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TITLE 250 – DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

CHAPTER 140 – WASTE AND MATERIALS MANAGEMENT

SUBCHAPTER 05 – SOLID WASTE

PART 2 – Solid Waste ~~Regulations No. 2~~ Landfills

2.1 Solid Waste Landfills

2.1.1 General Information

A. Definitions of terms used in these Regulations can be found in § 1.5 of this Subchapter.

BA. In addition to meeting the general requirements set forth in § 1.57 of this Subchapter, each application for a license to construct and operate a landfill subject to this Rule must contain the following:

1. Engineering plans detailing the proposed landfill's location of the property boundaries, adjacent land uses and complete construction plans pursuant to § 2.1.2 of this Part.
2. Operating plans pursuant to § 2.1.3 of this Part.
3. A sedimentation and erosion control plan prepared in accordance with § 2.1.4 of this Part.
4. An engineering report comprehensively describing the existing site conditions and an analysis of the landfill, including closure and post closure criteria, prepared in accordance with § 2.1.5 of this Part.
5. A quality assurance/quality control report prepared in accordance with § 2.1.6 of this Part.
6. A contingency plan report prepared in accordance with § 2.1.7 of this Part.
7. A hydrogeological report and water quality monitoring plan prepared in accordance with the provisions of § 2.1.8 of this Part.
8. A legal document certifying acceptance of leachate by the operator of a wastewater treatment facility for the discharge of leachate to that facility, if

applicable or, for on-site treatment and discharge of leachate, a Rhode Island Pollution Discharge Elimination system permit.

9. A closure plan and post-closure care plan prepared in accordance with § 2.1.9 of this Part.

2.1.2 Engineering Plans

A. The engineering plans must contain the following:

1. Locus Map: A copy of the latest geologic survey map delineating the site boundaries, the entire existing and proposed service area, as appropriate, and indicating directions and distances to airports within fifteen (15) miles of the landfill.
2. Radius Plan: A radius plan including all the information listed below shall be submitted. The radius plan must be drawn to an appropriate scale adjusted to fit on a standard size sheet and including all areas within a one half (1/2) mile radius out from all property lines of the site. The required information includes:
 - a. Zoning of the areas as required by § [1.75\(E\)\(5\)](#) of this Subchapter.
 - b. All buildings and dwellings
 - c. All water supplies (wells, etc.)
 - d. All surface waters including wetlands (with quality classifications)
 - e. All known principal and primary water supply aquifers (with quality classifications)
 - f. All roads, bridges, railroads, airports, and historic sites
 - g. All boring locations
 - h. Legal boundaries of site certified by a Registered Land Surveyor in the State of Rhode Island
 - i. North arrow
 - j. Extent of one hundred (100) year flood plain (where applicable)
 - k. All other existing and proposed non-made or natural features relating to the facility

- I. Legend
3. Site Plan: A site plan including all of the information listed below for all areas within the site shall be submitted. The site plans must be drawn to an appropriate scale adjusted to fit on a standard size sheet. The required information includes:
 - a. Initial ground contours at five foot (5') intervals
 - b. Final proposed contours at five foot (5') intervals
 - c. Boring locations, excavations and test pits
 - d. The location and placement of each liner system
 - e. The location and placement of each leachate collection system showing all critical grades and elevations of the collection pipe inverts and drainage envelopes, manholes, cleanouts, valves, sumps, and pumps if necessary
 - f. Proposed gas controls, wells, header pipes, vents and flares (if any)
 - g. Buildings
 - h. Water supply wells (if any)
 - i. Surface water courses (if any)
 - j. Roads
 - k. Cross section lines (see § 2.1.2(D) of this Part)
 - l. Areas to be used for storing salvaged materials and recycled materials
 - m. Areas to be used for special waste as listed in § 2.3.6(D) of this Part
 - n. Groundwater monitoring wells
 - o. Legal boundaries of the site certified by a Registered Land Surveyor in the State of Rhode Island
 - p. Power lines, pipe lines, rights of way and other utilities
 - q. Proposed fences

- r. Weighing facilities
 - s. North arrow
 - t. Location of borrow areas
 - u. Boundaries of areas to be filled including planned stage development of the landfill's construction and operation
 - v. Benchmarks and permanent survey markers
 - w. Lateral and vertical limits of previously filled areas (if any)
 - x. A wind rose
 - y. Berms, dikes, ditches, sedimentation ponds, swales and other devices as needed to control or collect surface water run-on and run-off
 - z. Location and details of leachate storage, treatment and disposal systems
 - aa. Typical roadway sections and profiles (for paved roadways)
 - bb. Legend
4. Cross Sections: Typical cross section plans including all the information listed below shall be submitted. A minimum of two (2) cross sections will be required of right angled center lines passing through the approximate middle of the site. The cross section plans should be drawn at appropriate horizontal and vertical scales. The required information includes:
- a. Proposed lifts
 - b. Virgin ground
 - c. Maximum groundwater table
 - d. Bedrock location
 - e. Side slopes
 - f. Details of surface drains and ditches
 - g. Final fill elevations and grades
 - h. Limits of excavations

- i. Final cover details & elevations
 - j. Details on access road construction
 - k. Details of the liner system
 - l. Details of leachate collection systems
 - m. Details of gas management facilities
 - n. Details of groundwater monitoring wells
5. Airport Safety: An owner or operator applying to site a new SWLF unit and/or a lateral expansion of an SWLF unit within a five (5) mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the Federal Aviation Administration (FAA) of this application and show proof to the Director of this notification.

2.1.3 Operating Plan

- A. An operating plan shall be submitted including information on all of the areas listed below. The duration of the operating plan shall equal that of the license. The operating plan shall be reviewed by the applicant prior to the license renewal and any changes to such plan shall be submitted to the Department for approval at that time.
- B. The applicant must demonstrate an ability to comply with all General Operating Standards and with the Sanitary Landfill Operating Standards listed in § [1.7](#) of this Subchapter and § 2.3 of this Part, respectively. The following information shall be included in the plan:
- 1. Type of landfill method to be used (trench, area, etc.)
 - 2. Proposed sequence of filling operation
 - 3. Fire control and prevention provisions
 - 4. Operating hours
 - 5. All types of refuse to be accepted with corresponding approximate percentages of the total refuse
 - 6. Personnel and duties, including a description of all personnel that will receive training in order to become knowledgeable of the procedure, equipment, and process at the facility, relative to the position in which they are employed

7. Projected use of completed site
8. Dust control program
9. Vector control program
10. Litter control program
11. Odor control program
12. Procedures to promote vegetative growth on completed areas
13. Equipment to be on site during operating hours
14. Substitute equipment arrangement
15. Communications equipment available
16. Population and service area
17. Winter operations
18. Provisions for limited access
19. Weighing facilities
20. Estimated life of landfill
21. Salvaging operations and handling procedures for source segregated recyclable materials or other recyclables to be stored for recycling
22. Handling procedures for special wastes as listed in § [1.7\(E\)](#) of this Subchapter and § 2.3.6(D) of this Part and procedures for SWLF units to exclude regulated hazardous wastes and PCB wastes, per § 2.3.6(E) of this Part
23. Leachate collection removal and disposal operations and schedule
24. Leachate treatment operations (if any)
25. Groundwater monitoring operations and schedule
26. Air monitoring operation and schedule including gas monitoring program
27. Surface drainage control methods

28. If applicable, a description of the operation of a convenience station at the landfill for smaller private vehicles to unload refuse at an area other than the landfill's working face
29. Outline of the records to be kept, location of records, and retention period of records

2.1.4 Sedimentation and Erosion Control Plan

- A. A sedimentation and erosion control plan including all of the information listed below for all areas within the site shall be submitted. The sedimentation and erosion control plan must be drawn to an appropriate scale adjusted to fit on a standard size sheet. The required information includes:
 1. The identification of all areas of disturbed, erodible, non-vegetated, non-stable soils
 2. The identification of all planned activity areas which could result in erosion due to unstable soil conditions
 3. The definitive, specific location for temporary sediment and erosion control installation
 4. The types of temporary sediment and erosion controls to be utilized. Such controls must be able to withstand all expected velocities from site flows under anticipated storm events and must be capable under such conditions to retain eroded soils with maximum stability and efficiency.
 5. The method of temporary sediment and erosion control installation, including the time of installation
 6. The method and schedule of maintenance, modification, enforcement, and replacement of temporary sediment and erosion controls based upon operations and existing or anticipated erosion problems, including on-site and off-site borrow areas and any other areas that may be disturbed by landfill operations
 7. The means and method of sediment removal collected within or behind any controls, including anticipated time periods between removal
 8. Existing vegetation to be retained
 9. Proposed vegetation to be used for cover, screening and other purposes
 10. Seeding and planting schedule that accounts for the various stages of landfill development (construction, operation and closure)

11. Seed mixture choice, fertilization procedures and procedures for seed application (identify seasonal limitations, as appropriate), mulching and maintenance
12. Planting plan and schedule (which must identify plants to be used consistent with future use proposals)
13. A schedule of cutting and clearing of existing vegetation so as to maintain the maximum natural area at all times

2.1.5 Engineering Report

- A. An engineering report containing a description of the existing site conditions and an analysis of the proposed landfill in accordance with the construction standards of § 2.2 of this Part shall be submitted. The following information shall be included in the report:
 1. The proposed design capacity of the landfill for which approval is being sought, expressed in tons per day.
 2. An analysis of the existing topography, surface water and subsurface geological conditions in accordance with the requirements of § 2.1.8 of this Part.
 3. A description of the materials and construction methods used for the placement of the following:
 - a. Groundwater monitoring wells
 - b. Gas venting system
 - c. Each liner and leachate collection and removal system
 - d. Leachate storage treatment and disposal system
 - e. Cover system
 - f. This description must demonstrate conformance with the construction requirements found in § 2.2 of this Part, and must include a discussion of provisions to be taken to prevent frost action upon each liner system in areas where refuse has not been placed.
 4. An estimate of the expected quantity of leachate to be generated, including:

- a. An annual water budget that must estimate leachate generation quantities during initial operation, upon application of intermediate cover and following facility closure. At a minimum, the following factors must be considered:
- (1) Average monthly temperature
 - (2) Average monthly precipitation
 - (3) Evaporation
 - (4) Evapotranspiration
 - (5) Surface/cover soil conditions
 - (6) All other sources of moisture contribution to the landfill
 - (7) Guidance for leachate calculations may utilize National Weather Service data for Providence, RI, United States Department of Agriculture Climate Data for Providence, RI and USDA, Soil Conservation Service for Rhode Island soil data.
- b. Liner and leachate collection system efficiencies that must be calculated using an appropriate analytical or numerical assessment. At a minimum, the factors to be considered must include:
- (1) The saturated hydraulic conductivity of the liner
 - (2) The liner thickness
 - (3) The saturated hydraulic conductivity of the leachate collection system
 - (4) The leachate collection system porosity
 - (5) The base slope of the liner and leachate collection and removal system interface
 - (6) The maximum flow distance across the liner and leachate collection and removal system interface to the nearest leachate collection pipe

- (7) The estimated leachate generation quantity as computed in accordance with the requirements of § 2.1.5(D)(1) of this Part
 - c. Predictions of the static head of leachate on the liners, volume of leachate to be collected, and the volume of leachate that may permeate through the entire liner system, all on a monthly basis. Information gained from the collection efficiency calculations required in §§ 2.1.5(D)(1) and (2) of this Part must be used to make these predictions. This assessment also must address the amount of leachate expected to be found in the secondary leachate collection and removal system in gallons per acre per day (the "action leakage rate").
5. Design of a leachate storage facility, if necessary. The storage facility's capacity must be based upon the leachate generation calculation required in § 2.1.5(D) of this Part. The design capacity for the leachate storage facility must be based on the proposed leachate disposal method that must allow sufficient lead time for either:
 - a. Approval for the construction and operation of an on-site leachate treatment facility or
 - b. Approval to handle leachate destined for off-site treatment at a wastewater treatment facility.
6. A description of the contingency plan for the construction phase. This plan must describe procedures for responding to construction deficiencies resulting from circumstances including, but not limited to, inclement weather and defective materials or construction inconsistent with specifications as demonstrated by quality control testing. The plan must:
 - a. Provide a description of the criteria to be utilized in evaluating deficiencies
 - b. Select and implement corrective actions
 - c. Discuss the closure and post-closure maintenance and operation of the landfill which must include, but not be limited to:
 - (1) A closure design consistent with the requirements of §§ 2.1.9 and 2.2.12 of this Part
 - (2) A post-closure water quality monitoring program consistent with § 2.1.9 of this Part

- (3) An operation and closure plan for the leachate collection, treatment, and storage facilities
 - (4) A discussion of the future use of the site, including the specific proposed or alternative uses. Future uses must conform to the sedimentation and erosion control plan, required pursuant to § 2.1.4 of this Part, and must not adversely affect the final cover system.
7. A description of the daily and intermediate cover material, including a sieve analysis, performed by a competent soil testing agency. An estimation of the amount (in cubic yards) of cover material available and the source will also be required. If the cover material is to be purchased, a letter from the vendor stating the amounts which can be supplied must also be submitted.
8. A description of procedures and precautions to be taken during the placement of the first lift of waste above the liner and leachate collection system, describing the selected solid waste and its placement, approach and operation of collection vehicles and compaction equipment, with concern for minimizing adverse impacts on the liner and leachate collection system.

2.1.6 Quality Assurance/Quality Control Report

- A. The project's Quality Assurance (QA) and Quality Control (QC) report must address the construction requirements set forth in § 2.2 of this Part for each specified phase of construction. This plan must include, but not be limited to:
 1. A delineation of the QA and QC management structures, including the chain of command of the QA and QC inspectors, and describing the quality control and corrective action implementation responsibilities of the QA and QC inspectors and the contractors.
 2. A description of the required level of experience for the contractor and his crew for every major phase of construction which shall be sufficient to ensure that the installation methods and procedures as required per § 2.2 of this Part are properly implemented.
 3. A description of the required level of experience of the QA and QC inspectors for every major phase of construction to ensure that the QA and QC testing is properly implemented.
 4. A description of the required level of training, if necessary, to be provided for the contractor's personnel and the inspectors, to ensure that the

installation methods and procedures and the contingency methods are properly implemented and that corrective action will be properly employed, when necessary.

5. A description of the QA and QC testing and inspections for every major phase of construction, which shall include but not be limited to the following:
 - a. The frequency of inspections
 - b. The frequency of field testing
 - c. The frequency of sampling for laboratory testing
 - d. The sampling and field testing procedures to be utilized
 - e. The sampling and field testing equipment to be utilized
 - f. The calibration of field testing equipment
 - g. The frequency of system or performance audits
 - h. The sampling size
 - i. The soils or geotechnical laboratory to be used
 - j. The laboratory procedures to be utilized
 - k. The calibration of laboratory equipment and QA/QC of laboratory procedures
 - l. The limits for test failure
 - m. The description of the corrective procedures to be used upon test failure

2.1.7 Contingency Plan

- A. The contingency plan must discuss an organized, planned and coordinated, technically and financially feasible course of action to be taken in responding to contingencies during the construction and operation of a landfill. The plan must address, at a minimum:
 1. Actions to be taken with respect to personnel and user safety
 2. On-site personal injury

3. Fires
4. Explosive landfill gases detected on site
5. Equipment breakdown
6. Unusual traffic conditions
7. Deposition or receipt of waste not authorized by the Department to be disposed of at the facility
8. Releases of hazardous or toxic materials
9. Groundwater and surface water contamination including public and private water supply contamination
10. Presence of leachate in the secondary leachate collection and removal system, including:
 - a. Establishing limits for Action Leakage Rates (ALR) and Rapid and Large Leakages (RLL)
 - b. Description of Response Action Plan (RAP) if ALR and RLL are exceeded
11. The leachate storage facility being at or above capacity
12. Leachate tank and surface impoundment spills or leakage (including removal of the waste and repair of such structures)
13. The inability of the approved leachate treatment facility to accept leachate from the landfill for an indefinite period of time.

2.1.8 Hydrogeological Report

- A. The hydrogeologic report must define the landfill site geology and hydrology and relate these factors to regional and local hydrogeologic patterns; provide a three-dimensional understanding of groundwater and surface water flow at the site sufficient to determine the ultimate suitability of the site for landfilling; establish an environmental monitoring system capable of readily detecting a contaminant release from the facility and determining whether the site is contaminating surface or subsurface waters; and form the basis for design of the facility and contingency plans relating to ground or surface water contamination or gas migration. The hydrogeologic report for a new landfill, and for a lateral expansion of an existing landfill, must contain a site investigation plan, a site investigation report, and an environmental monitoring plan.

B. Requirements of the Site Investigation Plan: The site investigation plan must clearly define all methods to be used in investigating the hydrogeologic conditions of the site, the scope of the intended investigation, and any specific hydrogeologic questions that the investigation is designed to address. The applicant is strongly encouraged to develop a draft version of the plan for review with the Department before starting the hydrogeologic investigation, and to keep the Department informed of the findings and subsequent investigative proposals as the study proceeds. The final version of the plan included in the hydrogeologic report section of the license application must fully describe all methods of investigation used. The plan must comply with the following:

1. General requirements for all methods used – In obtaining the required hydrogeologic information, the applicant must employ current, standard, and generally accepted procedures in meeting the requirements of this Section. Unless otherwise approved by the Department, all work must be done in accordance with applicable American Society for Testing Materials standards or current and appropriate U.S. Environmental Protection Agency guidance documents. Alternative or innovative methodologies may be approved by the Department. All procedures must be conducted under the supervision of a geologist, hydrogeologist, or geotechnical engineer having experience in similar hydrogeologic investigations, in a manner that ensures accuracy of the data and precludes environmental degradation. The location of all installations, geophysical and geochemical surveys, and seismic lines must be shown on a map with the same scale and coordinate grid system used on the engineering plans.
2. Literature search – A comprehensive search must be made for pertinent and reliable existing information concerning regional and site-specific hydrogeologic conditions. The literature search must include, as available, records and reports of the U.S. Soil Conservation Service; basin planning reports, water table maps, geologic bulletins, water supply papers, professional papers and other reports of the U.S. Geological Survey; publications and bulletins of the Geological Society of America and other professional organizations; and publications of the U.S. Environmental Protection Agency and Department, college and university reports; and aerial photography or remotely sensed imagery.
3. Surficial geologic mapping – The site must be mapped to determine the distribution of surficial deposits on and surrounding the site based upon existing information, field evaluations, and field confirmation of all interpretations made on the site itself.
4. Water well surveys – A survey of public wells within three miles of the site and private water wells within one mile downgradient and one-quarter mile

upgradient of the proposed site must be conducted. An alternative distance may be agreed upon by the Director. Surveys must obtain, where available, the location of wells, which must be shown on a map with their elevation and depth, name of owner, age and usage of the well; geologic unit screened; well construction; static water levels; well yield; actual or perceived water quality; and any other relevant data which can be obtained.

5. Fracture trace analysis – The Department may require the use of fracture trace analysis to identify potential pathways of groundwater and contaminant migration.
6. Geophysical and geochemical surveys – The Department may require the use of geophysical and geochemical methods, such as electromagnetic resistivity, seismic surveys, and soil gas analysis, to justify the interpretations and conclusions of the site investigation report, and to provide information between boreholes and aid in the siting of wells.
7. Tracer studies – The Department may require the use of tracer studies to aid in understanding groundwater flow and potential contaminant transport, or to otherwise assist in devising an effective environmental monitoring plan.
8. Monitoring wells and piezometers
 - a. Construction in general
 - (1) Monitoring wells and piezometers must define the three-dimensional flow system within the aquifer to justify the interpretations and conclusions of the hydrogeologic report. For all landfill units, monitoring wells must be installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer.
 - (2) Construction techniques must be appropriate to ensure that groundwater samples and head level measurements characterize discrete stratigraphic intervals; and to prevent leakage of groundwater or contaminants along the well annulus. If leakage is detected, it must be corrected or the well must be abandoned.
 - (3) Monitoring wells and piezometers may be placed individually or as well clusters. Well clusters consist of individual wells at varying depths in close proximity, each installed in its own

boring. Multiple wells placed into one (1) large borehole are prohibited unless Department approval is obtained.

- (4) Soil borings, soil samples, and rock cores must characterize each geologic unit within the aquifer to justify the interpretations and conclusions of the hydrogeologic report.
- (5) Every appropriate precaution must be taken during drilling and construction of monitoring wells to avoid introducing contaminants into a borehole. Only potable water may be used in drilling monitoring wells or piezometers.
- (6) All equipment to be placed into the boring must be properly decontaminated before use at the site and between boreholes. The initial cleaning at the site must be sufficient to ensure that no contaminants from the last site drilled will be introduced into the borings. All equipment must be steam cleaned between holes. Upgradient wells should be drilled first.

b. Construction of monitoring wells and piezometers

- (1) Well casing: All permanent groundwater monitoring wells shall be constructed of PVC well casing material. All casing shall have a minimum inside diameter of two inches (2.0"). Monitoring wells constructed in unconsolidated material less than one hundred feet (100') in depth shall be constructed using a minimum of schedule forty (40) PVC. Wells greater than one hundred feet (100') shall be constructed using a minimum of schedule eighty (80) PVC. Assembly and installation: All casing shall be constructed of flush threaded joints or threaded coupling joints. All joints shall be fitted with an "O" ring or wrapped with teflon tape. Solvent welded joints are not permissible without prior written permission of the Director. Exceptions: The Director may allow alternate well casing material if the containment concentrations or geologic setting require an alternative construction. Alternative materials include but are not limited to:

(AA) Teflon,

(BB) Stainless steel, or

(CC) Uncoated or galvanized steel.

