee must apply a final cover as outlined in Table XVI.4., as specified in the Approved Closure Plan provided in Section {XXX} of the Approved Permit Application, and in accordance with 40 CFR 264.310(a) the final cover must be designed and constructed to:

XVI.I.1.a. Provide long-term minimization of migration of liquids through the closed landfill;

XVI.I.1.b. Function with minimum maintenance;

XVI.I.1.c. Promote drainage and minimize erosion or abrasion of the cover;

XVI.I.1.d. Accommodate settling and subsidence so that the cover's integrity is maintained; and

XVI.I.1.e. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

{Permit Writer: According to 40 CFR 264.301(k) and 40 CFR 270.32(b)(2), industry best practices may be included as additional permit conditions if the Director determines they are necessary based on site-specific considerations. Note that condition XVI.I.2. is written as a general guideline using "should" instead of "must."}

XVI.I.2. The Permittee should design and construct final covers using industry best practices as defined in [Final Covers on Hazardous Waste Landfills and Surface Impoundments \(EPA/530-SW-89-047\)](#).

Table XVI.4. Final Cover Requirements

Cover Feature	Technical Requirements
Example: Top layer for vegetation and to impede erosion	1 foot of vegetation layer in accordance with the local State Department of Agriculture planting recommendations for landfill location
Drainage layer	2 feet of drainage aggregate
Geosynthetic drainage net	Geosynthetic drainage net (double sided)
Low-permeability layer FML component needs to be below biotic layer	40 mil Low-density polyethylene (LDPE)
Low-permeability compacted soil component is above gas vent layer and below biotic layer	2 feet of 1×10^{-6} cm/sec low compacted permeability soil
Gas vent layer	1 foot of drainage aggregate with gas collection pipes and/or gas collection geogrid
Biotic barrier layer	Physical barriers, such as layers of cobbles or coarse gravel beneath the top layer, and chemical barriers, have been proposed to discourage or reduce the threat of bio-intrusion

{Permit Writer: While the 40 CFR 264 Subpart N landfill regulations do not specify a timeline for submitting documentation of the landfill cover construction and quality assurance inspections, condition XVI.I.3. has been added to the permit under the authority of 40 CFR 270.32(b)(2). This is crucial to ensure the proper placement of the cover, thereby protecting human health and the environment by effectively capping hazardous waste after closure.}

XVI.I.3. All documentation of the construction of the landfill cover and the quality assurance inspections must be submitted to the {Director} within 90 days of final inspection.

XVI.I.4. After final closure, the Permittee must comply with all post-closure requirements specified in Module IX, Post-Closure Care of this Permit and 40 CFR 264.117 - 264.120. In accordance with 40 CFR 264.310(b), the Permittee must be required to perform the following:

XVI.I.4.a. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events.

XVI.I.4.b. Continue to operate the leachate collection and removal system until leachate is no longer detected.

XVI.I.4.c. Maintain and monitor the leak detection system in accordance with 40 CFR 264.301(c)(3)(iv) and (4) and 264.303(c) and comply with all other applicable leak detection system requirements of this Permit.

XVI.I.4.d. Maintain and monitor the groundwater monitoring system as required by 40 CFR part 264, Subpart F, and comply with all other applicable requirements of 40 CFR 264.310(b), and in accordance with the requirements specified in Module VI, Groundwater Requirements of this Permit.

XVI.I.4.e. Prevent run-on and run-off from eroding or otherwise damaging the final cover.

XVI.I.4.f. Protect and maintain surveyed benchmarks used in complying with 40 CFR 264.309.

XVI.J. SPECIAL REQUIREMENTS

{Permit Writer: This section contains special requirements for specific types of wastes that are dependent on the approved hazardous waste types for an individual Facility. Delete Permit Conditions that do not apply to a Facility.}

XVI.J.1. Special Requirements for Ignitable or Reactive Wastes

The Permittee must not place ignitable or reactive waste in any landfill cell except as allowed under in 40 CFR 264.312, as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application, and in accordance with 40 CFR 264.316(c), (d), and (e).

XVI.J.2. Special Requirements for Incompatible Wastes

The Permittee must not place incompatible wastes, or incompatible wastes and materials, in the same landfill cell, except as specified in the section describing facility operations provided in Section {XXX} of the Approved Permit Application and in accordance with 40 CFR 264.313 and 40 CFR 264.316(d).