- (2) Well screen: The well screen slot size shall be sized to retain at least ninety percent (90%) of the grain size of a filter pack or at least sixty percent (60%) of the grain size of the collapsed formation. Well screens on water table wells shall not exceed fifteen feet (15') in length. Well screens for piezometers shall not exceed five feet (5') in length. Well screens shall be factory slotted. A bottom cap and sump sediment trap shall be installed. Water table variations, site stratigraphy, expected contaminant behavior, and groundwater flow must be considered in determining the screen length, materials, and position. Where existing contamination is suspected or known, down hole geophysical techniques may be required by the Department to aid in selecting well screen elevations.
- (3) Filter pack: The filter pack shall be chemically inert, well rounded and well sorted glass beads or silica based sand or gravel of uniform grain size. The filter pack must minimize the amount of fine material entering the well, and it must not inhibit the flow of water into the well. The filter pack shall extend no more than five feet (5') above the well screen. The filter pack shall not contaminate groundwater.
- (4) Sealing requirements:
 - (AA) Filter pack seal: All monitoring wells installed with a filter pack shall be constructed with a top of filter pack seal.
 - (BB) Annular space seal: All monitoring wells shall be installed with an annular space seal that has a permeability of 1×10^{-7} centimeters per second or less.
 - (CC) Ground surface seal: All monitoring wells shall be constructed with a continuous pour concrete ground surface seal. The ground surface seal shall extend to a minimum of forty inches (40") below the land surface and shall be flared such that the diameter at the top is greater than the diameter at the bottom. The top of the ground surface seal shall be sloped away from the well casing, and shall be imprinted with the designation of the monitoring well.

- (5) Protective cover pipe: The protective pipe shall consist of a minimum four inch (4") diameter metal casing with locking cap. The protective pipe shall extend from the bottom of the ground surface seal to a minimum of twenty-four inches (24") above the land surface. There shall be no more than four inches (4") between the top of the well casing and the top of the protective pipe. The monitoring well designation shall be indicated clearly on the protective cover pipe. A gas vent shall be installed. A high visibility guard post to prevent destruction of the well may be required. The Director may request additional protective devices as necessary. "Road boxes" will be acceptable in locations where protective cover pipes are not stable. All road boxes shall be locking and air tight.
 - (6) Where under the circumstances of a particular situation the Department believes that the methods identified in this section are inadequate, it may require additional measures to be taken to prevent migration of contaminants along the well annulus or to otherwise protect the well.
 - (7) Alternative construction methods for piezometers may be approved by the Department if those methods meet the requirements set forth in this Part.
- c. Well and piezometer development – Development of all monitoring wells and piezometers shall be performed no earlier than twenty-four (24) hours after installation and before the initial water quality samples are taken. The goal of well development is to produce water free of fine sand and coarser material, all drill cuttings and drilling fluids.
- (1) Survey – The locations and elevations of all existing and abandoned test pits, soil borings, monitoring wells, and piezometers must be surveyed to obtain their precise location and plotted on a map in the hydrogeologic report. The vertical location of the ground surface and the mark made on the top of the monitoring well and piezometer risers must be accurately measured to the nearest one hundredth foot (1/100').
 - (2) Where a well is damaged, or for any other reason cannot be sampled, the Department must be notified in writing no later than fifteen (15) days after discovery of the situation.

- (3) Replacement of wells – All wells must be properly protected to ensure their integrity. If in the opinion of the Department, water quality or other data show that the integrity of a well is lost, the well must be replaced and sampled within a time period acceptable to the Department after written notification by the Department.
- (4) Abandonment of wells – All soil borings or rock cores which are not completed as monitoring wells or piezometers, and other abandoned wells, must be fully sealed in a manner appropriate for the geologic conditions in order to prevent contaminant migration through the borehole.
- (5) Abandonment procedures – The well shall be checked from the land surface through the entire depth of the well before it is sealed to ensure against the presence of any obstructions that will interfere with sealing operations.
 - (AA) Wells constructed with an annular seal shall be abandoned by cutting off the casing a minimum of four feet (4') below land surface. The remaining casing shall be completely filled with a neat cement grout or bentonite-cement grout.
 - (BB) Wells not known to be constructed with an impermeable annular seal shall be abandoned by completely removing the well casing and sealing with neat cement or bentonite-cement grout. If the casing cannot be removed during the abandonment of a well, the casing shall be thoroughly ripped or perforated from top to bottom, except that perforations will not be required over intervals of the well that are sealed with cement. The screened portion of the well and the annular space between the casing and the drillhole wall shall be effectively and completely filled with cement or bentonite-cement grout applied under pressure.
- (6) The owner or operator of an SWLF unit must notify the Director that the documentation of the development and decommissioning of any monitoring wells and piezometers has been placed in the landfill's operating record.

9. Geologic sampling – A representative number of borings and rock cores must be sampled continuously throughout the length of the hole. In any additional borings not continuously sampled, samples must be taken at five foot (5') intervals in unconsolidated deposits and, in rock, as required by the Department. For well clusters, continuous samples must be collected from the surface to the base of the deepest well. Other wells in the cluster must be sampled at all stratigraphic changes, and at the screened interval. Soil borings must be sampled using the split spoon method and bedrock or boulders must be sampled by coring with standard size NX or larger diameter core bits. Samples must be retained in labeled glass jars or wooden core boxes. Core samples must be securely stored and accessible throughout the life of the facility. Unconsolidated samples must be retained for three (3) years after the permit is issued. The proposed location of the storage area must be designated in the operation and maintenance plan for the facility.

10. Logs
 - a. Complete and accurate drilling logs must be provided to the Department for all soil borings. These logs must provide detailed soil classification. Logs also must contain a description of matrix and clasts, mineralogy, roundness, color, appearance, odor, and behavior of materials using an appropriate descriptive system. A clear description of the system used must be included with the logs. When undisturbed samples have been taken, the interval tested and the test results must be clearly shown on the logs. All well logs must contain drilling information as observed in the field including: moisture content, location of the water table during drilling, water loss during drilling, depth to significant changes in material and rock, sample recovery measured in tenths of a foot, hammer blow counts, and other pertinent comments, the method of drilling, anomalous features such as gas in the well, and the use and description of drilling fluids or additives, including the source and calculated and actual amounts of materials used.

 - b. Rock core logs must describe the lithology, mineralogy, degree of cementation, color, grain size, and any other physical characteristics of the rock, percent recovery and the rock quality designation (RQD), other primary and secondary features, and contain all drilling observations and appropriate details required for soil boring logs. A clear photographic record of all labeled cores must also be taken and submitted with the logs.

- c. Well completion logs must contain a diagram of the completed well, all pertinent details on well construction, a description of materials used and elevations of all well features. The owner or operator of an SWLF unit must notify the Director that the documentation of the design and installation of any monitoring wells and piezometers, has been placed in the landfill's operating record.
 - d. For an SWLF unit, there shall be either a certified statement from a qualified groundwater scientist or approval by the Director of the number, spacing, and depths of the installed groundwater monitoring wells. If there is a certified statement from a qualified groundwater scientist, concerning this matter, then the owner or operator of the SWLF unit shall notify the Director, within fourteen (14) days of this certification, that the certified statement has been placed in the landfill's operating record.
11. Water quality sampling and analysis – Water quality samples, low in turbidity, must be collected by personnel trained in sample collection methods and fully informed of the sampling techniques specified in the site investigation and environmental monitoring plans. These plans must specify: how samples will be collected and preserved; chain of custody documentation; analyses required; methods of analyses; and quality control/quality assurance protocols. All methods must be acceptable to the Department. A record of the methods employed and the personnel involved must be kept and reported to the Department with the analytical data. The owner or operator of an SWLF unit must notify the Director that the documentation of these sampling and analytical devices and procedures has been placed in the landfill's operating record.
- a. Monitoring well sampling techniques must be consistently performed each time a well is sampled, and must comply with the following:
 - (1) In areas where the presence of explosive or organic vapors as suspected, ambient air in the well must be checked for their presence before the well is evacuated. In addition, before evacuation of the well, static water level must be measured to the nearest one-hundredth of a foot (1/100') using standard techniques; and for wells with documented contamination, where contamination by non-aqueous phase liquids may be present, standing water in the well must be checked for immiscible layers or other contaminants that are lighter or heavier than water (floaters or sinkers). If present,

floaters or sinkers must be sampled and analyzed separately by a method described in the site investigation plan.

- (2) Evacuation of the well must replace stagnant water in the well and the sand pack with fresh water representative of the aquifer. Evacuation methods must create the least possible turbidity in the well and must not lower the water in the well below the top of the sand pack. Evacuated water must be properly managed.
- b. Surface water sampling – The Department may require the sampling and analysis of surface water sampling points in a variety of situations. Surface water sampling methods must be consistently applied each time a point is sampled and must comply with the following:
- (1) Samples collected from shallow water should not include bottom sediment. In shallow moving water, downstream samples must be collected first to avoid disturbing the bottom sediments.
 - (2) Each water body over ten feet (10') deep that is sampled must be checked for stratification, and each stratum must be checked for contamination using field parameters. Each stratum showing evidence of contamination must be separately analyzed. If no stratum shows such evidence, a composite sample having equal parts of water from each stratum must be analyzed.
- c. Except as otherwise specified by the Department, all samples must be whole and unfiltered and must be collected in a manner which produces the least possible turbidity.
- d. Analysis of water quality data
- (1) Field analysis must be performed after evacuation of the well, either within the borehole using a probe or immediately after collection. All field test equipment must be calibrated at the beginning of each sampling day and checked and recalibrated according to the manufacturer's specifications. Calibration data must be reported with the analytical results.
 - (2) Laboratory analyses must be performed using analytical methodologies acceptable to the Department. Where necessary to achieve acceptable minimum detection levels,

the Department may require the use of specific analytical methods.

- (3) All samples must be collected and stored in the order of the parameter's volatilization sensitivity using methods, consistently applied, which ensure sample integrity.
- (4) Written reports containing the laboratory results must be submitted to the Department, and must include certification by the laboratory as to the accuracy and analytical methods used.
- (5) After volatile organic samples have been collected, field parameters must be measured from the next sample collected.
- (6) Samples must be properly preserved and delivered to the laboratory within all appropriate holding times for the parameters to be analyzed and with proper chain of custody.
- (7) Blanks and replicate samples must be collected and analyzed in accordance with a method acceptable to the Department.

C. Site Investigation Report: The site investigation report must include, at a minimum, a final version of the site investigation plan, raw field data collected, analytical calculations, maps, flow nets, cross sections, interpretations and conclusions. Such report must comprehensively describe, at a minimum:

1. Regional geology: The discussion of regional geology must demonstrate how the regional geology relates to the formation of on-site geologic materials, the potential for and effects of off-site contaminant migration, and the location of nearby sensitive environments. This discussion must include available and appropriate information to describe:
 - a. Bedrock geology and structural features (represented on maps and columnar diagrams) constructed from field exposures and the geologic literature and describing formation and member names; geologic ages; rock types; thicknesses; the units' mineralogic and geochemical compositions and variabilities; rock fabrics; porosities and bulk permeabilities; and structural geology, including orientation and density or spacing of folds, faults, joints, and other features;

- b. Glacial geology, including a discussion of the formation, timing, stages, and distribution of glacial deposits, advances and retreats of ice, and hydrologic characteristics of the surficial deposits, such as kames, esker, outwash moraines, etc.;
 - c. Major topographic features, their origin and influence upon drainage basin characteristics; and
 - d. Surface water and groundwater hydrologic features, including surface drainage patterns, recharge and discharge areas, wetlands and other sensitive environments, inferred regional groundwater flow directions, aquifers, and known primary water supply and principal aquifers, public water supply wells, and private water supply wells identified in the water supply well survey; any known peculiarities in surface water and groundwater geochemistry and any other relevant features.
2. Site specific geology – The site investigation report must define site hydrogeologic conditions in three (3) dimensions and their relationship to the proposed landfill. The report must define site geology, surface water and groundwater flow, and must relate site-specific conditions to the regional geology. The report must describe the potential impact the landfill may have on surface and groundwater resources and other receptors, including future hydrogeologic conditions which may occur with site development, and must describe the hydrogeologic conditions in sufficient detail to construct a comprehensive understanding of groundwater flow which can be quantified and verified through hydrologic, geochemical, and geophysical measurements. The report must provide sufficient data to specify the location and sampling frequency for environmental monitoring points, form the basis for contingency plans regarding ground and surface water contamination and explosive gas migration, and support the engineering design of the landfill.
3. The site-specific hydrogeologic evaluation must specifically discuss all consolidated and unconsolidated geologic units. Such evaluation must include maps, cross-sections, other graphical representations, and a detailed written analysis of the following:
- a. All hydrogeologic units such as specific glacial deposits and bedrock types, and how they relate to surface water and groundwater flow. This must include all hydrogeologic data collected during the site investigation and explain and evaluate the hydrologic and engineering properties of the site and each specific unit; and

- b. Local groundwater recharge and discharge areas, high and low groundwater tables and potentiometric surfaces for each hydrologic unit, vertical and horizontal hydraulic gradients, groundwater flow directions and velocities, groundwater boundary conditions, surface and groundwater interactions, and an evaluation of existing water quality.

D. Environmental Monitoring Plan: The environmental monitoring plan must describe all proposed monitoring, including the location of all monitoring points, sampling schedule, the method of sample collection and preservation, procedures for shipment of samples for analysis, chain of custody documentation, analyses to be performed, quality assurance and quality control measures, analytical and statistical methods, and reporting requirements. The plan must also include a schedule for initiation of the existing water quality and operational water quality monitoring programs and a contingency water quality monitoring plan. The owner or operator of an SWLF unit must notify the Director that the environmental monitoring plan has been placed in the landfill's operating record. This plan must comply with the following:

- 1. Groundwater sampling – Groundwater monitoring wells must be capable of detecting landfill-derived groundwater contamination.
 - a. Horizontal well spacing
 - (1) Horizontal well spacing must be based upon site-specific conditions including groundwater flow rates, estimated longitudinal and transverse dispersivity rates, proximity to or presence of sensitive environments and groundwater users, the nature of contaminants disposed of at the site, and the proposed design and size of the **landfill including capability for liner monitoring through a leak detection system.**
 - (2) At a minimum, well spacing must provide at least one (1) upgradient and three (3) downgradient monitoring wells or well clusters for each water-bearing unit of the aquifer.
 - (3) Some of the downgradient monitoring wells must be located as close as practical to the waste boundary to ensure early detection of any contaminant plume.
 - (4) For SWLF units, all of the downgradient wells shall be no more than one-hundred fifty (150) meters from the waste management unit boundary and will be located on land

owned by the owner of the SWLF unit. The acceptable distance of these wells from the waste management unit boundary, i.e. the relevant point of compliance, shall depend on the results of the hydrogeological report's site investigation, per § 2.1.8(A) of this Part. For sites where physical obstacles prohibit installation of some or all of the downgradient wells at the relevant point of compliance, then these downgradient monitoring wells shall be installed at the closest practicable hydraulically downgradient distance from the relevant point of compliance specified by the Director and the distance chosen shall be approved by the Director.

- b. Well screen placement – Well screens must be located to readily detect groundwater contamination.
 - c. Screen length – Well screens must not exceed fifteen feet (15') in length unless otherwise approved by the Department. The applicant must provide technical justification for the actual screen length chosen.
 - d. Geophysical and geochemical techniques – Where existing contamination is suspected, the Department may require the use of geophysical and geochemical techniques to locate contaminated zones before selecting appropriate well locations and screen depths for environmental monitoring points.
2. Surface water sampling – The environmental monitoring plan must designate monitoring points for use in contingency monitoring of the facility for all surface water bodies that may be significantly impacted by a contaminant release from the facility. In bodies of standing water, these points must be located at the point or points of highest likely impact and must be included in existing water quality monitoring. In flowing water bodies these points must include sufficient upgradient and downgradient locations to allow the facility's impact to be measured. These points, however, do not require existing water quality analysis. The detailed sampling and analysis requirements of these points must be specified in the contingency monitoring plan.
 3. Water quality monitoring program – A water quality monitoring program must be implemented for all environmental monitoring points specified in the environmental monitoring plan. This program must be tailored to the site to establish existing water quality for the site prior to landfilling, operational water quality during operation of the site and the post-closure

period, and contingency water quality if contamination is detected at the site. These programs must meet the following minimum requirements:

E. Existing water quality

1. The applicant must establish an existing water quality database to characterize the site geochemistry.
 - a. The license application must contain a preliminary evaluation of water quality consisting of the first round of sampling and analyses for a representative number of monitoring points. These samples must be analyzed for the parameters listed in §§ 2.3.26 and 2.3.27 of this Part. The Department may increase or reduce sampling and analysis of monitoring points and parameters as necessary to define site hydrogeology and geochemistry in support of the interpretations and conclusions of the site investigation report.
 - b. Before disposition of waste in the facility, all environmental monitoring points not previously sampled must be sampled and analyzed for one (1) round of quarterly sampling. This round must be analyzed for the parameters listed in §§ 2.3.26 and 2.3.27 of this Part.
 - c. If elevated contaminant levels are detected and additional detailed information is needed to establish a complete existing water quality database, the Department may require one (1) or more rounds of sampling and analysis in any sampling point.

F. Detection monitoring

1. The environmental monitoring plan must include a plan for detection monitoring to be conducted during the operation, closure, and post-closure periods of the facility. The detection monitoring plan must be able to distinguish landfill-derived contamination from the existing water quality at the site. The plan also must describe trigger mechanisms based on a Department approved statistical method for initiating assessment monitoring. Trigger mechanisms shall consist of statistically significant increases over background for one (1) or more of the § 2.3.26 of this Part parameters, at any landfill groundwater monitoring wells at the waste management unit boundary. The Department may require modification of this plan as additional sampling data becomes available throughout the life of the facility. The minimum requirements for detection monitoring are:
 - a. Except as provided below in each calendar year, sampling and analysis must be performed at least quarterly during the active

operating life of the landfill and at least semi-annually during the closure and post-closure monitoring periods. For SWLF units, sampling and analysis shall be performed for each upgradient and downgradient well, during each monitoring event, with allowed exceptions for wells in vicinities where landfilling has not commenced, per § 2.1.8(C)(3)(b)((2)) of this Part.

- b. The Department may approve phased sampling, where hydrogeologic conditions warrant, as landfill cells are constructed or as post-closure monitoring is completed. With Department approval, sampling of specific environmental monitoring points which are not potentially impacted by the portions of the landfill already constructed, may be deferred, provided that scheduled sampling commences at least one (1) year before landfill construction in the vicinity. The Department may withdraw this approval at any time based upon a change in facility design, operation, or performance.
- c. Routine analysis shall be performed on parameters from § 2.3.26 of this Part. The Department may modify the list of routine parameters before granting a permit for the facility, or during the duration of the permit, if leachate composition so warrants. If subsequent leachate compositions vary, or if the waste disposed of at the facility changes, the Department may reinstate analytical requirements. The license application must include a list of parameters selected from § 2.3.26 of this Part that will be used for the routine quarterly monitoring.
- d. At each upgradient (background) and downgradient well, there shall be at least four (4) independent samples, each separately collected and analyzed for parameters in § 2.3.26 of this Part during the first sampling event (of the detection monitoring program during or after waste has been deposited.)
- e. The statistical method chosen for evaluating groundwater monitoring data for each parameter in § 2.3.26 of this Part shall be one of the allowed optional methods per 40 C.F.R. §§ 258.53(g) and (h) (2017), incorporated in § [1.3\(A\)](#) of this Subchapter. The owner or operator of an SWLF unit must specify in the landfill's operating record, the statistical method to be used.
- f. If the owner or operator of an SWLF unit determines that there is a statistically significant increase over background for one (1) or more of the parameters in § 2.3.26 of this Part, at any of the landfill's

boundary monitoring wells, than the owner or operator shall, within fourteen (14) days of this finding, place a notice of these details in the landfill's operating record and shall notify the Director of this action.

- g. If triggering of assessment monitoring occurs, then the owner or operator of an SWLF unit has the option to successfully demonstrate, within ninety (90) days, that this triggering was due to an error in sampling, analysis, statistical evaluation or natural variation in groundwater quality. If this successful demonstration occurs, including a report documenting this demonstration, as certified by a qualified groundwater scientist or approved by the Director, ~~then~~ the landfill owner or operator can continue to employ detection monitoring (rather than assessment monitoring).

h. Upon notification by the Department, the owner or operator must, within one hundred and eighty (180) days, monitor groundwater for the full suite of Per- and Polyfluoroalkyl Substances (PFAS) using a methodology approved by the Department for at least two (2) rounds. If exceedances of the Department's groundwater standards are detected, the owner or operator must revise the environmental monitoring plan to address the exceedances and any impacts it may have.-

G. Assessment Monitoring

1. The environmental monitoring plan must include a plan for assessment monitoring, as described in § 2.1.8(D)(3)(c) of this Part, which must be conducted when contamination is found. The plan also must describe trigger mechanisms based on a Department approved statistical method for initiating corrective action. Trigger mechanisms shall consist of MCLs promulgated under ~~Section § 1412 of~~ the Safe Drinking Water Act (codified) under 40 C.F.R. § 141 (2017), and an appropriate, health-based and/or environmental protection-based level approved by the Department. All assessment monitoring plans are subject to Department approval, may be modified at any time by the Department when necessary to protect public health and the environment, and must include the following:
 - a. If contamination as determined by using the statistical method in evaluating detection monitoring for one (1) or more routine parameters is found, or if there is any scientifically valid evidence of off-site contamination, then:

- (1) The owner or operator of the facility must sample and analyze all affected monitoring points for the parameters in §§ 2.3.26 and 2.3.27 of this Part during the next quarterly sampling event. This next sampling event must occur within ninety (90) days of the triggering of assessment monitoring. If contamination detected poses an immediate threat to public health or the environment as determined by the Department, additional or more frequent sampling may be required as part of a corrective action plan approved by the Department.
- (2) Subsequent sampling and analysis for parameters in §§ 2.3.26 and 2.3.27 of this Part must be conducted within ninety (90) days and at least quarterly subsequently for active, operating landfills and at least semi-annually subsequently for closed landfills (during the closure and post-closure monitoring periods), until the conditions for curtailing contingency water quality monitoring specified in § 2.1.8(D)(3)(c)((4)) of this Part are met.
- (3) The Director may specify an appropriate subset of wells to be sampled and analyzed for parameters in §§ 2.3.26 and 2.3.27 of this Part during assessment monitoring. The Director may delete any of the § 2.3.27 of this Part monitoring parameters, if the owner or operator of an SWLF unit, or their representative, can show that the removed constituents are not reasonably expected to be in or derived from the waste contained in the landfill.
- (4) At least one (1) sample must be collected and analyzed from each well monitored, during each sampling event. Furthermore for any of the parameters listed in §§ 2.3.26 and 2.3.27 of this Part detected in any downgradient well in these nits, during assessment monitoring, a minimum of four (4) independent samples must be collected and analyzed from each background well and from at least each downgradient well having detected that parameter, to establish a background level for that parameter and for statistical comparison purposes.
- (5) The owner or operator of an SWLF unit must place in the landfill operating record, within fourteen (14) days of receipt of analytical results from assessment monitoring, a notice identifying any of the parameters listed in §§ 2.3.26 and

2.3.27 of this Part that have been detected and must notify the Director that this notice has been placed in this record.

- b. If contamination as determined by using the statistical method in evaluating assessment monitoring for one or more of the parameters in § 2.3.27 of this Part is found, or if there is any scientifically valid evidence of off-site contamination, then:
 - (1) The owner or operator of the facility must initiate an assessment of corrective measures, select a remedy and implement a corrective action program in accordance with the requirements described in § 2.3.28 of this Part.
- c. The Department may require initiation of specific assessment monitoring based upon landfill containment failure shown by any means, including, but not limited to, contamination found in off-site wells beyond the property boundary.
- d. Once initiated, assessment monitoring must be continued until the elevated parameter is shown not to be landfill-derived, or that the release by the landfill has been remediated. Assessment monitoring also may be reduced or discontinued with the approval of the Department if such monitoring is no longer needed to protect public health or the environment. Assessment monitoring for parameters in §§ 2.3.26 and 2.3.27 of this Part must continue at affected well(s) at least until the concentration of all parameters in §§ 2.3.26 and 2.3.27 of this Part are shown to be at or below background values (at the upgradient well(s)), using one (1) of the accepted statistical procedures in 40 C.F.R. § 258.53(g) (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, for two (2) consecutive sampling events. The owner or operator of the SWLF unit must notify the Director of these occurrences during the two (2) consecutive sampling events and must, at minimum, return to detection monitoring at these previously affected wells. For SWLF units, assessment monitoring at affected wells must continue, if these wells' analytical results continue to show concentrations of one (1) or more parameters in §§ 2.3.26 and 2.3.27 of this Part above background (upgradient) values and all concentrations are below the groundwater protection standard values established per § 2.1.8(C)(3)(c)((7)) of this Part below.
- e. Where existing water quality shows contamination, the applicant must establish an assessment monitoring plan capable of detecting additional groundwater contamination from the proposed facility.

f. If one or more of the parameters in §§ 2.3.26 and 2.3.27 of this Part are detected at statistically significant levels above the groundwater protection standard values established per § 2.1.8(C)(3)(c)((7)) of this Part below, then:

- (1) The landfill owner or operator must place in its operating record, within fourteen (14) days of receiving analytical results, a notice identifying the parameters in §§ 2.3.26 and 2.3.27 of this Part that have statistically exceeded the groundwater protection standard values, in any sampling event, and must notify the Director and the local government officials that the notice has been placed in its operating record.
- (2) The landfill owner or operator must characterize the nature and extent of the release by installing additional monitoring wells as necessary and, at minimum, must install at least one (1) monitoring well at the facility boundary in the direction of contaminant migration and must perform assessment monitoring at this well.
- (3) The landfill owner or operator must notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination, if contaminants have migrated off-site as indicated by sampling of wells.
- (4) The landfill owner or operator must initiate an assessment of corrective action within ninety (90) days (per § 2.3.28 of this Part) or may, at his option, demonstrate that a source other than his landfill caused the contamination or demonstrate that the indicated contamination resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by a qualified groundwater scientist or must be approved by the Director and the report shall be placed in the landfill's operating record. If this successful demonstration is made, then:
 - (AA) The landfill owner or operator does not have to initiate an assessment of corrective measures, but must continue assessment monitoring, until necessary conditions for returning to detection monitoring are met, per § 2.1.8(C)(3)(c)((4)) of this Part.

- (BB) The landfill owner or operator does not have to add additional monitoring wells, per § 2.1.8(C)(3)(c)((6)) of this Part, or notify the owner or occupants of adjacent property of off-site migration of contaminants, per § 2.1.8(C)(3)(c)((6)) of this Part.
- g. For all landfill units, the groundwater protection standard value for each parameter in §§ 2.3.26 and 2.3.27 of this Part shall be the following:
- (1) For parameters for which a maximum contaminant level (MCL) has been promulgated under § 1412 of the Safe Drinking Water Act (codified) under 40 C.F.R. § 141 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, the MCL for that parameter.
 - (2) For parameters for which MCLs have not been promulgated, either:
 - (AA) The background concentration for the parameter as established from background (upgradient) well(s) or
 - (BB) An alternate groundwater protection standard, established by the Director, based on appropriate health risks which satisfy the following criteria:
 - (i) The level is derived in a manner consistent with Federal guidelines for assessing the health risks of pollutants ([EPA/630/P-03/001F published March 2005](#)) (~~51 FR 33992, 34006, 34014, 34028, Sept. 24, 1986~~, incorporated in § [1.3\(B\)](#) of this Subchapter), and
 - (ii) The level is based on scientifically valid studies conducted in accordance with the Toxic Substances Control Act Good Laboratory Practice Standards, 40 C.F.R. § 792 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter or equivalent; and
 - (iii) For carcinogens, the level represents a concentration associated within an excess lifetime cancer risk level (due to continuous lifetime exposure) within the 1×10^{-4} to 1×10^{-6} range; and

(iv) For systemic toxicants (which include toxic chemicals causing effects other than cancer or mutation) the level represents a concentration to which the human population (including sensitive sub-groups) could be exposed to on a daily basis that is likely to be without appreciable risk of deleterious effects during a lifetime.

(CC) In establishing alternate groundwater protection standards, per § 2.1.8(D)(3)(b) of this Part the Director may consider:

- (i) Multiple contaminants in the groundwater,
- (ii) Exposure threats to sensitive environmental receptors,
- (iii) Other site-specific exposure or potential exposure to ground water.

h. For parameters for which the background level is higher than the MCL, per § 2.1.8(C)(3)(c)((7)) of this Part, or is higher than health-based levels per § 2.1.8(C)(3)(c)((7)) of this Part, the background concentration shall be used.

H. Reporting of data

1. Unless more rapid reporting is required to address an imminent environmental or public health concern, the owner or operator of the facility must report all water quality monitoring results to the Department on a quarterly basis. The report must include:
 - a. A table showing the sample collection date, the analytical results, designation of upgradient wells and location number for each environmental monitoring point sampled, applicable water quality standards, trigger values, QA/QC notations, and method detection limits (MDL).
 - b. In addition, tables or graphical representations comparing current water quality and existing water quality and upgradient water quality must be presented.
 - c. A summary of the contraventions of water quality standards, and discussion of results, including elevations of parameters above

background concentrations based on statistical analyses; and any proposed modifications to the sampling and analysis schedule necessary to meet the requirements of §§ 2.1.8(D)(3)(c)((7))((BB)) ((i)) through ((iii)) of this Part.

- d. Any determination of contamination detected must be reported to the Department within forty-eight (48) hours of such determination.
- e. All QA/QC documentation must be made available to the Department upon request.
- f. The annual report must contain a summary of the water quality information presented, with special note of any changes in water quality which have occurred throughout the year.
- g. Contaminant trigger mechanisms – In sensitive environments or in areas of existing contamination, the Department may require the environmental monitoring plan to specify contaminant levels which, when exceeded, will signal groundwater contamination and commence assessment monitoring and possible remedial actions.

2.1.9 Closure and Post – Closure Plans and Financial Assurance

- A. Pursuant to the requirements set forth in § [1.5\(J\)](#) of this Subchapter, the operator or applicant shall submit a closure plan, including information on the following:
 - 1. Fences, gates, and all other security measures to prevent unauthorized access to the site
 - 2. Groundwater and surface water monitoring devices and stations
 - 3. Final grades
 - 4. Legal boundaries
 - 5. Final cover system, including a description of the methods and procedures to be used to install the cover, and meeting the requirements of § 2.2.12 of this Part:
 - a. Bedding layer
 - b. Low permeability barrier layer
 - c. Drainage layer
 - d. Top soil and vegetative cover

- B. Accompanying the plan in § 2.1.9(A) of this Part, the operator or applicant shall also submit information on the following:
1. Anticipated date of closure
 2. Methods of restricting access and preventing additional waste disposal
 3. Methods of protecting ground and surface water and controlling air emissions
 4. Anticipated starting and completion date of installation of the final cover system, including a schedule for completing each portion of the cover system.
 5. Method of maintaining drainage control structures to prevent ponding and erosion to the cover. The surface drainage system must be designed and constructed to protect the cover from the peak discharge of a twenty-four (24) hour one hundred (100) year frequency storm.
 6. Method of maintaining soil cover integrity, slopes, cover vegetation and gas venting structures during the post-closure monitoring and maintenance period.
 7. Method of maintaining the leachate collection and disposal system. Leachate treatment or disposal must be addressed for a minimum of thirty (30) years or for as long as leachate is capable of adversely impacting the environment.
 8. An estimate of the largest area of the landfill ever requiring a final cover at any time during the active life of the landfill.
 9. An estimate of the maximum inventory of wastes ever on site over the active life of the landfill.
 10. Description of the operation and maintenance of a gas monitoring system, that meets the requirements of 40 C.F.R. § 258.23 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter and § 2.3.8 of this Part.
- C. A post-closure monitoring and maintenance operations manual is required. This must provide personnel with detailed instructions for assuring efficient monitoring, leachate management which would include recording of the total volume of leachate stored and removed from the facility, sampling and analysis, and proper maintenance of all facility components to maintain the facility and meet the requirements of this rule for a minimum period of thirty (30) years after landfill closure. This manual must be submitted with the closure plan developed

in accordance with this rule. The manual must indicate the frequency for monitoring and maintenance actions and the name, address, and telephone number of the facility contact person during the post-closure period.

- D. A financial estimate of the costs to properly close the facility. With respect to financial assurance (§ [1.5\(J\)\(b\)](#) of this Subchapter), the applicant must post financial assurance for the full amount of the closure cost estimate as a pre-condition for the issuance of a solid waste management facility license.
- E. The landfill owner or operator shall notify the Director when a copy of the closure plan has been placed in the landfill's operating records and for a new SWLF unit, this action must occur prior to receiving waste at the facility.
- F. Prior to beginning closure of each SWLF unit, the landfill owner or operator shall notify the Director that a notice of intent to close the unit has been placed in the landfill's operating record.
- G. Planned uses (if any) of the property during the post closure period, subject to requirements of § 2.3.4(C)(6)(b) of this Part, shall be submitted to the Director. The owner or operator of an existing SWLF unit shall notify the Department expediently that a post-closure plan has been placed in the landfill's operating record. The owner or operator of a new SWLF unit or of a lateral expansion of an SWLF unit shall notify the Department that this post-closure plan has been placed in its operating record, prior to initial receipt of waste in the new or lateral expansion unit.
- H. Financial Assurance for Closure of an SWLF Unit:
 - 1. The landfill owner or operator must have a detailed written estimate, in current dollars of the cost of hiring a third party to close the largest area of the landfill ever requiring a final cover at any time during the active life, in accordance with the closure plan. The owner or operator must notify the Director that the estimate has been placed in the landfill's operating record.
 - 2. The closure cost estimate must equal the cost of closing the largest area of the landfill ever requiring a final cover at any time during its active life when the extent and manner of its operation would make closure the most expensive.
 - 3. During the landfill's active life, the owner or operator must annually adjust the closure cost estimate for inflation.
 - 4. The owner or operator must increase the closure cost estimate and the amount of financial assurance provided, if changes to the closure plan or

landfill conditions increase the maximum cost of closure at any time during the remaining active life.

5. The owner or operator may reduce the closure cost estimate and the amount of financial assurance provided, if the cost estimate exceeds the maximum cost of closure at any time during the remaining life of the landfill. The owner or operator must notify the Director that the justification for the reduction in the closure cost estimate and the amount of financial assurance has been placed in the landfill's operating record.
6. The landfill owner or operator must establish financial assurance for closure of the landfill, in compliance with § 2.3.29 of this Part. The owner or operator must provide continuous closure assurance until released from financial assurance requirements by demonstrating compliance with §§ 2.3.4(C)(5) and (6) of this Part.

I. Financial Assurance for Post Closure of an SWLF Unit:

1. The landfill owner or operator must have a detailed written estimate, in current dollars, of the cost of hiring a third (3rd) party to conduct post-closure care of the landfill in compliance with the post-closure requirements within §§ 2.1.9(B) and (C) of this Part. The post-closure cost estimate used to demonstrate financial assurance must account for the total costs of conducting post-closure care, including annual and periodic costs incurred over the entire post-closure care period. The owner or operator must notify the Director that this estimate has been placed in the landfill's operating record.
2. The cost estimate for post-closure care must be based on the most expensive costs of post-closure care during the post-closure care period.
3. During the active life of the landfill and during the post-closure care period, the owner or operator must annually adjust the post-closure cost estimate for inflation.
4. The owner or operator must increase the post-closure cost estimate and the amount of post-closure care financial assurance provided, if changes in the post-closure plan or landfill conditions increase the cost of post-closure care.
5. The owner or operator may reduce the post-closure cost estimate and the amount of post-closure care financial assurance provided, if the cost estimate exceeds the maximum cost of post-closure care remaining over the post-closure care period. The owner or operator must notify the Director that the justification for the reduction of the post-closure cost

estimate and the amount of financial assurance has been placed in the operating record.

6. The owner or operator must establish financial assurance for post-closure care, in compliance with § 2.3.29 of this Part. The owner or operator must provide continuous post-closure care assurance until released from financial assurance requirements by demonstrating compliance with post-closure care requirements, per §§ 2.1.9(B) and (C) of this Part.

J. Installation of Solar Panels on Landfills

1. For Landfills undergoing closure overseen by the Office of Land Revitalization and Sustainable Materials Management, solar panel systems may be installed on the footprint of the landfill if the panels are approved as part of the overall cap design.
2. For Inactive Landfills that have or will undergo closure overseen by the Office of Land Revitalization and Sustainable Materials Management, the owners must obtain authorization from the Department in order to install a solar panel system on the landfill. Solar Panel systems may be installed on the footprint of the landfills if all of the provisions are met:
 - a. The landfill has been or shall be closed/capped in conformance with Solid Waste Regulations or the Landfill Closure Program.
 - b. A Solar Panel Feasibility study evaluating the impact of the solar panel system on following issues:
 - (1) Details of how the system will be placed and anchored
 - (2) Compatibility of the system with the existing cap (including potential to puncture the membrane)
 - (3) An analysis of the weight bearing capacity of the existing cap and related structures (i.e. gas and leachate controls), including loads placed on the cap during construction from equipment and snow and wind loads and in consideration of cap integrity
 - (4) Potential for increased settlement
 - (5) Slope and stability analysis
 - (6) Vegetative cover
 - (7) Existing or proposed gas or leachate management systems

- (8) Stormwater control and impact on wetlands and/or surface waters
 - (9) Minimum spacing for maintenance and emergency events.
 - (10) Access roads and access restrictions to the site.
 - (11) Electrical plans and specifications showing electrical lines and related equipment
 - (12) Health and Safety Plan
 - c. Gas monitoring and alarms will be in place for any controlled structure or buried line or other confined space.
 - d. Other aspects of the cap meet the requirements of the Solid Waste Regulations or the Landfill Closure Program.
3. Solar panel systems proposed to be installed on the capped footprint of filled areas shall be considered an integral part of the final remedy for the purpose of review and approval under this Rule. Therefore, activities that may affect freshwater wetlands and that are approved the Office of Land Revitalization and Sustainable Materials Management under this rule, capping, closure, or for remediation of contamination resulting from the release of oil or hazardous materials are allowed in accordance with the Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act, § 150-15-1.6(A) of this Title and Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases, Subchapter 30 Part 1 of this Chapter.
- a. Stormwater Control. Applicants proposing solar panels on the capped footprint of filled areas shall either:
 - (1) Obtain a RIPDES General Permit for Stormwater Discharge Associated with Construction Activity (Construction General Permit) from the Office of Water Resources, or
 - (2) Comply with pre-approved construction mitigation standards established by the Office of Land Revitalization and Sustainable Materials Management.

2.1.10 Site Engineering

- A. The following areas shall be marked with stakes at the site at the time of the engineering survey. The stakes must be visible and must be maintained at all times.
1. Area enclosed by legal boundaries
 2. Areas to be filled as indicated in operating plan
 3. Areas to be used for leachate treatment, storage or disposal
 4. Areas to be used for storing salvaged materials
 5. Areas to be used for special waste as listed in § 2.3.6(D) of this Part

2.1.11 Conservation Easement

As a condition of issuance of a license for a solid waste management facility, the owner of the land on which the facility is to be located shall grant to the State of Rhode Island and Providence Plantations a perpetual conservation easement. The easement shall be recorded in the land evidence records of the city (cities) or town (towns) in which the land is located and shall describe the permitted facility and the activities to be conducted therein. Under the terms of the easement, the Director or his duly authorized agents of the State of Rhode Island shall have a perpetual right to enter upon such land at reasonable times for the purpose of inspecting the facility, or for the purpose of conducting tests where the facility is or was located. Such easement shall include a prohibition on any excavation or other disturbance or construction of the facility site without prior written approval from the Director. The conservation easement shall also include the notation required by § 2.3.15 of this Part.

2.1.12 Landfill Gas Recovery Facilities

- A. § 2.1.12 of this Part regulates the construction and operation of all landfill gas recovery facilities that remove landfill gas from landfills subject to regulation under the provisions of this Rule. Landfill gas recovery facilities must be constructed and operated in accordance with all applicable requirements of all Federal and State Regulations.
- B. An application for approval to construct and operate a landfill gas recovery facility must be submitted in accordance with the following requirements.
- C. Site Plans: Site plans including all of the information listed below for all areas within the site shall be submitted. The site plans must be drawn to an appropriate scale adjusted to fit on a standard size sheet. The required information includes:

1. Landfill property boundaries from which the landfill gas is to be removed
 2. Location of the landfill gas recovery facility
 3. Off-site and on-site utilities including sanitary sewer systems
 4. Locations of existing and proposed gas venting structures, wells, piezometers, environmental and landfill monitoring points
 5. On-site buildings
 6. Fences and gates
 7. Roads and parking areas
 8. Existing drainage culverts and on-site drainage structures
 9. Landfill areas from which landfill gas is to be recovered
 10. Site topography with five foot minimum contour intervals
 11. North arrow
 12. Location and grades of all landfill gas collection lines
 13. Collection pipe inverts, clean-outs and valves
 14. Extraction well locations
- D. Construction and Engineering Plans: A complete set of construction and engineering plans and specifications relating to all buildings and equipment of the facility must be submitted to the Department.
- E. Operating Plan: An operating plan shall be submitted including information on all of the areas listed below:
1. A description of the operation of the facility and how the recovered landfill gas will be used.
 2. An estimate of the quantities of condensate to be generated and a description of how the condensate will be disposed of
 3. Operating hours
 4. Personnel and duties
 5. Communications equipment available

6. A description of the equipment machinery, operational controls, and processes to be used during normal operation
 7. A description of procedures to be followed during start up and planned and unplanned shutdown of operations
 8. A description of the safety features of the equipment, controls, and machinery
 9. Site security methods
- F. Contingency Plan: The contingency plan must discuss an organized and planned method of responding to unexpected events during the construction and operation of the landfill gas facility. The plan must address, at a minimum, actions to be taken with respect to:
1. Noise
 2. Personal injury
 3. Explosions
 4. Fires
 5. Detection of explosive landfill gases both on-site and off-site
 6. Equipment to be used to maintain proper landfill gas venting and control when normal operations cease
- G. Closure Plan: Pursuant to the requirements set forth in § [1.5\(J\)](#) of this Subchapter, the operator or applicant shall submit a closure plan including information on the following:
1. Date of proposed closure
 2. Methods of restricting access
 3. Methods of protecting ground and surface water and controlling air emissions in the vicinity of the facility
 4. Methods to vent and control landfill gases after operation of the facility ceases
 5. An estimate of the costs to properly close the facility

6. Intended future use of the facility, following closure (immediate and long term use)

2.2 Solid Waste Landfill Construction Standards

2.2.1 General

Construction of sanitary landfill facilities shall meet all regulations set forth in this Rule and shall also comply with all applicable Federal Rules, Laws, Regulations or other Federal requirements.