XVI.J.3. Special Requirements for Bulk and Containerized Liquids

XVI.J.3.a. The Permittee must not place bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids (whether or not sorbents have been added) in any landfill cell. [Refer to 40 CFR 264.314(a).]

XVI.J.3.b. The Permittee must demonstrate the absence of free liquids in all containerized or bulk waste that is suspected by the Permittee or the {Director} to contain free liquids. This demonstration must be made by using the following test: "Method 9095B (Paint Filter Liquid Test)" as described in "[Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods](#)" (EPA Publication No. SW-846). [Refer to 40 CFR 260.11 and 264.314(b).]

XVI.J.3.c. The Permittee must not place containers holding free liquids in any landfill unit unless the requirements of 40 CFR 264.314(c)(1) - (4) are met.

XVI.J.3.d. The Permittee must use nonbiodegradable sorbents to treat free liquids (whether containerized or noncontainerized) to be disposed of in the landfill in accordance with 40 CFR 264.314(d).

XVI.J.3.d.i. The Permittee must use the test methods specified in the Approved Waste Analysis provided in Section {XXX} of the Approved Permit Application to confirm a nonbiodegradable sorbent. Alternatively, the permittee may use sorbents listed in 40 CFR 264.314 (d)(1), materials that pass one of the tests in 40 CFR 264.314(d)(2), or materials that are determined by EPA to be nonbiodegradable through the Part 260 petition process.

XVI.J.3.d.ii. The Permittee must maintain results of the testing for nonbiodegradable sorbents in the Facility operating record as required by 40 CFR 264.13 and Permit Condition I.E.9. of this Permit.

XVI.J.3.e. The Permittee must demonstrate the following to the {Director} prior to placement of any liquid that is not a hazardous waste in accordance with 40 CFR 264.314(e)(1) and (2):

XVI.J.3.e.i. The only reasonably available alternative to the placement in such landfill is placement in a landfill or unlined surface impoundment, whether or not Permitted or operating under interim status, which contains or may reasonably be anticipated to contain hazardous waste.

XVI.J.3.e.ii. Placement in such owner or operator's landfill will not present a risk of contamination of any "underground source of drinking water" (as that term is defined in 40 CFR 270.2).

XVI.J.4. Special Requirements for Containers

XVI.J.4.a. Except as provided in Condition XVI.I.4.c. of this module, the Permittee must not dispose of any containers in any landfill that are larger than ampules unless they are filled at least 90% full or are crushed, shredded, or similarly reduced in volume to the maximum practical extent before burial or placement in the landfill in accordance with 40 CFR 264.315.

XVI.J.4.b. The Permittee is permitted to place containers (or inner liners removed from a container) into a landfill unit, provided all the criteria for being RCRA empty as defined in 40 CFR 261.7(b) is met and each container is crushed to the maximum practical extent prior to burial, in accordance with the specifications outlined in the section describing facility operations provided in Section {XXX} of the Approved Permit Application. [Refer to 40 CFR 264.315(b).]

XVI.J.4.c. The Permittee is permitted to dispose of small containers of hazardous waste within overpacked drums (i.e., lab packs), provided all the requirements specified in 40 CFR 264.316(a) through (f) are met, as detailed in the section describing facility operations provided in Section {XXX} of the Approved Permit Application. [Refer to 40 CFR 264.316(a) through and (f).]

XVI.J.5. Special Requirements for Hazardous Wastes Restricted from Landfill Units

{Permit Writer: According to 40 CFR 264.317(b), the Director has the authority to determine if additional design, operating, and monitoring requirements are necessary for landfills managing hazardous wastes FO20, FO21, FO22, FO23, FO26, and FO27. These additional measures may be

required to minimize the risk of waste migration to groundwater, surface water, or air, thereby ensuring the protection of human health and the environment. Add any additional requirements needed under this section.}

XVI.J.4.c. The Permittee must not dispose of any F020, F021, F022, F023, F026, F027, or F028 listed hazardous waste(s) in any landfill unit, unless the {Director} approves a management plan for these wastes and except in a form (e.g., incineration residues) that meets all applicable requirements of 40 CFR 264.317(a) and (b).