2.2.2 Horizontal and Vertical Control

- A. One permanent survey benchmark of known elevation measured from the National Geodetic Vertical Datum of 1929 must be established and maintained for each twenty-five (25) acres of developed landfill, or part thereof, at the site. This benchmark must be the reference point for establishing vertical elevation control.
- B. North American Datum of 1983 Coordinates must be established. Horizontal control must be established and one (1) of its points must be the benchmark of known NAD 1983 Coordinates.

2.2.3 Liner System

- A. The minimum liner requirements for all landfills accepting solid waste must consist of the following:
 1. On all bottom areas where the landfill slope is less than or equal to twenty-five percent (25%), the liner system must consist of a double composite liner separated by a secondary leachate collection and removal system.
 2. On all side slope areas where the landfill slope is greater than twenty-five percent (25%), the liner system need only consist of an upper geomembrane liner and a secondary (lower) composite liner separated by a secondary leachate collection and removal system.
 3. A composite liner must consist of two components; an upper geomembrane liner placed directly above a low permeability soil layer meeting the requirements specified in §§ 2.2.7 and 2.2.6 of this Part respectively. Each composite liner is considered a single liner.
 4. The double composite liner system must include a primary leachate collection and removal system consisting of a twenty-four inch (24") granular soil layer with a leachate collection pipe network. The primary

leachate collection and removal system lies above the primary (upper) composite liner. The primary composite liner consists of a geomembrane that directly overlays an eighteen inch (18") low permeability soil layer. The primary composite liner lies above the secondary leachate collection and removal system. The secondary leachate collection and removal system consists of either a leachate collection pipe network with a twelve inch (12") granular soil layer, or an effective layer of geosynthetic material. The secondary leachate collection and removal system lies above the secondary (lower) composite liner, which consists of a geomembrane that directly overlays a twenty-four inch (24") low permeability soil layer.

5. The Department shall not allow any variance from the requirement to include a secondary (lower) composite liner, as part of the liner system.

2.2.4 Leachate Collection and Removal System

- A. The leachate collection and removal system must be designed to effectively remove leachate from the landfill. A means of assessing leachate flows in both the primary and secondary leachate collection and removal system must be detailed on plans and discussed in the engineering report.
- B. The primary and secondary leachate collection and removal systems must conform to the following requirements:
 1. A primary leachate collection and removal system, located over the upper composite liner, must be hydraulically designed to remove leachate from the landfill and ensure that the leachate head over the primary composite liner does not exceed one foot (1') at expected flow capacity, except during storm events. This collection and removal system must be designed and constructed, at a minimum, in accordance with the requirements of §§ 2.2.8 and 2.2.9 of this Part.
 2. A secondary leachate collection and removal system must be located between the upper and lower liner systems to effectively collect and rapidly remove leachate from the lower liner system. This collection system must be designed and constructed, at a minimum, in accordance with the requirements of §§ 2.2.8, 2.2.9 and 2.2.10 of this Part.
 3. The primary and secondary leachate collection and removal systems must be designed and built to allow for representative sampling of leachate, and to operate without clogging during the effective site life and post-closure maintenance period. All pipes located in the primary leachate collection and removal system must be designed to allow for accessibility of equipment for routine cleaning and maintenance. All leachate conveyance

lines outside the double composite liner system of the landfill must be designed to have double containment, and must be constructed to provide for leak detection and collection. Double containment and leak detection provisions shall be maintained along the entire length of conveyance line(s) handling only leachate or other liquid wastes associated with the design of the landfill.

2.2.5 Landfill Subgrade

- A. The landfill subgrade is the uppermost in-situ soil layer or select fill that must be graded and prepared for landfill construction. A foundation analysis must be performed to determine the structural integrity of the subgrade to support the loads and stresses imposed by the weight of the landfill and to support overlying facility components. For lateral expansions adjacent to existing landfills, the Department may approve encroachment upon the existing landfill's side slope if a leachate barrier system is designed and constructed to minimize leachate migration into the existing landfill.
1. **Materials Required:** The landfill subgrade must be free of organic material and consist of on-site soils, or any select fill if approved by the Department.
 2. **Construction Requirements:** The landfill subgrade must be graded in accordance with the requirements of the approved engineering plans, report, and specifications. The material must be sufficiently dry and structurally sound to ensure that the first lift and all succeeding lifts of soil placed over the landfill subgrade can be adequately compacted to the design requirements.
 3. **Certification Requirements:** At a minimum, the subgrade surface must be inspected in accordance with the following requirements:
 - a. Before placing any material over the subgrade, the project engineer must visually inspect the exposed surface to evaluate the suitability of the subgrade and ensure that the surface is properly compacted, smooth, and uniform, and that elevations are consistent with the Department approved plans.
 - b. The subgrade must be proof-rolled using procedures and equipment acceptable to the Department.
 - c. The subgrade must be tested for density and moisture content at a minimum frequency of five tests per acre.

2.2.6 Soil Component of the Liner System

- A. The soil component of the liner system must be a continuous layer of low permeability soil constructed to control fluid migration.
1. Materials Required
 - a. Primary composite liner: The soil component of the primary composite liner must be a minimum compacted thickness of eighteen inches (18"). The top six inches (6") directly below and in contact with the upper geomembrane liner must have a maximum remolded coefficient of permeability of 1×10^{-7} centimeters per second. The lower twelve inches (12") of soil must be compacted to achieve a maximum remolded coefficient of permeability of 1×10^{-5} centimeters per second and be placed without damaging any geosynthetic or secondary leachate collection and removal system components below the primary composite liner. The soil material must be free of particles greater than three inches (3") in any dimension.
 - b. Secondary composite liner: The soil component of the secondary composite liner must be at least twenty-four inches (24") in compacted thickness, and must have a maximum remolded coefficient of permeability of 1×10^{-7} centimeters per second throughout its thickness. The soil material must be free of particles greater than three inches (3") in any dimension.
 2. Construction Requirements: The project engineer must ensure that the soil component of the liner system installation conforms with the following minimum requirements:
 - a. The soil component of the liner system must be placed on a slope of no less than two percent to promote positive drainage across the liner surface and at a maximum slope not greater than thirty-three percent (33%) to minimize erosion and facilitate construction.
 - b. Compaction must be performed by properly controlling the moisture content, lift thickness, and other necessary details to obtain satisfactory results. The maximum final compacted thickness of each lift of soil material must be six inches (6"). When placing the first lift of the soil component of the liner system, the thickness may be increased to ensure adequate compaction and attain the desired permeability depending upon the type and size of compaction equipment used and whether or not the liner and subgrade are of dissimilar materials. Any succeeding lifts of the soil component of

the lining system may be reduced in thickness, depending upon the compaction equipment used.

- c. The moisture content of the soil component of the liner system must be maintained within the range identified in accordance with § 2.2.6(C) of this Part before and during compaction of the soil lift to ensure that the remolded lift attains a maximum in-situ permeability as required. The density after compaction must be within the range identified in accordance with § 2.2.6(C) of this Part to ensure that the remolded lift attains a maximum in-situ permeability, as required.
3. Certification Requirements: The project engineer must include in the construction certification report a discussion of all quality assurance and quality control testing required in § 2.2.6(A)(3) of this Part. The testing procedures and protocols must be submitted in accordance with § 2.1.6 of this Part and approved by the Department. The results of all testing must be included in the construction certification report including documentation of any failed test results, descriptions of the procedures used to correct the improperly installed material, and statements of all retesting performed in accordance with the following requirements:
 - a. The project engineer must certify the quality control testing of any soil liner materials to ensure that the specified material meets the permeability requirements of § 2.2.6(A) of this Part and the approved engineering plans, reports, and specifications. Before and during construction of the soil component of the liner system, the following information must be approved by the project engineer: one (1) analysis of soil particle size for every two thousand five hundred (2,500) cubic yards of soil liner materials placed; one (1) Atterberg limits analysis of plastic and liquid limit and plasticity index for every one thousand five hundred (1,500) cubic yards of soil liner material placed; one (1) laboratory permeability test using a triaxial cell with back pressure for every five thousand (5,000) cubic yards of material placed; one (1) moisture content test for every one thousand (1,000) cubic yards of material placed; and a minimum of one (1) comparison of the moisture-density-permeability relation for every five thousand (5,000) cubic yards of material placed, and one (1) comparison each time soil material changes are noted.
 - b. Quality assurance testing included in this Rule must be compared to and evaluated against the quality control testing of § 2.2.6(C)(1) of this Part, where applicable. Quality assurance testing must

include: at least five (5) density tests must be performed per acre per lift of soil material placed; a minimum of five (5) moisture content tests per acre per lift of soil material placed; and one (1) Shelby tube sample for laboratory permeability testing must be taken per acre per lift. Any tests resulting in penetration of the soil liner must be repaired using bentonite or other means acceptable to the Department.

2.2.7 Geomembrane Liners

- A. Geomembrane liners are low permeability geosynthetics having a maximum coefficient of permeability of 1×10^{-12} centimeters per second, and are used to control fluid migration from landfills.
1. **Materials Required:** The geomembrane liner material must have a demonstrated hydraulic conductivity less than 1×10^{-12} centimeters per second, and chemical and physical resistance not adversely affected by waste placement or generated leachate. Documentation must be submitted to ensure chemical compatibility of the geomembrane liner material chosen or, in absence of the appropriate documentation, chemical compatibility testing must be performed using a test method acceptable to the Department.
 2. **Construction Requirements:** Geomembranes must be installed in accordance with the requirements of the approved engineering plans, reports and specifications, and manufacturer's recommendations. The project engineer must ensure that the geomembrane installation, at a minimum, must conform with the following:
 - a. The geomembrane must have a minimum thickness of forty-five (45) mils in the primary composite liner and thirty-six (36) mils in the secondary composite liner. Geomembranes consisting of high density polyethylene (HDPE) shall be at least eighty (80) mils thick in the primary composite liner and sixty (60) mils thick in the secondary composite liner.
 - b. All geosynthetic materials must be installed on a subgrade that has a minimum two percent (2%) slope to promote positive drainage.
 - c. Any geosynthetic materials installed on slopes greater than twenty-five percent (25%) must be designed to withstand the calculated tensile forces acting upon the geosynthetic materials. The design must consider the maximum friction angle of the geosynthetic with

regard to any soil-geosynthetic or geosynthetic-geosynthetic interface, and must ensure that overall slope stability is maintained.

- d. The surface of the supporting soil below which the geosynthetic material will be installed must be reasonably free of stones, organic matter, irregularities, protrusions, loose soil, and any abrupt changes in grade that could damage the geosynthetic. The supporting soil must conform to the requirements of § 2.2.5 of this Part.
 - e. The anchor trench must be excavated to the length and width prescribed on the approved design drawings.
 - f. Field seams should be oriented parallel to the line of maximum slope, i.e., oriented along, not across the slope. In corners and irregularly-shaped locations, the number of field seams should be minimized. No horizontal seam should be less than five feet (5') from the toe of slope toward the upslope direction of the landfill.
 - g. The materials must be seamed using an appropriate method acceptable to the Department. Seam testing must be in accordance with the requirements of § 2.2.7(C) of this Part.
 - h. The seam area must be free of moisture, dust, dirt, debris, and foreign material of any kind before seaming.
 - i. Field seaming is prohibited when ambient air temperatures, precipitation and wind conditions prevent construction of the liner seams in accordance with all quality assurance and quality control requirements.
 - j. The field crew foreman of the liner installer must have a documented minimum qualification of successful installation experience of at least fifty (50) acres of previous landfill or comparable geosynthetic systems on a minimum of five (5) different projects.
3. Certification Requirements: The project engineer must include in the construction certification report a discussion of the approved data resulting from the quality assurance and quality control testing required in § 2.2.7(A)(3) of this Part. The results of all testing must be included in the construction certification report including documentation of any failed test results, descriptions of the procedures used to correct the failed material, and statements of all retesting performed.

- a. The project engineer must certify the quality control testing of any geosynthetic materials ensuring that the material and workmanship meet the requirements of the approved engineering plans, reports, and specifications. Before installing any geosynthetic material, the following information must be available to the project engineer for approval:
 - (1) Origin and identification of the raw materials used to manufacture the geosynthetic material;
 - (2) Copies of quality control certificates issued by the producer of the raw materials used to manufacture the geosynthetic material; and
 - (3) Reports of tests conducted to verify the quality of raw materials used to manufacture the geosynthetics. Tests for specific gravity, melt flow index, and percent carbon black must be performed using a method acceptable to the Department.

- b. The project engineer must verify through appropriate documentation that the quality control testing of any geosynthetic rolls fabricated into blankets at the factory took place in accordance with the following requirements:
 - (1) The geomembrane was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, and foreign materials. Additionally, the geomembrane liner must be inspected for tears, punctures, and blisters. Any imperfections must be immediately repaired and re-inspected.
 - (2) Non-destructive seam testing was performed on all fabricated seams over their full length using a test method acceptable to the Department.
 - (3) Destructive seam testing was performed on a minimum of two (2) samples per blanket. The samples must be taken from extra material at the beginning or end of blanket seams such that the blanket is not damaged and the blanket geometry is not altered. The size of the sample taken must be large enough to perform the required testing. An independent laboratory acceptable to the Department must have performed the required testing on the samples taken. If

a sample fails a destructive test, the entire seam length must be reconstructed or repaired using a method acceptable to the Department and retested using non-destructive seam testing over their full length using a method acceptable to the Department.

- c. Quality assurance testing performed in the field under the supervision of the project engineer must assure conformity of the geosynthetic installation with the engineering plans, reports, and specifications submitted in accordance with the following requirements:
- (1) During the construction phase, the geosynthetic must be inspected for uniformity, damage, and imperfections. The liner must be inspected for tears, punctures, or blisters. Any imperfections must be immediately repaired and reinspected.
 - (2) All field seams must be non-destructively tested in accordance with the procedures listed in this clause using a test method acceptable to the Department. The project engineer must: Supervise all non-destructive testing; Record the location, date, test unit number, name of tester, and results of all testing; Inform the installer of any required repairs; and overlay all seams which cannot be non-destructively tested with the same geomembrane. The seaming and patching operation must be inspected by the project engineer for uniformity and completeness.
 - (3) Destructive testing must be performed on the geomembrane liner seam sections in accordance with the requirements listed in this Rule and using test methods acceptable to the Department.
 - (4) Seam samples for testing must be taken as follows: a minimum of one (1) test per every five hundred feet (500') of seam length unless a more frequent testing protocol is agreed upon by the installer and project engineer; additional test locations may be determined during seaming at the project engineer's discretion; all test locations must be appropriately documented.

- (5) The project engineer must approve the sample size to be taken. The sample size must be predetermined as being large enough to perform the required testing.
- (6) An independent laboratory acceptable to the Department must perform the required testing, which must include, at a minimum, testing for seam strength and peel adhesion using testing procedures acceptable to the Department.
- (7) If a sample fails destructive testing the project engineer must ensure that: the seam is reconstructed between the location of the sample which failed and the location of the next acceptable sample; or the welding path is retraced to an intermediate location at least ten feet (10') from the location of the sample which failed the test, and a second sample is taken for an additional field test. If this second test sample passes, the seam must be then reconstructed between the location of the second test and the original sampled location. If the second sample fails, this process must be repeated.
- (8) All acceptable seams must lie between two (2) locations where samples passed the test procedures found in § 2.2.7(C)(3)(c)((4)) of this Part, and include one (1) test location along the reconstructed seam.
- (9) Non-destructive testing of the geomembrane liner must be performed in accordance with § 2.2.7(C)(3)(b) of this Part.

2.2.8 Soil Drainage Layers

- A. All soil material used in the primary and secondary leachate collection and removal systems of the landfill must conform to the following requirements:
 1. **Materials Required:** Soil materials used to construct a drainage layer must be designed to ensure that the hydraulic leachate head on the primary liner system does not exceed one foot (1') at the expected flow capacity from the drainage area, except during storm events. The soil drainage layer must be free of any organic material and have less than five percent (5%) of the material by weight pass the No. 200 sieve. Soil material testing must be performed in accordance with § 2.2.8(~~G~~)(c) of this Part.
 2. **Construction Requirements:** The soil drainage layer must be constructed and graded in accordance with the requirements of the approved engineering plans, reports, and specifications along with the following requirements:

- a. The minimum thickness of the soil drainage layer in the primary leachate collection and removal system must be twenty-four inches (24") and provide adequate protection to all liner materials and piping placed within the primary leachate collection system, and have a minimum coefficient of permeability of 1×10^{-2} centimeters per second.
 - b. The minimum thickness of the secondary leachate collection and removal system layer must be twelve inches (12") and have a minimum coefficient of permeability of 1×10^{-1} centimeters per second.
 - c. The soil drainage layer must be designed and placed on a minimum slope of two percent (2%) to promote efficient positive drainage to the nearest leachate collection pipe and prevent ponding above the liner.
3. Certification Requirements: The project engineer must include in the construction certification report the results of an analysis of the approved data resulting from quality assurance and quality control testing required in § 2.2.8(A)(3) of this Part. The results of all testing must be included in the construction certification report including any failed test results, descriptions of the procedures used to correct the failed material, and any retesting performed.
- a. The project engineer must certify the quality control testing of any soil drainage materials, and ensure that the material meets the requirements of § 2.2.8(A)(1) of this Part and the approved engineering plans, reports, and specifications. A particle size analysis of the soil drainage layer material must be submitted to the project engineer for approval before installation of the soil drainage layer and during installation at a frequency of at least one (1) test for every one thousand five hundred (1,500) cubic yards of material placed.
 - b. Quality assurance testing performed by the project engineer must ensure that the material is placed in accordance with the requirements of the engineering plans, reports, and specifications.

2.2.9 Leachate Collection Pipes

- A. Leachate collection pipes that are located in any soil or geosynthetic drainage layer must be hydraulically designed to remove leachate from the landfill, provide

conveyance to an appropriately designed and sized storage or treatment facility, and must comply with the following:

- B. **Materials Required:** The leachate collection pipe must have a minimum diameter of four inches (4") and meet the following:
1. The physical and chemical properties must not be adversely affected by waste placement or leachate generated by the landfill. Documentation must be submitted which demonstrates the chemical compatibility of the leachate collection pipe material or, in absence of the appropriate documentation, chemical compatibility testing must be performed using a method acceptable to the Department.
 2. Piping must have adequate structural strength to support the maximum static and dynamic loads and stresses that will be imposed by the overlying material, including the drainage layer, liners, waste material, and any equipment used in constructing and operation of the landfill. Specifications for the proposed leachate collection pipe network must be submitted in the engineering report.
- C. **Construction Requirement:** Leachate collection pipes must be installed in accordance with the requirements of the approved engineering plans, reports, and specifications. The leachate collection pipe size, spacing and slope of at least one percent (1%) must be designed to ensure that the leachate head on the primary liner does not exceed one foot (1') at the expected flows from the drainage area, except during storm events.
- D. **Certification Requirements:** The project engineer must include in the construction certification report a discussion of all quality assurance and quality control testing to ensure that the material is placed in accordance with requirements of the approved engineering plans, reports, and specifications. The testing procedures and protocols must be acceptable to the Department and submitted in accordance with § 2.1.6 of this Part. The results of all testing must be included in the construction certification report, including documentation of any failed test results, a description of the procedures used to correct the failed material, and any retesting performed.

2.2.10 Geosynthetic Drainage Layers

- A. Any geosynthetic drainage layers used in the secondary leachate collection and removal system of a landfill must be designed and constructed to have an equivalent hydraulic transmissivity to that of a one foot (1') sand layer with a minimum coefficient of permeability of 1×10^{-1} centimeters per second, and must comply with the following:

1. **Materials Required:** The hydraulic conductivity, transmissivity, and chemical and physical resistance of the geosynthetic material must not be adversely affected by waste placement or leachate generated by the landfill. Documentation must be submitted which demonstrates the chemical compatibility of the geosynthetic drainage layer material and the waste to be deposited, or chemical compatibility testing must be performed using a method acceptable to the Department. Documentation must also be submitted to ensure effective liquid removal throughout the active life of the facility, and that the maximum compressive load of the materials to be placed above the geosynthetic drainage layer does not impede transmissivity during the post-closure period.
2. **Construction Requirements:** The project engineer must ensure that the geosynthetic drainage layers are installed in accordance with the requirements of the approved engineering plans, reports, and specifications, and conform with the following requirements:
 - a. The geosynthetic drainage layer must be designed and constructed to effectively remove leachate from the landfill's secondary leachate collection and removal system.
 - b. The geosynthetic drainage layer must be installed in accordance with the procedure set forth in §§ 2.2.7(B)(2) through (6) and 2.2.7(B)(10) of this Part.
3. **Certification Requirements:** The project engineer must include in the construction certification report a summary of all quality assurance and quality control testing required in § 2.2.10(A)(3) of this Part. The testing procedures and protocols must be acceptable to the Department and submitted in accordance with § 2.1.6 of this Part. The results of all testing must be included in the construction certification report, including documentation of any failed test results, a description of the procedures used to correct the failed material, and any testing performed.
 - a. The project engineer must certify the quality control testing according to the requirements of § 2.2.7(C)(1) of this Part for any geosynthetic drainage materials. The project engineer must also certify that a hydraulic transmissivity test was performed on the geosynthetic drainage material at the maximum design compressive load on the materials to be used in the geosynthetic drainage layers. The test method must consider the physical properties of all the materials above and below the geosynthetic drainage material being tested.

- b. Quality assurance testing as performed by the project engineer must adequately demonstrate that the material is placed in accordance with the requirements of the engineering plans, reports, and specifications.

2.2.11 Filter Layer Criteria

A. The filter layer must be designed to prevent the migration of the fine soil particles into a coarser grained material, and allow water or gases to freely enter a drainage medium (pipe or drainage blanket) without clogging.

- 1. For graded cohesionless soil filters – The granular soil material used as a filter must have not more than five percent (5%) by weight passing the No. 200 sieve and no soil particles larger than three inches (3") in any dimension.
- 2. Geosynthetic Filters: Geotextiles filter material must demonstrate that the hydraulic conductivity, and chemical and physical resistance, is not adversely affected by waste placement, any overlying material or leachate generated at the landfill. Geotextile filter openings must be sized in accordance with the following criteria which takes into consideration the soil found in layers located adjacent to the geotextile filter:

$$\left(\frac{O_{95} \text{ of the geotextile}}{d_{85} \text{ of this soil}} \right) < 2 \text{ and}$$

$$\left(\frac{O_{95} \text{ of the geotextile}}{d_{15} \text{ of this soil}} \right) > 2$$

- a. The d85 is the soil particle size at which eighty-five percent (85%) of the particles are finer, and the d15 is the soil particle size at which fifteen percent (15%) of the particles are finer. The O95 is the apparent opening size of the geotextile at which ninety-five percent (95%) of the soil particles will pass. An apparent opening size test acceptable to the Department must be performed to demonstrate compliance with this criteria.
- 3. Construction Requirements: Both the soil filters and geotextiles filters must be installed in accordance with the approved engineering plans, reports, and specifications.
- 4. Certification Requirements: The project engineer must include in the construction certification report the results of all the required quality

assurance and quality control testing performed. The testing procedures and protocols must be acceptable to the Department and submitted in accordance with § 2.1.6 of this Part.

2.2.12 Final Cover System

- A. The final cover must be designed to minimize infiltration of precipitation into the landfill after closure. It must operate with minimum maintenance and promote drainage from its surface while minimizing erosion. It must also be designed so that settling and subsidence are accommodated to minimize the potential for disruption of continuity and function of the final cover.
1. Bedding Layer Criteria: A bedding layer must be located directly below the barrier layer of the final cover system and above the compacted waste layer.
 - a. Materials required: The bedding layer for the final cover system must be free of organic material and consist of on-site soils or any select fill if approved by the Department. The bedding material must be free of particles greater than three inches (3") in any dimension.
 - b. Construction requirements: The bedding layer must be constructed and graded in accordance with the requirements of the approved engineering plans, reports, and specifications. The minimum thickness of the bedding layer must be six inches (6").
 - c. Certification requirements: The project engineer must include in the construction certification report the results of all the required quality assurance and quality control testing performed. The testing procedures and protocols must be acceptable to the Department, and submitted in accordance with § 2.1.6 of this Part.
 2. Low Permeability Covers:
 - a. Low permeability barrier soil covers: A low permeability barrier soil cover is a layer of low permeability soil constructed to minimize precipitation migration into the landfill.
 - (1) Materials required: A low permeability barrier soil cover must consist of materials having the same characteristics as those found in § 2.2.6(A)(2) of this Part.
 - (2) Construction requirements: Low permeability barrier soil covers must be constructed in accordance with the requirements of § 2.2.6(B) of this Part. The low permeability

barrier soil cover must be placed on a slope of no less than five percent (5%) to promote positive drainage and at a maximum slope of thirty-three percent (33%) to minimize erosion.

(3) Certification requirements: Certification for the installation of barrier soil covers must be conducted in accordance with the requirements in § 2.1.6 of this Part.

b. Geomembrane covers: A geomembrane may be used as an alternative to the low permeability barrier soil cover as a final cover and must be constructed to preclude precipitation migration into the landfill.

(1) Materials required: The geomembrane material used in a final cover system must have a maximum coefficient of permeability of 1×10^{-12} centimeters per second, chemical, and physical resistance to materials it may come in contact with, and accommodate the expected forces and stresses caused by settlement of waste.

(2) Construction requirements: Geomembrane covers must be constructed in accordance with the same requirements as those found in § 2.2.7 of this Part with the following exceptions: The geomembrane must have a minimum thickness of thirty-six (36) mils. Geomembrane consisting of high density polyethylene (HDPE) shall be at least sixty (60) mils thick. The geomembrane must be placed on a five percent (5%) minimum slope to promote gravity drainage and a thirty-three percent (33%) maximum slope to ensure stability of the capping system.

c. Certification requirements: Certification for the installation of a geomembrane cover must be conducted in accordance with the same conditions found in § 2.2.7(C) of this Part.

3. Drainage Layer Criteria: All soil material used in the drainage layer of the final cover system must conform to the following requirements.

a. Materials required: Soil materials used to construct the drainage layer must be free of any organic material and have less than five percent (5%) of the material by weight pass the No. 200 sieve. Soil material testing must be performed in accordance with § 2.2.8(C) of this Part.

- b. Construction requirements: The soil drainage layer must be constructed and graded in accordance with the requirements of the approved engineering plans, report and specifications, along with the following requirements:
 - (1) The minimum thickness must be twelve inches (12") and have a minimum coefficient of permeability of 1×10^{-3} centimeters per second.
 - (2) The soil drainage layer must have a final bottom slope of at least five percent (5%) to allow for settling and subsidence.
 - (3) To prevent clogging, the soil drainage layer must be overlain by a graded granular or synthetic fabric filter that meets the specifications of §§ 2.2.11(A) through (D) of this Part.
 - (4) The soil drainage layer must be designed so that discharge flows freely in the lateral direction to minimize head on and flow through the low permeability layer.
 - c. Certification requirements: The drainage soil layer must be certified in accordance with the same conditions found in §§ 2.2.8(C)(1) and (2) of this Part.
4. Vegetated Top Cover: A vegetated top cover must be designed and constructed to maintain vegetative growth over the landfill.
- a. Materials required: The vegetated layer must be suitable to maintain vegetative growth.
 - b. Construction requirements: The vegetated top cover must be constructed and graded in accordance with the following requirements:
 - (1) The vegetated top cover must be at least twelve inches (12") thick.
 - (2) It must support vegetation that will effectively minimize erosion without need for contingency application of fertilizers, irrigation, or other non-applied materials to ensure viability and persistence. (Fertilizers, water and other materials may be applied during the closure or post-closure period, if necessary, to establish vegetation or to repair damage).

- (3) The vegetated top cover must be planted with persistent species that will effectively minimize erosion, and that do not have a root system that will penetrate beyond the vegetative and drainage layer.
- (4) The final top slope must be, at a minimum, between three (3%) and five percent (5%) after allowing for settling and subsidence, and at a maximum slope of thirty-three percent (33%). For slopes exceeding five percent (5%), the maximum erosion rate should not exceed two (2) tons/acre per year using the USDA Universal Soil Loss Equation (USLE).
- (5) The vegetated top cover must have a surface drainage system capable of conducting run-off across the cap without forming erosion rifts and gullies.

2.2.13 Construction Certification Report

A construction certification report must be submitted to the Department within forty-five (45) days after the completion of landfill construction. This report must include, at a minimum, the information prepared in accordance with the application requirements of § 2.1.6 of this Part containing results of all quality assurance and quality control testing required in this section, including documentation of any failed test results, descriptions of procedures used to correct the improperly installed material, and statements of all retesting performed. In addition, the construction certification report must contain as-built drawings noting any deviation from the approved engineering plans and must also contain a comprehensive analysis including, but not limited to, daily reports from the project engineer and a series of color photographs of major project features. The Department will review the submitted material for approval within thirty (30) days after receipt.

2.2.14 Equivalent Design

The applicant may propose an equivalent design to the individual components of the primary composite liner required in § 2.2.3(D) of this Part by the submission in the application of documentation substantiating the alternative component's ability to perform in the same manner as the component specified in this section.

2.3 Solid Waste Landfill Operating Standards

2.3.1 General

Sanitary landfill facilities shall meet all regulations set forth in this rule in addition to the General Operating Standards in § 1.7 of this Subchapter and shall also comply with all applicable Federal Rules, Laws, Regulations or other Federal requirements.

2.3.2 Working Face

The width of the working face shall be kept as narrow as is consistent with the proper operation of trucks and equipment in order that the area of waste material exposed during the operating day is minimal. No working face shall exceed one hundred fifty feet (150') in width when measured across the operating surface of the fill. Except where separate areas are designated on the engineering design for specific wastes, no more than one (1) working face shall be in use at any one time.

2.3.3 Lift Height

No lift shall exceed twelve feet (12') in height unless otherwise specified on the approved engineering design for the site.

2.3.4 Cover Material

- A. Initial Cover: All top surfaces and faces of the working lift shall be covered with six inches (6") of cover material at least at the end of each working day, or at more frequent intervals if necessary, to control disease vectors, fires, odors, blowing litter and scavenging. The cover material shall be earthen material, except that alternate materials of a thickness other than six inches (6"), may be approved by the Director, if the SWLF owner or operator demonstrates that the alternate material and thickness control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment.
- B. Intermediate Cover: When an additional lift is not to commence within six (6) months, an additional six inch (6") layer of cover material shall be applied over the six inch (6") initial cover layer within one (1) week after the disposal of refuse to all top surfaces and faces.
- C. Final Cover:
 - 1. When no additional lift is to be added for one (1) year, a total thickness of twenty-four inches (24") of cover material shall be maintained on all surfaces and faces.

2. When the landfill operation is terminated in an area, the area must be closed in accordance with the approved closure plans and must meet the requirements of § 2.2.12 of this Part.
3. The landfill owner or operator must begin closure within thirty (30) days of the final receipt of waste or within one year of the most recent receipt of waste, if there is remaining landfill capacity and there is reasonable likelihood that the landfill will receive additional waste. A request by the landfill owner or operator for extension beyond the one (1) year deadline for beginning closure may be approved by the Director, if the owner or operator demonstrates that the landfill has capacity to receive additional waste and the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed landfill.
4. The landfill owners or operators must complete closure activities of each SWLF unit, in accordance with the closure plan, within one-hundred eighty (180) days of the beginning of closure of the unit. A request by the landfill owner or operator for an extension beyond the one hundred eighty (180) day deadline may be approved by the Director, if the owner or operator demonstrates that closure will, of necessity, take longer than one hundred eighty (180) days and the owner or operator has taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed SWLF unit.
5. Following closure of an SWLF unit, the owner or operator shall notify the Director that closure has been completed in accordance with the operating plan and that the notice of this closure has been placed in the landfill's operating record. This notice shall include a certification, signed by an independent registered professional engineer or approved by the Director, verifying that closure has been completed in accordance with the closure plan.
6. Following closure of an SWLF unit, the owner or operator shall record a notation on the deed to the landfill facility property, (or on some other instrument that is normally examined during title search) and notify the Director of this notation action, and that a copy of this notated document has been placed in the landfill's operating record. The notation on the instrument must in perpetuity notify any potential purchaser of the property that:
 - a. The land has been used as a landfill facility.

- b. The land's future use is restricted; any future use shall not disturb the integrity of the final cover, liner(s) or any other components of the containment system or the functioning of the monitoring systems, except if the proposed disturbance is approved by the Director and if the owner or operator demonstrates that such disturbance will not increase the potential threat to human health or the environment.
- D. **Cover Material Supply:** A four (4) day supply of cover material shall be stored upon the landfill property at all times. This supply should be calculated on the basis of one (1) part cover material to four (4) parts of compacted waste (1,000 lbs/yd³).
- E. **Maintenance of Cover Material:** All applications of cover material shall be maintained by the operator in conformance with the requirements of this section.
- F. **Permeability of Cover Material:** The Director may specify the permeability of cover material used on a site specific basis. The Director may also require the use of an impermeable cover to mitigate water pollution or for other purposes described in these Rules.
- G. **Vegetation:** The operator shall plant and maintain vegetative growth on all completed areas.

2.3.5 Water Pollution

- A. **General**
 - 1. No sanitary landfill shall be operated so as to cause or to be likely to cause pollution of the ground waters or surface waters of the State at or beyond the boundary of the licensed area of the sanitary landfill.
 - 2. For purposes of these rules, groundwater monitoring well results taken pursuant to §§ 2.1.8 and 2.3.11 of this Part shall be deemed to be indicative of results of ground water beyond the property line of the sanitary landfill, in the absence of actual groundwater results at or beyond such property line.
 - 3. In determining whether said operation of a sanitary landfill is causing or is likely to cause pollution of the ground waters or the surface waters of the State, the Director may consider the following factors:
 - a. Groundwater monitoring results from the licensed area of the sanitary landfill show significant statistical increases in excess of

any one or more of the parameters as delineated in § 2.3.26 of this Part.

- b. Groundwater monitoring results from the facility show detection of one or more of the parameters as delineated in § 2.3.27 of this Part.
 - c. Topography, hydrology and geology of the area encompassing the sanitary landfill indicates a likelihood of contamination of a surface water body or groundwater.
 - d. Groundwater leaving the licensed area is likely to impact private or public drinking wells down gradient from the facility.
 - e. Groundwater leaving the licensed area is likely to impact groundwater used for commercial or industrial processes down gradient from the facility.
 - f. Facility violates a groundwater standard.
 - g. An actual or potential discharge into any surface water.
4. In the event that the Director finds that the operation of a sanitary landfill is causing or is likely to cause pollution of the groundwaters or the surface waters of the State, the Director may evaluate the operation of said sanitary landfill and require such measures as are necessary to abate, eliminate or avoid such pollution, including, but not limited to, the following:
- a. Groundwater removal and treatment
 - b. Contaminated groundwater encapsulation
 - c. Alternate sources of drinking water to impacted individuals
 - d. The limiting or exclusion of surface water percolation into refuse filled areas
 - e. Identification and closure of a particular cell or portion of the facility that is causing the pollution
 - f. Closure of the facility

B. Surface Water

1. No new sanitary landfill shall be conducted within the watershed of any surface public water supply. Furthermore, no refuse shall be deposited within two hundred feet (200') of any surface water or within one thousand two hundred feet (1,200') on any river per R.I. Gen. Laws § 23-18.9-9.1. Other landfill siting prohibitions, relative to surface water shall also apply, per R.I. Gen. Laws § 23-18.9-9.1.
2. New sanitary landfills shall not be located on drainage areas of surface public water supplies.

C. Groundwater

1. No sanitary landfill shall be constructed where solid waste may be in direct contact with groundwaters of the State. A minimum of five feet (5') of soil is required between the highest water table level and the lowest level of the liner system. At the Director's discretion, a greater separation may be required.
2. Sanitary landfills shall not be located within four hundred feet (400') of an existing public water supply well. At the Director's discretion, a greater separation may be required.
3. Other landfill siting prohibitions, relative to groundwater issues shall also apply, per R.I. Gen. Laws § 23-18.9-9.1 and [§150-05-3.8 of this Title](#).

D. Groundwater Reservoirs and Recharge Areas

1. As provided in R.I. Gen. Laws § 23-18.9-9.1, no person shall dispose of solid waste on or in the ground overlying groundwater reservoirs or groundwater recharge areas, provided that such groundwater reservoirs or groundwater recharge areas have been designated on the basis of hydrogeologic data as an existing or planned public drinking water source by the municipality in which such reservoir or recharge area is located, and that such municipality has enacted a municipal ordinance relating to groundwater reservoirs or groundwater recharge areas.
2. Where an existing solid waste management landfill overlies such groundwater reservoir or groundwater recharge area designated by the municipality in accordance with § 2.3.5(D)(1) of this Part, the Director is authorized to order cessation of solid waste disposal operations and closure of said landfill under the following conditions:
 - a. The municipality has, after notice and public hearing and resolution to the Director, requested the Director to determine whether the continued operation of any Solid Waste Management Facility-

Landfill on or over any such reservoir or recharge area presents a hazard to the public drinking water source.

- b. The Director, after the investigation, notice and hearing to said landfill, determines that such existing Solid Waste Management Facility-Landfill does present a hazard to the public drinking water source.

2.3.6 Waste Handling

- A. Unloading of Waste: The unloading of solid waste shall be controlled and restricted to an area such that the material can easily be incorporated into the working face.
- B. Spreading and Compacting of Waste: Solid waste shall be spread in layers of approximately two feet (2') in depth and compacted with a minimum of four (4) passes of the compaction equipment.
- C. Litter: Windblown refuse shall be eliminated or controlled by using fences or other means. The sanitary landfill shall be kept free of windblown refuse at all times.
- D. Handling of Special Waste
 1. Bulky waste: Bulky waste shall be disposed of in accordance with the requirements of § [1.7\(E\)](#) of this Subchapter, at the toe of the working face and incorporated into the working cell, or stored in a separate area of the landfill approved by the Department for the purpose of salvaging these items. Any salvaged material must be stored in closed-top containers for a period approved by the Department.
 2. Construction waste and demolition waste: All construction waste and demolition waste shall be disposed of by covering along with daily refuse.
 3. Brush: Any brush accepted at a sanitary landfill must be stored at a minimum distance of two hundred feet (200') from the working face, or buried. All brush not buried must be chipped within one (1) week after arrival. Chipped brush may be stored indefinitely in this area.
 4. Non-hazardous liquid waste
 - a. Non-hazardous liquid waste shall be disposed of in a sanitary landfill only if special provisions are made for such disposal and are approved by the Department.

- b. Any non-hazardous liquid waste accepted for disposal shall be covered immediately after it is dumped at any sanitary landfill. No uncovered pools of these materials will be allowed at any time.
 - c. Bulk or non-containerized liquid waste cannot be landfilled unless:
 - (1) The waste is household waste other than septic waste or
 - (2) The waste is leachate or gas condensate (liquid from gas recover processes) derived from the SWLF unit and the SWLF unit, regardless of whether it is a new or existing SWLF unit or a lateral expansion of an SWLF unit, is designed with at least a double composite liner and leachate collection system. (These design details must be demonstrated in the landfill's operating record and the Director must be notified that these design details have been placed in the operating record).
 - d. Containerized liquid waste may not be placed in solid waste landfills, unless:
 - (1) The waste is household waste or
 - (2) The container is small and similar in size to that normally used for containing household waste.
5. Oil spill cleanup debris: Oil spill cleanup debris shall be disposed of only in a sanitary landfill constructed with a liner system per § 2.2 of this Part, or in an alternate facility approved by the Department.
6. Asbestos disposal
- a. Friable asbestos material shall not be disposed in a sanitary landfill unless the operator of the sanitary landfill has received specific approval from the Director to accept such material. This approval shall be granted based on, but not necessarily limited to, the amount of refuse accepted at the landfill, the equipment and personnel available, and the need for asbestos disposal facilities. This approval may be revoked by the Director at any time.
 - b. Friable asbestos material must be treated with water and labeled or processed into a non-friable form according to 40 C.F.R. § 61.150(a)(1) (2017), incorporated in § [1.3\(A\)](#) of this Subchapter.

- c. Asbestos material accepted at a sanitary landfill shall be placed at the bottom of the working face and immediately covered with either a minimum of two feet (2') of refuse or a minimum of six inches (6") of clean fill.
 - d. There shall be no visible emissions of asbestos material from any sanitary landfill which has accepted asbestos material.
 - e. Landfilling of friable asbestos material must comply with all applicable requirements of the National Emission Standards for Hazardous Air Pollutants Asbestos Regulations, 40 C.F.R. § 61, Subpart M (2017), incorporated in § [1.3\(A\)](#) of this Subchapter.
- E. SWLF unit owners or operators must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes and polychlorinated biphenyls (PCB) wastes. This program must, include, at minimum:
 - 1. Random inspections of incoming loads, unless the SWLF 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 of incoming loads
 - 3. Training of facility personnel to recognize regulated hazardous wastes and PCB wastes
 - 4. Notification of the Director if a regulated hazardous waste or PCB waste is discovered at the facility

2.3.7 Equipment Requirements

- A. General Requirements: All equipment used shall meet the performance specifications necessary for operating the sanitary landfill in accordance with the operating requirements contained in these Regulations.
- B. Required Equipment for Refuse and Cover Material Handling: There shall be sufficient types and quantities of equipment for digging, spreading, compacting, or covering waste or applying cover material to adequately meet the requirements of these regulations.
- C. Each piece of equipment must have a minimum basic weight without blade, bucket or other accessories of seventeen thousand (17,000) pounds.

- D. Equipment breakdown: Arrangements in writing for emergency equipment shall be made to allow for operating equipment breakdown. Emergency equipment shall be on the site with twenty-four (24) hours of operating equipment breakdown.

2.3.8 Gas Control

- A. The concentration of methane gas generated by the facility does not exceed twenty-five percent (25%) of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components).
- B. The concentration of methane gas does not exceed twenty-five percent (25%) of the lower explosive limit for methane at the facility property boundary.
- C. Sanitary landfills must implement a routine methane monitoring program to ensure compliance with §§ 2.3.8(A) and (B) of this Part.
 - 1. The type and frequency of monitoring must be determined based on the following factors:
 - a. Soil conditions
 - b. The hydrogeologic conditions surrounding the facility
 - c. The hydraulic conditions surrounding the facility
 - d. The location of facility structures and property boundaries.
 - 2. The minimum frequency of monitoring shall be quarterly.
- D. If methane gas levels exceeding the limits specified in §§ 2.3.8(A) and (B) of this Part are detected, the facility must:
 - 1. Immediately take all necessary steps to ensure protection of human health and notify the Department.
 - 2. Within seven (7) days of detection, place in the operating plan the methane gas levels detected and a description of the steps taken to protect human health.
 - 3. Within sixty (60) days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating plan, and notify the Department that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.

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

2.3.9 Fire Protection

- A. A facility shall not pose a hazard to the safety of persons or property from fires. In addition, the following requirements must be met:
 - 1B. All sanitary landfills shall arrange in writing for a nearby fire department to provide emergency service whenever called.
 - 2G. There shall be within one thousand feet (1,000') of the working face, either an adequate supply of water under pressure or a stockpile of the equivalent of four (4) days cover material for use exclusively in fighting fires.
 - D3. All landfill equipment (dozer, front end loaders and landfill compactors) shall be supplied with fire extinguishers.

2.3.10 Surface Drainage

The operator shall make provisions to have the sanitary landfill site, including the fill surface, graded and provided with a drainage system to minimize surface water runoff onto and into the fill, to prevent erosion of the fill, to drain off rain water falling on the fill, and to prevent the collection of standing water. The surface drainage system must be designed to control the water volume from a twenty-four (24) hour, twenty-five (25) year storm. Measures must be taken to prevent sedimentation associated with surface drainage from borrow areas and other disturbed areas. The minimum top surface slopes shall be three percent (3%). The maximum side slopes shall be no steeper than 3/1.

2.3.11 Monitoring Wells

- A. Sanitary landfills shall install monitoring wells at locations approved by the Department based on the hydrogeological report and water quality monitoring plan submitted per § 2.1.8 of this Part for the purpose of monitoring groundwater conditions. The operator shall arrange for the sampling and analysis for constituents designated by the Director on a schedule as determined by the Director. The operator shall notify the Director at least forty-eight (48) hours prior to sampling groundwater monitoring wells. The Director may, at his discretion, sample such groundwater monitoring wells pursuant to § 2.1.8 of this Part.

- B. New sanitary landfills shall conduct preliminary sampling and analysis for constituents designated by the Director prior to commencing operation of the facility, and pursuant to § 2.1.8 of this Part.

2.3.12 Distance to Property Lines

No refuse shall be disposed of within six hundred feet (600') of any property line. No excavations shall occur within six hundred feet (600') of any property line. The Director may, at his discretion, require a greater distance in order to meet the operational requirements of §§ 2.2 and 2.3 of this Part. Existing sanitary landfills may continue to operate within the two-hundred foot (200') buffer rule only in areas approved in their existing license and operating plan.

2.3.13 Limited Access

Dumping of any solid waste at a sanitary landfill after one-half (1/2) hour past sunset will not be allowed.

2.3.14 Flood Plain, Wetlands, and Coastal Restrictions

- A. No refuse shall be deposited in the one hundred (100) year flood plain.
- B. New SWLF units and lateral expansions of SWLF units shall not be located in wetlands (as defined in 40 C.F.R. § 232.2(r) (2017), incorporated in § [1.3\(A\)](#) of this Subchapter and in [Subchapter 15 Part 1 of this Chapter](#), Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act), or constructed in a manner that will alter wetlands, except if a permit to alter a freshwater wetlands is received from the Office of Water Resources and, when required, by the Coastal Resources Management Council:
 - 1. Where applicable under the Clean Water Act, 33 U.S.C. § 1344, or applicable State wetlands laws, the presumption that practicable alternative to the proposed landfill is available which does not involve wetlands is clearly rebutted;
 - 2. The construction and operation of the SWLF unit will not:
 - a. Cause or contribute to violations of any applicable State water quality standard.
 - b. Violate any applicable toxic effluent standard or prohibition under the Clean Water Act, 33 U.S.C. § 1317,
 - c. Jeopardize the continued existence of endangered or threatened species or result in destruction or adverse modification of a critical

habitat, protected under 16 U.S.C. §1531 et seq. (1973) ~~“The Endangered Species Act” of 1973~~, and

- d. Violate any requirement under 16 USC § 1431 et seq. and 33 USC §1401 et seq. (1988) ~~the~~ Marine Protection, Research, and Sanctuaries Act ~~of 1972~~ for the protection of a marine sanctuary.
3. The SWLF unit will not cause or contribute to significant degradation of wetlands. The owner or operator must demonstrate the integrity of the SWLF unit and its ability to protect ecological resources by addressing the following factors:
 - a. Erosion, stability, and migration potential of native wetland soils, muds, and deposits used to support the SWLF unit,
 - b. Erosion, stability, and migration potential of dredged and fill materials used to support the SWLF unit,
 - c. The volume and chemical nature of the waste managed in the SWLF unit,
 - d. Impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste or operation of the SWLF unit,
 - e. The potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment, and
 - f. Any additional factors as necessary, to demonstrate that ecological resources in the wetlands are sufficiently protected.
 4. To the extent required under 33 U.S.C. § 1344, or applicable State wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by § 2.3.14(B)(1) of this Part, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g. restoration of existing degraded wetlands or creation of man-made wetlands), and
 5. Sufficient information is available to make a reasonable determination with respect to these demonstrations.

- C. Coastal prohibitions, per R.I. Gen. Laws § 23-18.9-9.1, shall also apply to the siting of sanitary landfills.

2.3.15 Deed Restrictions/Conservation Easement

- A. Prior to any waste disposal, the operator shall insure that notations are properly made upon the deed for the disposal site land. The notation shall be amended as frequently as necessary to ensure that all sites are properly documented. No license renewal shall be granted until the operator demonstrates that such notation has been made and/or updated. Such notation shall include:
 1. Type of waste disposed of at the site;
 2. The exact location of such waste shown on a map with a legend;
 3. Notice that excavation of previously filled areas shall not be conducted without prior written approval from the Department.

2.3.16 Height Monitoring

An annual survey of the landfill height shall be taken by a properly licensed Rhode Island land surveyor or professional engineer. This survey shall be submitted to the Department within thirty (30) days after the survey. Once the facility is within eighty percent (80%) of its proposed final site elevation, the Department may require more frequent surveys as necessary to ensure such elevation is not exceeded.

2.3.17 Excavation

No person shall excavate previously filled areas without prior written approval from the Director.

2.3.18 Resource Recovery and Solid Waste Incinerator Ash Residue Monofills

- A. Landfills used solely for the disposal of solid waste resulting from Resource Recovery and Incineration operations are subject to all requirements of these Regulations.
- B. Each application for a license to construct and operate an ash residue landfill must meet all requirements set forth in § [1.6](#) of this Subchapter and § 2.1 of this Part.
- C. All ash residue monofills are subject to all operating and design regulations set forth in § [1.7](#) of this Subchapter, §§ 2.2 and 2.3 of this Part with the exception of the gas venting requirements specified in § 2.3.8 of this Part.

2.3.19 Airport Safety

Owners or operators of new SWLF units, existing SWLF units and their lateral expansions that are located within ten thousand feet (10,000') (three thousand forty-eight (3,048) meters) of any airport runway end used by turbojet aircraft or within five thousand feet (5,000') (one thousand five hundred twenty-four (1524) meters) of any airport runway end used by only piston type aircraft shall demonstrate that their landfills are designed and operated so that the landfills do not pose a bird hazard to aircraft. Each owner or operator shall document demonstration of this design and operation in its operating record and shall notify the Director of this documenting action.

2.3.20 Fault Areas

- A. New SWLF units and lateral expansions of SWLF units shall not be located within two hundred feet (200') (sixty (60) meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates to the Director that an alternative setback distance of less than two hundred feet (200') (sixty (60) meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment where:
1. "Fault" means a fracture or a zone of fractures in any material along which strata on one (1) side have been displaced with respect to that on the other side.
 2. "Displacement" means the relative movement of any two (2) sides of a fault measured in any direction.
 3. "Holocene" means the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch to the present.

2.3.21 Seismic Impact Zones

- A. New SWLF units and lateral expansions of SWLF units shall not be located in seismic impact zones, unless the owner or operator demonstrates to the Director that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator shall place this demonstration in the operating record and notify the Director that it has been placed in the operating record, and where:
1. "Seismic impact zone" means an area with a ten percent (10%) or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull will exceed one tenth (0.10) g in two hundred fifty (250) years.

2. "Maximum horizontal acceleration in lithified earth material" means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a ninety percent (90%) or greater probability that this acceleration will not be exceeded in two hundred fifty (250) years or it means the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.
3. "Lithified earth material" means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.

2.3.22 Unstable Areas

- A. Owners or operators of new SWLF units, existing SWLF units, and lateral expansions of SWLF units located in unstable areas must demonstrate that engineering measures have been incorporated into the SWLF unit's design to ensure that the integrity of the structural components of the SWLF Unit will not be disrupted. The owner or operator must place this demonstration in the operating record and notify the Director that it has been placed in the operating record.
 1. "Unstable area" means a location that is susceptible to natural or human induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and Karst Terranes.
 2. "Structural components" means liners, leachate collection systems, final covers, run-on/run-off systems and any other component used in the construction and operation of the SWLF that is necessary for protection of human health and the environment.
 3. "Poor foundation conditions" means those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of an SWLF unit.
 4. "Areas susceptible to mass movement" means those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where the movement of earth material at, beneath, or adjacent to the SWLF unit, because of natural or man-induced events, results in the downslope transport of soil and rock material by means of

gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and floods, solifluction, block sliding, and rock fall.

5. "Karst terranes" means areas where karst topography, with its characteristic surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terranes include but are not limited to, sinkholes, sinking streams, caves, large springs, and blind valleys.

B. The owner or operator shall consider the following factors, at a minimum, when determining whether an area is unstable:

1. On-site or local soil conditions that may result in significant differential settling;
2. On-site or local geologic or geomorphologic features; and
3. On-site or local human-made features or events (both surface and subsurface).

2.3.23 Closure of Existing Solid Waste Landfill Units in Unstable Areas

A. Any existing SWLF unit that is sited in an unstable area shall close or may continue to operate based on the following criteria:

1. It shall be allowed to continue to operate, provided it can demonstrate to the Director that engineering measures have been incorporated in its design to ensure the structural components of the landfill will not be disrupted.
2. ~~If it cannot demonstrate to the Director that engineering measures have been incorporated in its design to ensure the structural components of the landfill will not be disrupted, then:~~
 - a. ~~It shall close by 9 October 1998, provided it can demonstrate to the Director, that there is no available alternative disposal capacity and that there is no immediate threat to human health and the environment; otherwise,~~
 - b. ~~It shall close by 9 October 1996.~~

2.3.24 Post-Closure Care

Post-closure care shall be carried out in accordance with the requirements of §§ 2.1.9(B) and (C) of this Part. Following completion of the post-closure period, the landfill owner or operator shall submit to the Department a copy of a certification signed by an independent registered professional engineer or approved by the Director, verifying that post-closure care has been completed in accordance with the post-closure plan and that this certification has been placed in the landfill's operating record.

2.3.25 Record Keeping Requirements for SWLF Units

- A. The landfill owner or operator must record and retain near the facility in an operating record or in an alternate location approved by the Director, the following information as it becomes available:
1. Any location restriction documentation required, per § 2.3 of this Part and its subsections.
 2. Waste inspections records, training procedures, and notification procedures required in § 2.3.6(E) of this Part.
 3. Gas monitoring results and any remediation plans required by § 2.3.8 of this Part.
 4. Any SWLF unit design documentation for placement of leachate or gas condensate in the landfill, per § 2.3.6(D)(4) of this Part.
 5. Any groundwater demonstration, certification, finding, monitoring, testing, or analytical data required by § 2.1.8 of this Part and its subsections.
 6. Closure and post-closure care plans and any monitoring, testing or analytical data required by §§ 2.1.9 and 2.3.4(C) of this Part.
 7. Any cost estimate and financial assurance documentation required by §§ 2.1.9(E), (F), and 2.3.26(D) of this Part.
- B. The landfill owner or operator must notify the Director when the documents from § 2.3.25(A) of this Part have been placed or added to the landfill's operating record, and all information contained in the operating record must be furnished upon request to the Director or be made available at all reasonable times for inspection by the Director.
- C. The landfill owner or operator shall retain all records required in § 2.3.25 of this Part for the life of the facility, to include the closure and post-closure care periods.

D. Per R.I. Gen. Laws § 23-18.9-12, any private landfill operator shall keep a written record of the vehicles which unload cargo at the landfill. The record shall contain the date and time of unloading of the cargo, a description of the cargo, as well as the vehicle registration. The landfill operator shall, upon request, make the written record available for inspection by the Department.

2.3.26 Constituents for Detection Monitoring

Common name	CAS RN Chemical Abstract Service registry number
Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals).	Where "(Total)" is entered, all species in the ground water that contain this element are included.
Inorganic Constituents:	
(1) Antimony	(Total)
(2) Arsenic	(Total)
(3) Barium	(Total)
(4) Beryllium	(Total)
(5) Cadmium	(Total)
(6) Chromium	(Total)

(7) Cobalt	(Total)
(8) Copper	(Total)
(9) Lead	(Total)
(10) Nickel	(Total)
(11) Selenium	(Total)
(12) Silver	(Total)
(13) Thallium	(Total)
(14) Vanadium	(Total)
(15) Zinc	(Total)
Organic Constituents:	
(16) Acetone	67-64-1
(17) Acrylonitrile	107-13-1
(18) Benzene	71-43-2
(19) Bromochloromethane	74-97-5
(20) Bromodichloromethane	75-27-4

(21) Bromoform; Tribromomethane	75-25-2
(22) Carbon disulfide	75-15-0
(23) Carbon tetrachloride	56-23-5
(24) Chlorobenzene	108-90-7
(25) Chloroethane; Ethyl chloride	75-00-3
(26) Chloroform; Trichloromethane	67-66-3
(27) Dibromochloromethane; Chlorodibromomethane	124-48-1
(28) 1,2-Dibromo-3-chloropropane; DBCP	96-12-8
(29) 1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4
(30) o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
(31) p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
(32) trans-1, 4-Dichloro-2-butene	110-57-6
(33) 1,1-Dichlorethane; Ethylidene chloride	75-34-3
(34) 1,2-Dichlorethane; Ethylene dichloride	107-06-2
(35) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	75-35-4

(36) cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2
(37) trans-1, 2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5
(38) 1,2-Dichloropropane; Propylene dichloride	78-87-5
(39) cis-1,3-Dichloropropene	10061-01-5
(40) trans-1,3-Dichloropropene	10061-02-6
(41) Ethylbenzene	100-41-4
(42) 2-Hexanone; Methyl butyl ketone	591-78-6
(43) Methyl bromide; Bromomethane	74-83-9
(44) Methyl chloride; Chloromethane	74-87-3
(45) Methylene bromide; Dibromomethane	74-95-3
(46) Methylene chloride; Dichloromethane	75-09-2
(47) Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
(48) Methyl iodide; Iodomethane	74-88-4
(49) 4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
(50) Styrene	100-42-5

(51) 1,1,1,2-Tetrachloroethane	630-20-6
(52) 1,1,2,2-Tetrachloroethane	79-34-5
(53) Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
(54) Toluene	108-88-3
(55) 1,1,1-Trichloroethane; Methylchloroform	71-55-6
(56) 1,1,2-Trichloroethane	79-00-5
(57) Trichloroethylene; Trichloroethene	79-01-6
(58) Trichlorofluoromethane; CFC-11	75-69-4
(59) 1,2,3-Trichloropropane	96-18-4
(60) Vinyl acetate	108-05-4
(61) Vinyl chloride	75-01-4
(62) Xylenes	1330-20-7

2.3:27 List of Hazardous Inorganic and Organic Constituents

Common name (those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals)	CAS RN Chemical Abstracts Service Registry	Chemical abstracts service index name (those used in the 9th Cumulative Index)
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	Number	
Where "(Total)" is entered for CAS RN, all species in the ground water that contain this element are included.		
Acenaphthene	83-32-9	Acenaphthylene, 1,2-dihydro-
Acenaphthylene	208-96-8	Acenaphthylene
Acetone	67-64-1	2-Propanone
Acetonitrile; Methyl cyanide	75-05-8	Acetonitrile
Acetophenone	98-86-2	Ethanone, 1-phenyl-
2-Acetylaminofluorene; 2-AAF	53-96-3	Acetamide, N-9H-fluoren-2-yl-
Acrolein	107-02-8	2-Propenal
Acrylonitrile	107-13-1	2-Propenenitrile
Aldrin	309-00-2	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1,4,4a,5,8,8a)-
Allyl chloride	107-05-1	1-Propene, 3-chloro-
4-Aminobiphenyl	92-67-1	[1,1'-Biphenyl]-4-amine
Anthracene	120-12-7	Anthracene

Antimony	(Total)	Antimony
Arsenic	(Total)	Arsenic
Barium	(Total)	Barium
Benzene	71-43-2	Benzene
Benzo[a]anthracene; Benzanthracene	56-55-3	Benz[a]anthracene
Benzo[b]fluoranthene	205-99-2	Benz[e]acephenanthrylene
Benzo[k]fluoranthene	207-08-9	Benzo[k]fluoranthene
Benzo[ghi]perylene	191-24-2	Benzo[ghi]perylene
Benzo[a]pyrene	50-32-8	Benzo[a]pyrene
Benzyl alcohol	100-51-6	Benzenemethanol
Beryllium	(Total)	Beryllium
alpha-BHC	319-84-6	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1 α ,2 α ,3 β ,4 α ,5 β ,6 β)-
beta-BHC	319-85-7	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1 α ,2 β ,3 α ,4 β ,5 α ,6 β)-
delta-BHC	319-86-8	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1 α ,2 α ,3 α ,4 β ,5 α ,6 β)-

gamma-BHC; Lindane	58-89-9	Cyclohexane, 1,2,3,4,5,6- hexachloro-, (1 α ,2 α , 3 β , 4 α ,5 α ,6 β)-
Bis(2-chloroethoxy)methane	111-91-1	Ethane, 1,1'-[methylenebis (oxy)]bis [2-chloro-
Bis(2-chloroethyl)ether; Dichloroethyl ether	111-44-4	Ethane, 1,1'-(oxy)bis [2-chloro-
Bis(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodiisopropyl ether; DCIP This substance is often called bis(2-chloroisopropyl) ether, the name Chemical Abstracts Service applies to its noncommercial isomer, propane, 2,2"-oxybis[2-chloro-(CAS RN 39638-32-9).	108-60-1	Propane, 2,2'-(oxy)bis[1-chloro-
Bis(2-ethylhexyl) phthalate	117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl)ester
Bromochloromethane; Chlorobromomethane	74-97-5	Methane, bromochloro-
Bromodichloromethane; Dibromochloromethane	75-27-4	Methane, bromodichloro-
Bromoform; Tribromomethane	75-25-2	Methane, tribromo-
4-Bromophenyl phenyl ether	101-55-3	Benzene, 1-bromo-4-phenoxy-
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester

Cadmium	(Total)	Cadmium
Carbon disulfide	75-15-0	Carbon disulfide
Carbon tetrachloride	56-23-5	Methane, tetrachloro-
Chlordane This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 5566-34-7), and constituents of chlordane (CAS RN 57-74-9 and CAS RN 12789-03-6).	5103-71-9 see adjacent note	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
p-Chloroaniline	106-47-8	Benzenamine, 4-chloro-
Chlorobenzene	108-90-7	Benzene, chloro-
Chlorobenzilate	510-15-6	Benzeneacetic acid, 4-chloro--(4-chlorophenyl)- -hydroxy-, ethyl ester-
p-Chloro-m-cresol; 4-Chloro-3-methylphenol	59-50-7	Phenol, 4-chloro-3-methyl-
Chloroethane; Ethyl chloride	75-00-3	Ethane, chloro-
Chloroform; Trichloromethane	67-66-3	Methane, trichloro-
2-Chloronaphthalene	91-58-7	Naphthalene, 2-chloro-
2-Chlorophenol	95-57-8	Phenol, 2-chloro-

4-Chlorophenyl phenyl ether	7005-72-3	Benzene, 1-chloro-4-phenoxy-
Chloroprene	126-99-8	1,3-Butadiene, 2-chloro-
Chromium	(Total)	Chromium
Chrysene	218-01-9	Chrysene
Cobalt	(Total)	Cobalt
Copper	(Total)	Copper
m-Cresol; 3-Methylphenol	108-39-4	Phenol, 3-methyl-
o-Cresol; 2-Methylphenol	95-48-7	Phenol, 2-methyl-
p-Cresol; 4-Methylphenol	106-44-5	Phenol, 4-methyl-
Cyanide	57-12-5	Cyanide
2,4-D; 2,4-Dichlorophenoxyacetic acid	94-75-7	Acetic acid, (2,4-dichlorophenoxy)-
4,4'-DDD	72-54-8	Benzene 1,1'-(2,2-dichloroethylidene) bis[4-chloro-
4,4'-DDE	72-55-9	Benzene, 1,1'-(dichloroethenylidene) bis[4-chloro-
4,4'-DDT	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene) bis[4-chloro-

Diallate	2303-16-4	Carbamothioic acid, bis(1-methylethyl)-, S- (2,3-dichloro-2-propenyl) ester.
Dibenz[a,h]anthracene	53-70-3	Dibenz[a,h]anthracene
Dibenzofuran	132-64-9	Dibenzofuran
Dibromochloromethane; Chlorodibromomethane	124-48-1	Methane, dibromochloro-
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	Propane, 1,2-dibromo-3-chloro-
1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4	Ethane, 1,2-dibromo-
Di-n-butyl phthalate	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester
o-Dichlorobenzene; 1,2- Dichlorobenzene	95-50-1	Benzene, 1,2-dichloro-
m-Dichlorobenzene; 1,3- Dichlorobenzene	541-73-1	Benzene, 1,3-dichloro-
p-Dichlorobenzene; 1,4- Dichlorobenzene	106-46-7	Benzene, 1,4-dichloro-
3,3'-Dichlorobenzidine	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'- dichloro-
trans-1,4-Dichloro-2-butene	110-57-6	2-Butene, 1,4-dichloro-, (E)-

Dichlorodifluoromethane; CFC 12	75-71-8	Methane, dichlorodifluoro-
1,1-Dichloroethane; Ethyldidene chloride	75-34-3	Ethane, 1,1-dichloro-
1,2-Dichloroethane; Ethylene dichloride	107-06-2	Ethane, 1,2-dichloro-
1,1-Dichloroethylene; 1,1-Dichloroethene;	75-35-4	Ethene, 1,1-dichloro-
Vinylidene chloride cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	Ethene, 1,2-dichloro-(Z)-
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5	Ethene, 1,2-dichloro-, (E)-
2,4-Dichlorophenol	120-83-2	Phenol, 2,4-dichloro-
2,6-Dichlorophenol	87-65-0	Phenol, 2,6-dichloro-
1,2-Dichloropropane	78-87-5	Propane, 1,2-dichloro-
1,3-Dichloropropane; Trimethylene dichloride	142-28-9	Propane, 1,3-dichloro-
2,2-Dichloropropane; Isopropylidene chloride	594-20-7	Propane, 2,2-dichloro-
1,1-Dichloropropene	563-58-6	1-Propene, 1,1-dichloro-
cis-1,3-Dichloropropene	10061-01-5	1-Propene, 1,3-dichloro-, (Z)-

trans-1,3-Dichloropropene	10061-02-6	1-Propene, 1,3-dichloro-, (E)-
Dieldrin	60-57-1	2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1a α ,2 β ,2a α ,3 β ,6 β ,6a α ,7 β ,7a α)-
Diethyl phthalate	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester-
Dimethoate	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
p-(Dimethylamino)azobenzene	60-11-7	Benzenamine, N,N-dimethyl-4-(phenylazo)-
7,12-Dimethylbenz[a]anthracene	57-97-6	Benz[a]anthracene, 7,12-dimethyl-
3,3'-Dimethylbenzidine	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
alpha, alpha-Dimethylphenethylamine	122-09-8	Benzeneethanamine, α,α -dimethyl-
2,4-Dimethylphenol; m-Xylenol	105-67-9	Phenol, 2,4-dimethyl-
Dimethyl phthalate	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester

m-Dinitrobenzene	99-65-0	Benzene, 1,3-dinitro-
4,6-Dinitro-o-cresol; 4,6-Dinitro-2-methylphenol	534-52-1	Phenol, 2-methyl-4,6-dinitro-
2,4-Dinitrophenol	51-28-5	Phenol, 2,4-dinitro-
2,4-Dinitrotoluene	121-14-2	Benzene, 1-methyl-2,4-dinitro-
2,6-Dinitrotoluene	606-20-2	Benzene, 2-methyl-1,3-dinitro-
Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
Di-n-octyl phthalate	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester
Diphenylamine	122-39-4	Benzenamine, N-phenyl-
Disulfoton	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
Endosulfan I	959-98-8	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide;
Endosulfan II	33213-65-9	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro- 1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3 α ,5 α ,6 β ,9 β ,9 α)-
Endosulfan sulfate	1031-07-8	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-

		hexahydro-, 3,3-dioxide
Endrin	72-20-8	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1 α , 2 β ,2a β , 3 α ,6 α ,6a β ,7 β ,7a α)-
Endrin aldehyde	7421-93-4	1,2,4-Methenocyclo-penta[cd]pentalene-5-carboxaldehyde,2,2a,3,3,4,7-hexachlorodecahydro-(1 α ,2 β ,2a β ,4 β ,4a β ,5 β ,6a β ,6b β ,7R*)-
Ethylbenzene	100-41-4	Benzene, ethyl-
Ethyl methacrylate	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester
Ethyl methanesulfonate	62-50-0	Methanesulfonic acid, ethyl ester
Famphur	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl]-O,O-dimethyl ester
Fluoranthene	206-44-0	Fluoranthene
Fluorene	86-73-7	9H-Fluorene
Heptachlor	76-44-8	4,7-Methano-1H-indene,1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
Heptachlor epoxide	1024-57-3	2,5-Methano-2H-indeno[1,2-b]oxirene,2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a,-hexahydro-, (1 α ,1b β ,2 α ,5 α ,5a β ,6 β ,6a α)

Hexachlorobenzene	118-74-1	Benzene, hexachloro-
Hexachlorobutadiene	87-68-3	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
Hexachlorocyclopentadiene	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
Hexachloroethane	67-72-1	Ethane, hexachloro-
Hexachloropropene	1888-71-7	1-Propene, 1,1,2,3,3,3-hexachloro-
2-Hexanone; Methyl butyl ketone	591-78-6	2-Hexanone
Indeno(1,2,3-cd)pyrene	193-39-5	Indeno[1,2,3-cd]pyrene
Isobutyl alcohol	78-83-1	1-Propanol, 2-methyl-
Isodrin	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1 α , 4 α , 4a β , 5 β , 8 β , 8a β)-
Isophorone	78-59-1	2-Cyclohexen-1-one, 3,5,5-trimethyl-
Isosafrole	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-
Kepone	143-50-0	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
Lead	(Total)	Lead

Mercury	(Total)	Mercury
Methacrylonitrile	126-98-7	2-Propenenitrile, 2-methyl-
Methapyrilene	91-80-5	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
Methoxychlor	72-43-5	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis [4-methoxy-
Methyl bromide; Bromomethane	74-83-9	Methane, bromo-
Methyl chloride; Chloromethane	74-87-3	Methane, chloro-
3-Methylcholanthrene	56-49-5	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
Methyl ethyl ketone; MEK; 2-Butanone	78-93-3	2-Butanone
Methyl iodide; Iodomethane	74-88-4	Methane, iodo-
Methyl methacrylate	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester
Methyl methanesulfonate	66-27-3	Methanesulfonic acid, methyl ester
2-Methylnaphthalene	91-57-6	Naphthalene, 2-methyl-
Methyl parathion; Parathion methyl	298-00-0	Phosphorothioic acid, O,O-dimethyl

4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1	2-Pentanone, 4-methyl-
Methylene bromide; Dibromomethane	74-95-3	Methane, dibromo-
Methylene chloride; Dichloromethane	75-09-2	Methane, dichloro-
Naphthalene	91-20-3	Naphthalene
1,4-Naphthoquinone	130-15-4	1,4-Naphthalenedione
1-Naphthylamine	134-32-7	1-Naphthalenamine
2-Naphthylamine	91-59-8	2-Naphthalenamine
Nickel	(Total)	Nickel
o-Nitroaniline; 2-Nitroaniline	88-74-4	Benzenamine, 2-nitro-
m-Nitroaniline; 3-Nitroaniline	99-09-2	Benzenamine, 3-nitro-
p-Nitroaniline; 4-Nitroaniline	100-01-6	Benzenamine, 4-nitro-
Nitrobenzene	98-95-3	Benzene, nitro-
o-Nitrophenol; 2-Nitrophenol	88-75-5	Phenol, 2-nitro-
p-Nitrophenol; 4-Nitrophenol	100-02-7	Phenol, 4-nitro-

N-Nitrosodi-n-butylamine	924-16-3	1-Butanamine, N-butyl-N-nitroso-
N-Nitrosodiethylamine	55-18-5	Ethanamine, N-ethyl-N-nitroso-
N-Nitrosodimethylamine	62-75-9	Methanamine, N-methyl-N-nitroso-
N-Nitrosodiphenylamine	86-30-6	Benzenamine, N-nitroso-N-phenyl-
N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; Di-n-propylnitrosamine	621-64-7	1-Propanamine, N-nitroso-N-propyl-
N-Nitrosomethylethalamine	10595-95-6	Ethanamine, N-methyl-N-nitroso-
N-Nitrosopiperidine	100-75-4	Piperidine, 1-nitroso-
N-Nitrosopyrrolidine	930-55-2	Pyrrolidine, 1-nitroso-
5-Nitro-o-toluidine	99-55-8	Benzenamine, 2-methyl-5-nitro-
Parathion	56-38-2	Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester
Pentachlorobenzene	608-93-5	Benzene, pentachloro-
Pentachloronitrobenzene	82-68-8	Benzene, pentachloronitro-
Pentachlorophenol	87-86-5	Phenol, pentachloro-
Phenacetin	62-44-2	Acetamide, N-(4-ethoxyphenyl)

Phenanthrene	85-01-8	Phenanthrene
Phenol	108-95-2	Phenol
p-Phenylenediamine	106-50-3	1,4-Benzenediamine
Phorate	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
<p>Polychlorinated biphenyls; PCBs</p> <p>Polychlorinated biphenyls (CAS RN 1336-36-3); this category contains congener chemicals, including constituents of Aroclor-1016 (CAS RN 12674-11-2), Aroclor-1221 (CAS RN 11104-28-2), Aroclor-1232 (CAS RN 11141-16-5), Aroclor-1242 (CAS RN 53469-21-9), Aroclor-1248 (CAS RN 12672-29-6), Aroclor-1254 (CAS RN 11097-69-1), and Aroclor-1260 (CAS RN 11096-82-5).</p>	<p>1336-36-3</p> <p>See adjacent note</p>	1,1'-Biphenyl, chloro derivatives
Pronamide	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
Propionitrile; Ethyl cyanide	107-12-0	Propanenitrile
Pyrene	129-00-0	Pyrene
Safrole	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-
Selenium	(Total)	Selenium

Silver	(Total)	Silver
Silvex; 2,4,5-TP	93-72-1	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-
Styrene	100-42-5	Benzene, ethenyl-
Sulfide	18496-25-8	Sulfide
2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-
2,3,7,8-TCDD; 2,3,7,8-Tetrachlorodibenzo- p-dioxin	1746-01-6	Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-
1,2,4,5-Tetrachlorobenzene	95-94-3	Benzene, 1,2,4,5-tetrachloro-
1,1,1,2-Tetrachloroethane	630-20-6	Ethane, 1,1,1,2-tetrachloro-
1,1,2,2-Tetrachloroethane	79-34-5	Ethane, 1,1,2,2-tetrachloro-
Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4	Ethene, tetrachloro-
2,3,4,6-Tetrachlorophenol	58-90-2	Phenol, 2,3,4,6-tetrachloro-
Thallium	(Total)	Thallium
Tin	(Total)	Tin
Toluene	108-88-3	Benzene, methyl-

o-Toluidine	95-53-4	Benzenamine, 2-methyl-
Toxaphene This entry includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2), i.e., chlorinated camphene.	8001-35-2 See adjacent note	Toxaphene
1,2,4-Trichlorobenzene	120-82-1	Benzene, 1,2,4-trichloro-
1,1,1-Trichloroethane; Methylchloroform	71-55-6	Ethane, 1,1,1-trichloro-
1,1,2-Trichloroethane	79-00-5	Ethane, 1,1,2-trichloro-
Trichloroethylene; Trichloroethene	79-01-6	Ethene, trichloro-
Trichlorofluoromethane; CFC-11	75-69-4	Methane, trichlorofluoro-
2,4,5-Trichlorophenol	95-95-4	Phenol, 2,4,5-trichloro-
2,4,6-Trichlorophenol	88-06-2	Phenol, 2,4,6-trichloro-
1,2,3-Trichloropropane	96-18-4	Propane, 1,2,3-trichloro-
O,O,O-Triethyl phosphorothioate	126-68-1	Phosphorothioic acid, O,O,O-triethyl ester
sym-Trinitrobenzene	99-35-4	Benzene, 1,3,5-trinitro-

Vanadium	(Total)	Vanadium
Vinyl acetate	108-05-4	Acetic acid, ethenyl ester
Vinyl chloride; Chloroethene	75-01-4	Ethene, chloro-
Xylene (total) Xylene (total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).	96-47-6 See adjacent note	Benzene, dimethyl-
Zinc	(Total)	Zinc

2.3.28 Corrective Actions Program

A. Assessment of Corrective Measures

1. Within ninety (90) days of finding that any of the constituents listed in § 2.3.27 of this Part have been detected at a statistically significant level exceeding the groundwater protection standards, the owner or operator must initiate an assessment of corrective measures. Such an assessment must be completed within a reasonable period of time.
2. The owner or operator must continue to monitor in accordance with the assessment monitoring program.
3. The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy, addressing at least the following:
 - a. The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

- b. The time required to begin and complete the remedy;
 - c. The costs of remedy implementation; and
 - d. The institutional requirements such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).
4. The owner or operator must discuss the results of the corrective measures assessment, prior to the selection of remedy, in a public meeting with interested and affected parties.

B. Selection of Remedy

1. Based on the results of the corrective measures assessment, the owner or operator must select a remedy that, at a minimum, meets the standards listed in § 2.3.28(B)(2) of this Part. The owner or operator must notify the Director, within fourteen (14) days of selecting a remedy that a report describing the selected remedy has been placed in the operating plan and that it meets the standards in § 2.3.28(B)(2) of this Part.
2. Remedies must:
- a. Be protective of human health and the environment;
 - b. Attain the groundwater protection standard as specified pursuant to § 2.1.8 of this Part.
 - c. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of § 2.3.27 of this Part into the environment that may pose a threat to human health or the environment; and
 - d. Comply with standards for management of wastes as specified in § 2.3.28(C)(4) of this Part.
3. In selecting a remedy that meets the standards of § 2.3.28(C)(2) of this Part, the owner or operator shall consider the following evaluation factors:
- a. The long and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:
 - (1) Magnitude of reduction of existing risks;

- (2) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;
 - (3) The type and degree of long-term management required, including monitoring, operation, and maintenance;
 - (4) Short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal of contaminants;
 - (5) Time until full protection is achieved;
 - (6) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;
 - (7) Long-term reliability of the engineering and institutional controls; and
 - (8) Potential need for replacement of the remedy.
- b. The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:
- (1) The extent to which containment practices will reduce further releases;
 - (2) The extent to which treatment technologies may be used.
- c. The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:
- (1) Degree of difficulty associated with constructing the technology;
 - (2) Expected operational reliability of the technologies;
 - (3) Need to coordinate with and obtain necessary approvals and permits from other agencies;
 - (4) Availability of necessary equipment and specialists; and

- (5) Available capacity and location of needed treatment, storage, and disposal services.
 - d. Practicable capability of the owner or operator, including a consideration of the technical and economic capability.
 - e. The degree to which community concerns are addressed by a potential remedy(s).
4. The owner or operator shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a schedule must require the initiation of remedial activities within a reasonable period of time, taking into consideration the factors set forth in §§ 2.3.28(B)(4)(a) through (h) of this Part. The owner or operator must consider the following factors in determining the schedule of remedial activities:
- a. Extent and nature of contamination;
 - b. Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards established under § 2.1.8 of this Part and other objectives of the remedy;
 - c. Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;
 - d. Desirability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;
 - e. Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;
 - f. Resource value of the aquifer including:
 - (1) Current and future uses;
 - (2) Proximity and withdrawal rate of users;
 - (3) Groundwater quantity and quality;
 - (4) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;

- (5) The hydrogeologic characteristic of the facility and surrounding land;
 - (6) Groundwater removal and treatment costs; and
 - (7) The cost and availability of alternative water supplies.
 - g. Practicable capability of the owner or operator.
 - h. Other relevant factors.
- 5. The Director may determine that remediation of a release ~~of a § 2.3.27 of this Part constituent from an SWLF unit~~ is not necessary if the owner or operator demonstrates to the satisfaction of the Director that:
 - a. The groundwater is additionally contaminated by substances that have originated from a source other than an SWLF unit, and those substances are present in concentrations such that cleanup of the release from the SWLF unit would provide no significant reduction in risk to actual or potential receptors; or
 - b. The constituent(s) present in groundwater:
 - (1) Is not currently or reasonably expected to be a source of drinking water; and
 - (2) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in a concentration(s) that would exceed the groundwater protection standards established under § 2.1.8 of this Part; or
 - c. Remediation of the release(s) is technically impracticable; or
 - d. Remediation results in unacceptable cross-media impacts.
- 6. A determination by the Director pursuant to § 2.3.28(B)(5) of this Part shall not affect the authority of the State to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are technically practicable and significantly reduce threats to human health or the environment.

C. Implementation of the Corrective Action Program

1. Based on the schedule established under § 2.3.28(B)(4) of this Part for initiation and completion of remedial activities, the owner/operator must:
 - a. Establish and implement a corrective action groundwater monitoring program that:
 - (1) At a minimum, meets the requirements of an assessment monitoring program;
 - (2) Indicates the effectiveness of the corrective action remedy; and
 - (3) Demonstrates compliance with the ground-water protection standard pursuant to § 2.3.28(C)(5) of this Part.
 - b. Implement the corrective action remedy selected under § 2.3.28(B) of this Part; and
 - c. Take any interim measures necessary to ensure the protection of human health and the environment. Interim measures should, to the greatest practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to § 2.3.28(B) of this Part. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:
 - (1) Time required to develop and implement a final remedy;
 - (2) Actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;
 - (3) Actual or potential contamination of drinking water supplies or sensitive ecosystems;
 - (4) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;
 - (5) Weather conditions that may cause hazardous constituents to migrate or be released;
 - (6) Risks of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or failure of a container or handling system; and
 - (7) Other situations that may pose threats to human health and the environment.

2. An owner or operator may determine, based on information developed after implementation of the remedy has begun or other information, that compliance with requirements of § 2.3.28(B)(2) of this Part are not being achieved through the remedy selected. In such cases, the owner or operator must implement other methods or techniques that could practicably achieve compliance with the requirements, unless the owner or operator makes the determination under § 2.3.28(C)(3) of this Part.
3. If the owner or operator determines that compliance with requirements under § 2.3.28(B)(2) of this Part cannot be practically achieved with any currently available methods, the owner or operator must:
 - a. Obtain certification of a qualified groundwater scientist or approval by the Director that compliance with requirements under § 2.3.28(B)(2) of this Part cannot be practically achieved with any currently available methods;
 - b. Implement alternate measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment; and
 - c. Implement alternate measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that are:
 - (1) Technically practicable; and
 - (2) Consistent with the overall objective of the remedy.
 - d. Notify the Director within fourteen (14) days that a report justifying the alternative measures prior to implementing the alternative measures has been placed in the operating plan.
4. All solid wastes that are managed pursuant to a remedy required under § 2.3.28(B) of this Part, or an interim measure required under § 2.3.28(C)(1) (c) of this Part, shall be managed in a manner:-
 - a. That is protective of human health and the environment; and
 - b. That complies with applicable [Requirements of Subchapter 10, Hazardous Waste, of this Chapter.](#) RCRA-requirements.
5. Remedies selected pursuant to § 2.3.28(A) of this Part shall be considered complete when:

- a. The owner or operator complies with the groundwater protection standards established under § 2.1.8 of this Part at all points within the plume of contamination that lies beyond the groundwater monitoring well system established under § 2.1.8 of this Part.
 - b. Compliance with the groundwater protection standards established under § 2.1.8 of this Part has been achieved by demonstrating that concentrations of § 2.3.27 of this Part constituents have not exceeded the groundwater protection standard(s) for a period of three (3) consecutive years using statistical procedures and performance standards.
 - c. The Director may specify an alternative length of time during which the owner or operator must demonstrate that concentrations of § 2.3.27 of this Part constituents have not exceeded the groundwater protection standard(s) taking into consideration:
 - (1) Extent and concentration of the release(s);
 - (2) Behavior characteristics of the hazardous constituents in the groundwater;
 - (3) Accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and
 - (4) Characteristics of the groundwater.
 - d. All actions required to complete the remedy have been satisfied.
6. Upon completion of the remedy, the owner or operator must notify the Director within fourteen (14) days that a certification that the remedy has been completed in compliance with the requirements of § 2.3.28(A)(5) of this Part has been placed in the operating plan. The certification must be signed by the owner or operator and by a qualified groundwater scientist, or approved by the Director.
 7. Upon certification by the landfill owner or operator that the remedy has been completed in compliance with § 2.3.28(A)(5) of this Part and this certification is also signed by a qualified groundwater scientist or approved by the Director, then the Department shall release the landfill owner or operator from the requirements for financial assurance for corrective action (per § 2.3.28(D) of this Part).
- D. Financial Assurance for Corrective Action at an SWLF Unit

1. An owner or operator of an SWLF unit required to undertake a corrective action program, must have a detailed written estimate, in current dollars, of the cost of hiring a third (3rd) party to perform the corrective action. The corrective action cost estimate must account for the total cost of corrective action activities as described in the correction action remedy for the entire corrective action period. The owner or operator must notify the Director that this estimate has been placed in the landfill's operating record.
2. The owner or operator must annually adjust the corrective action cost estimate for inflation until the corrective action program is completed.
3. The owner or operator must increase the corrective action cost estimate and the amount of financial assurance provided, if changes in the corrective action program or landfill conditions increase the maximum costs of corrective action.
4. The owner or operator may reduce the amount of the corrective action cost estimate and the amount of financial assurance provided, if the cost estimate exceeds the maximum remaining costs of corrective action. The owner or operator must notify the Director that the justification for the reduction of the corrective action cost estimate and the amount of financial assurance has been placed in the landfill's operating record.
5. The landfill owner or operator, required to undertake a corrective action program, must establish financial assurance for the most recent corrective action program, in accordance with § 2.3.29 of this Part. The owner or operator must provide continuous corrective action assurance until released from financial assurance requirements by demonstrating compliance with and completion of corrective action remedies.

2.3.29 Allowable Mechanisms for SWLF Units to Demonstrate Financial Assurance

- A. The mechanisms to demonstrate financial assurance must ensure that the funds necessary to meet the costs of closure, post-closure care, and corrective action for known releases, will be available whenever needed. SWLF unit private and local government owners and operators must choose from the options below and demonstrate compliance with one (1) or more of these allowed mechanisms by April 9, 1997:
 1. Trust Fund
 - a. A landfill owner or operator can establish a trust fund which conforms to the requirements § 2.3.29(A)(1)(a) of this Part. The trustee must be an entity which has the authority to act as a trustee

and whose trust operations are regulated and examined by a Federal or State agency. A copy of the trust agreement must be placed in the landfill's operating record.

- b. Relative to trust funds for closure or post-closure care, payments into the trust fund must be made annually by the landfill owner or operator over the term of the initial license or over the remaining life of the landfill, whichever is shorter. Relative to a trust fund for corrective action, payments into the trust fund must be made over one half (1/2) of the estimated length of the corrective action program. This payment period is referred to as the pay-in period.
- c. For a trust fund used to demonstrate financial assurance for closure or post-closure care, the first (1st) payment into the fund must be at ~~least~~ **least equal to the current cost estimate for closure or post-closure care except as provided in § 2.3.29(A)(10) of this Part, divided by the number of years in the pay-in period. The amount of subsequent payments must be determined by the following formula:**
 - (1) Next Payment = $(CE - CV)/Y$ where:
 - (2) CE = Current cost estimate for closure or post-closure care (updated for inflation or other changes)
 - (3) CV = Current value of the trust fund
 - (4) Y = Number of years remaining in the pay-in period
- d. For a trust fund used to demonstrate financial assurance for corrective action, the first payment into the fund must be at least equal to one half (1/2) of the current cost estimate for corrective action, except as provided in § 2.3.29(A)(10) of this Part, divided by the number of years in the corrective action pay-in period. The amount of subsequent payments must be determined by the following formula:
 - (1) Next Payment = $(RB - CV)/Y$ where:
 - (2) RB = most recent estimate of the required trust fund balance for corrective action (i.e. the total costs that will be incurred during the second (2nd) half of the corrective action period) and CV, Y are defined above.

- e. Relative to trust funds for closure or post-closure care, the initial payment into the fund must be made before the initial receipt of waste or by April 9, 1994, whichever is later. Relative to a trust fund for corrective action, the initial payment must be made no later than one hundred twenty (120) days after selection of the corrective action remedy.
- f. If the landfill owner or operator establishes a trust fund after using one (1) or more alternate allowable mechanisms to demonstrate financial assurance, then the initial payment into the trust fund must be at least the amount the fund would contain if the trust fund had been established initially and annual payments made according to §§ 2.3.29(A)(1)(c) and (d) of this Part.
- g. The landfill owner or operator, or other person, business, or organization authorized to conduct closure, post-closure care, or corrective action activities may request reimbursement from the trustee for these expenditures. Requests for reimbursement will be granted by the trustee only if sufficient funds remain in the trust fund to cover the remaining costs of closure, post-closure care, or corrective action and if justification and documentation of the cost is placed in the landfill's operating record. The owner or operator must notify the Director that documentation of the justification for reimbursement has been placed in the operating record and that reimbursement has been received.
- h. The trust fund may be terminated by the landfill owner or operator only if he substitutes alternate acceptable financial assurance or if he is no longer required to demonstrate financial assurance.

2. Surety Bond Guaranteeing Payment or Performance

- a. A landfill owner or operator may demonstrate financial assurance for closure or post-closure care by obtaining a payment or performance surety bond. An owner or operator may demonstrate financial assurance for corrective action by obtaining a performance bond. The bond must be effective before the initial receipt of waste or by April 9, 1994, whichever is later, relative to closure or post-closure care, or not later than one hundred twenty (120) days after the corrective action remedy has been selected. The owner or operator must notify the Director that a copy of the bond has been placed in the landfill's operating record. The surety company issuing the bond must, at a minimum, be among those listed as

acceptable sureties on Federal bonds in Circular 570 of the U.S. Department of Treasury.

- b. The penal sum of the bond must be in an amount at least equal to the current cost estimate for closure, post-closure or corrective action, whichever is applicable, except as provided in § 2.3.29(A)(11) of this Part.
- c. Under terms of the bond, the surety will become liable on the bond obligation when the owner or operator fails to perform as guaranteed by the bond.
- d. The owner or operator must establish a standby trust fund, which meets the requirements of § 2.3.29(A)(1) of this Part, except the requirements for initial payment and subsequent annual payments in §§ 2.3.29(A)(1)(b) through (e) of this Part.
- e. Payments made under terms of the bond will be deposited by the surety directly into the standby trust fund. Payments from the trust fund must be approved by the trustee.
- f. Under terms of the bond, the surety may cancel the bond by sending notice of cancellation by certified mail to the landfill owner and operator and to the Director at least one hundred twenty (120) days in advance of cancellation. If the surety cancels the bond, the landfill owner or operator must obtain alternate acceptable financial assurance.
- g. The landfill owner or operator may cancel the bond only if alternate acceptable financial assurance is substituted or if the owner or operator is no longer required to demonstrate financial assurance.

3. Letter of Credit

- a. A landfill owner or operator may obtain an irrevocable standby letter of credit. It must be effective before the initial receipt of waste or by April 9, 1994, whichever is later, relative to closure or post-closure care, or no later than one hundred twenty (120) days after the corrective action remedy has been selected. The owner or operator must notify the Director that a copy of the letter of credit has been placed in the landfill's operating record. The issuing institution must be an entity which has the authority to issue letters of credit and whose letter of credit operations are regulated and examined by a Federal or State agency.

- b. A letter from the owner or operator referring to the letter of credit by number, issuing institution, and date and providing the name and address of the facility and amount of funds assured, must be included with the letter of credit in the landfill operating record.
- c. The letter of credit must be irrevocable and issued for a period of at least one year in an amount at least equal to the current cost estimate for closure, post-closure, or corrective action, whichever is applicable, except as provided in § 2.3.29(A)(1) of this Part. The letter of credit must provide for an automatic extension of the expiration date for at least one (1) year, unless the issuing institution has canceled the letter of credit by sending a notice of cancellation by certified mail to the landfill owner and operator and to the Director at least one hundred twenty (120) days in advance of cancellation. If the letter of credit is canceled by the issuing institution, the landfill owner or operator must obtain alternate acceptable financial assurance.
- d. The landfill owner or operator may cancel the letter of credit only if alternate acceptable financial assurance is substituted or if the owner or operator is no longer required to demonstrate financial assurance.

4. Insurance

- a. The landfill owner or operator may demonstrate financial assurance for closure and post-closure care by obtaining insurance which is effective before the initial receipt of waste or by April 9, 1994, whichever is later. At a minimum, the insurer must be licensed to transact the business of insurance or must be eligible to provide insurance as an excess or surplus lines insurer, in one (1) or more States. The owner or operator must notify the Director that a copy of the insurance policy has been placed in the landfill operating record.
- b. The closure or post-closure care insurance policy must guarantee that funds will be available to close the landfill whenever final closure occurs or to provide post-closure care for the landfill whenever the post-closure care period begins, whichever applies. The policy must also guarantee that once closure or post-closure care begins, the insurer will be responsible for the paying out of funds to the landfill owner or operator or other person, organization or business authorized to conduct closure or post-closure care, up to an amount equal to the face amount of the policy.

- c. The insurance policy must be issued for a face amount at least equal to the current cost estimate for closure or post-closure care, whichever is applicable, except as provided in § 2.3.29(A)(1) of this Part. The term, "face amount" means the total amount the insurer is obligated to pay under the policy. Actual payments by the insurer will not change the face amount, although the insurer's future liability will be lowered by the amount of payments.
- d. The landfill owner or operator or other person authorized to conduct closure or post-closure care, may receive reimbursements for closure or post-closure expenditures, whichever applies. Requests for reimbursement will be granted by the insurer only if the remaining value of the policy is sufficient to cover the remaining costs of closure or post-closure care, and if justification and documentation of the cost is placed in the landfill's operating record. The owner or operator must notify the Director that the documentation of the justification for reimbursement has been placed in the landfill's operating record and that reimbursement has been received.
- e. Each insurance policy must contain a provision allowing assignment of the policy to a successor landfill owner or operator. Such assignment may be conditional upon consent of the insurer, provided that such content is not unreasonably refused.
- f. The insurance policy must provide that the insurer will not cancel, terminate, or fail to renew the policy except for failure to pay the premium. The automatic renewal of the policy must, at minimum, provide the insured with the option of renewal at the face amount of the expiring policy. If there is a failure to pay the premium, then the insurer may cancel the policy by sending notice of cancellation by certified mail to the landfill owner and operator and to the Director at least one hundred twenty (120) days in advance of cancellation. If the insurer cancels the policy, then the landfill owner or operator must obtain alternate acceptable financial assurance.
- g. For insurance policies providing coverage for post-closure care, commencing on the date that liability to make payments pursuant to the policy accrues, the insurer will thereafter annually increase the face amount of the policy. Such increase must be equivalent to the face amount of the policy, less any payments made, multiplied by an amount equivalent to eighty-five percent (85%) of the most recent investment rate or of the equivalent coupon issue yield

announced by the U.S. Dept. of the Treasury for twenty-six (26) week treasury securities.

- h. The landfill owner or operator may cancel the insurance policy only if alternate acceptable financial assurance is substituted or if the owner or operator is no longer required to demonstrate financial assurance.

5. Local Government Financial Test – A local government owner or operator that satisfies the requirements of §§ 2.3.29(A)(6)(a) through (c) of this Part may demonstrate financial assurance up to the amount specified in § 2.3.29(A)(6)(d) of this Part.

a. Financial Component

- (1) The owner or operator must satisfy either §§ 2.3.29(A)(6)(a) ((1)) or ((2)) of this Part.

- (AA) If the owner or operator has outstanding general obligation bonds, it must have a current Moody's rating of Aaa, Aa, A, or Baa or a current Standard and Poor's rating of AAA, AA, A, or BBB, on all outstanding general obligation bonds.

- (BB) If the owner does not have outstanding general obligation bonds, it must satisfy each of the following financial ratios: A ratio of cash plus marketable securities to total expenditures greater than or equal to 0.05; and A ratio of annual debt service to total expenditures less than an equal to 0.20; and A ratio of long-term debt issued and outstanding to capital expenditures less than or equal to 2.00.

- (2) The owner or operator must prepare its financial statements in conformity with General Accepted Accounting Principles for governments.

- (3) An owner or operator is not eligible to assure its obligations under this § 2.3.29(A)(6) of this Part if any of the following apply to the owner or operator: Is currently in default on any outstanding general obligation bonds; or Has one (1) or more outstanding general obligation bonds with a Moody's rating lower than Baa or with a Standard and Poor's rating lower than BBB; or operated at a deficit equal to five percent (5%) or more of total annual revenue in either of the past two

(2) fiscal years; or receives an adverse opinion, disclaimer of opinion, or other qualified opinion from the independent certified public accountant (or appropriate State agency) auditing its financial statement as required under § 2.3.29(F)(1)(b) of this Part. However, the Director may evaluate qualified opinions on a case-by-case basis and allow use of the financial test in cases where the Director deems the qualification insufficient to warrant disallowance of the test.

- b. Public Notice Component – The local government owner or operator must place a reference to the closure, post-closure care, or corrective action costs assured through the financial test into its most recent comprehensive annual financial report or budget. Relative to closure and post-closure care, this reference must be included by April 9, 1997 or prior to the initial receipt of waste at the facility, whichever is later. Relative to corrective action, this reference must be included not later than one hundred twenty (120) days after an acceptable corrective action remedy has been selected. The reference must include the amount of each cost estimate and the year(s) in which the local government expects these costs to be incurred. References in the budget must occur as budgeted line items if the activities are to occur in the period covered by the budget, but may appear in a supplemental data section if the activities will not occur until after the period covered by the budget.
- c. Recordkeeping and Reporting Requirements
 - (1) The local government owner or operator must place the following items in the facility's operating record:
 - (AA) A letter signed by the local government's Chief Financial Officer that: Lists all the current cost estimates covered by a financial test, as described in § 2.3.29(A)(6)(b) of this Part; provides evidence and certifies that the local government meets the conditions of either §§ 2.3.29(A)(6)(a)((1)) or ((2)) of this Part, and Certifies that the local government meets the conditions of § 2.3.29(A)(6)(d) of this Part.
 - (BB) The local government's independently audited year-end financial statements for the latest fiscal year, including the unqualified opinion of the auditor who must be an independent, certified public accountant

or an appropriate state agency that conducts equivalent comprehensive audits; and

- (CC) A report to the local government from the local government's independent certified public accountant or the appropriate State agency stating that:
 - (i) The certified public accountant or State agency has compared the data in the Chief Financial Officer's independently audited, year-end financial statements for the latest fiscal year, and
 - (ii) In connection with that examination, no matters came to his attention which caused him to believe that the data in the Chief Financial Officer's letter should be adjusted.
- (2) The items required § 2.3.29(F)(3)(a) of this Part must be placed in the facility operating record as follows:
 - (AA) Relative to closure and post-closure care, before April 9, 1997 or prior to the initial receipt of waste at the facility, whichever is later; or
 - (BB) Relative to corrective action, not later than one hundred twenty (120) days after an acceptable corrective action remedy is selected.
- (3) After placement of § 2.3.29(F)(3)(a) of this Part items in the facility's operating record, the local government owner or operator must at least annually update this information and place the updated information in the facility's operating record within ninety (90) days following the end of the owner or operator's fiscal year.
- (4) The local government owner or operator is no longer required to meet the requirements of § 2.3.29(F)(3)(e) of this Part when either:
 - (AA) The owner or operator substitutes alternate financial assurance as specified in § 2.3.29(F)(3)(e) of this Part; or

- (BB) The owner or operator is released from the requirements of this section in accordance with §§ 2.1.9 and 2.3.28 of this Part.
 - (5) A local government must satisfy the requirements of the financial test at the close of each fiscal year. If the local government owner or operator no longer meets the requirements of the local government financial test, it must, within one hundred twenty (120) days following the end of the owner or operator's fiscal year, obtain alternative financial assurance that meets the requirements of this section, place the required submissions for assurance in the facility operating record, and notify the Director that the owner or operator no longer meets the criteria of the financial test and that alternate financial assurance has been obtained.
 - (6) The Director, based on a reasonable belief that the local government owner or operator no longer meets the requirements of the local government financial test, may at any time require additional reports of financial condition from the local government. If the Director finds, on the basis of such reports or other information, that the owner or operator no longer meets the requirements of the local government financial test, then the local government must provide alternate financial assurance in accordance with § 2.3.29(A)(6)(c)((5)) of this Part.
- d. Calculation of Costs to be Assured – The portion of the closure, post-closure, and corrective action costs for which an owner or operator can assure under § 2.3.29(F)(4) of this Part is determined as follows:
- (1) If the local government owner or operator does not assure other environmental obligations through a financial test, it may assure closure, post-closure, and corrective action costs that equal up to forty-three percent (43%) of the local government's total annual revenue.
 - (2) If the local government assures other environmental obligations through a financial test, including those associated with UIC facilities under 40 C.F.R. § 144.62 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, petroleum underground storage tank facilities under 40

C.F.R. § 280 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, PCB storage facilities under 40 C.F.R. § 761 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, and hazardous waste treatment, storage, and disposal facilities under 40 C.F.R. §§ 264 and 265 (2017), incorporated in § [1.3\(A\)](#) of this Subchapter, it must add those costs to the closure, post-closure and corrective action costs it seeks to assure under § 2.3.29(A)(6)(d) of this Part. The total must not exceed forty-three percent (43%) of the local government's total annual revenue.

- (3) The owner or operator must obtain an alternate financial assurance instrument for those costs that exceed the limits set in §§ 2.3.29(A)(6)(d)((1)) and ((2)) of this Part.
6. Local Government Guarantee – An owner or operator may demonstrate financial assurance for closure, post-closure, and corrective action, as required by §§ 2.1.9 and 2.3.28 of this Part, by obtaining a written guarantee provided by a local government. The guarantor must meet the requirements of the local government financial test in § 2.3.29(A)(6) of this Part, and must comply with the terms of a written guarantee.
 - a. Terms of the Written Guarantee – Relative to closure and post-closure care, the guarantee must be effective before April 9, 1997 or before the initial receipt of waste, whichever is later. Relative to corrective action, the guarantee must be no later than one hundred twenty (120) days after an acceptable corrective action remedy has been selected. The guarantee must provide that:
 - (1) If the owner or operator fails to perform closure, post-closure care, and/or corrective action of a facility covered by the guarantee, the guarantor will either: Perform, or pay a third (3rd) party to perform, closure, post-closure care, and/or corrective action as required; or establish a fully funded trust fund, as specified in § 2.3.29(A)(1) of this Part, in the name of the owner or operator.
 - (2) The guarantee will remain in force unless the guarantor sends notice of cancellation by certified mail to the owner or operator and to the Director. Cancellation may not occur, however, during the one hundred twenty (120) days beginning on the date of receipt of the notice of cancellation by both the owner or operator and the Director, as evidenced by the return receipts.

- (3) If a guarantee is canceled, the owner or operator must, within ninety (90) days following receipt of the cancellation notice by the owner or operator and the Director, obtain alternate financial assurance, place evidence of that alternate financial assurance in the facility operating record, and notify the Director. If the owner or operator fails to provide alternate financial assurance within the ninety (90) day period, the guarantor must provide that alternate assurance within one hundred twenty (120) days following the close of the guarantor's fiscal year, obtain alternative assurance, place evidence of the alternate assurance in the facility operating record, and notify the Director.

b. Recordkeeping and Reporting

- (1) Relative to closure and post-closure care, the owner or operator must place a certified copy of the guarantee, along with the items required within § 2.3.29(A)(6)(c) of this Part, into the facility's operating record before April 9, 1997 or before the initial receipt of waste, whichever is later. Relative to corrective action, this certified copy and items must be placed into the facility's operating record no later than one hundred twenty (120) days after an acceptable corrective action remedy has been selected.
- (2) The owner or operator is no longer required to maintain the items specified in § 2.3.29(A)(8)(a) of this Part of this section when either: The owner or operator substitutes alternate financial assurance as specified in this section; or the owner or operator is released from the requirements of this section in accordance with §§ 2.1.9 and 2.3.28 of this Part.
- (3) If a local government guarantor no longer meets the requirements of § 2.3.29(A)(6)(a) of this Part, the owner or operator must, within ninety (90) days following the end of the guarantor's fiscal year, obtain alternative assurance, place evidence of the alternate assurance in the facility's operating record, and notify the Director. If the owner or operator fails to provide alternate financial assurance within the ninety (90) day period, the guarantor must provide that alternate assurance within one hundred twenty (120) days.

7. State-Approved Mechanism – An owner or operator may satisfy the requirements of this section by obtaining any other mechanism that meets

the criteria specified in § 2.3.29 of this Part and that is approved by the Director.

8. State Assumption of Responsibility – If the Director either assumes legal responsibility for an owner or operator's compliance with closure, post-closure care and/or corrective action requirements or assures that funds will be available from State sources to cover these requirements, then the owner or operator will be in compliance with the requirements of this section. Any assumption of this responsibility, by the Director, must meet the criteria specified in § 2.3.29 of this Part. The owner or operator will not be relieved of this responsibility, except if the Director assumes the responsibility and declares such responsibility, in writing, to the owner or operator or their representative or successor.
9. Use of Multiple Mechanisms – An owner or operator may demonstrate financial assurance for closure, post-closure, and corrective action, as required by §§ 2.1.9 and 2.3.28 of this Part, by establishing more than one (1) financial mechanism per facility, except that mechanisms guaranteeing performance, rather than payment, may not be combined with other instruments. The mechanisms must be as specified in §§ 2.3.29(A)(1) through (8) of this Part, except that financial assurance for an amount at least equal to the current cost estimate for closure, post-closure care, and/or corrective action may be provided by a combination of mechanism, rather than a single mechanism.
10. Other Requirements of the Financial Mechanisms
 - a. The financial assurance mechanisms must ensure that the amount of funds assured is sufficient to cover the cost of closure, post-closure care, and corrective action for known releases when needed and will be available in a timely fashion when needed.
 - b. The financial assurance mechanisms must be obtained by the owner or operator by the effective date of these requirements or prior to the initial receipt of solid waste, whichever is later, in the case of closure and post-closure care, and no later than one hundred twenty (120) days after the corrective action remedy has been properly selected, until the Director releases the owner or operator from financial assurance requirements, per §§ 2.1.9 and 2.3.28 of this Part.
 - c. The financial assurance mechanisms must be legally valid, binding, and enforceable under State and Federal Law.