

DWPC Wastewater Residuals Guidance Document No. 89-2

Closure/Post Closure Requirements For Residuals Landfills

1. Landfill Closure Requirements.

(1) Notification of closure. *The owner or operator of a landfill must submit for Department review and approval a closure/post closure plan at least six (6) months prior to proposed closure activities.*

(2) Final Closure Plan Requirements. *The closure/post closure plan shall provide such schematic, descriptive, and data information as the Department deems necessary to describe and evaluate the procedures the applicant proposes to use to close the facility and maintain and care for the site during post closure in a manner that minimizes the impacts to public health, safety, and the environment. A closure/post closure plan shall include:*

a. a narrative description, with appropriate references to the site and design plans, of the activities and sequence of activities necessary to deactivate and/or close the facility including the site preparation and closure activities necessary to cap and secure the landfill; and activities necessary to maintain the landfill during post-closure.

b. a description of measures to be utilized to comply with the closure and post closure requirements set forth in this document;

c. a description of the proposed subsequent use of the site and/or facility and;

d. other provisions that the Department deems necessary on a site or facility specific basis to ensure proper closure of the facility.

e. proof that the proposed facility is located within the site assigned boundaries as described in the Departments hearings pursuant to M.G.L. c. 83, ss. 6 & 7; or c. 21, s. 43.

f. certification from the Secretary of Environmental Affairs that the applicant has complied with the MEPA process, if applicable; and

g. proof that the applicant has received required approval for work in a wetlands resource area, or its buffer zone in accordance with M.G.L. c. 131, s. 40 and the regulations promulgated thereunder and 310 CMR 10, if applicable.

h. a description and implementation schedule of the proposed closure activities and a description and schedule of proposed post closure maintenance, monitoring, and assessment activities necessary to protect the public health, safety and the environment.

In addition to the aforementioned requirements the final closure plan shall include a hydrogeological evaluation of the landfill site that shall be conducted as part of the environmental assessment. The Department may require that closure plans for an existing facility be updated to reflect actual conditions of the site prior to final closure.

(3) Filing. *The applicant shall file two (2) copies of the plan to the Department. One (1) copy shall be filed with the Division of Water Pollution Control section in the appropriate Regional Office and one (1) copy shall be filed with the Division of Water Pollution Control's Boston Office.*

(4) Site Preparation for Closure. *The owner or operator of a residuals landfill shall prepare the portion of the site to be closed by undertaking the following actions:*

a. perform all necessary corrective site activities to the satisfaction of the Department; and

b. dispose of all residual materials stockpiled at the site.

(5) Closure Requirements. *In addition to the closure requirements previously set forth the operator shall ensure that:*

a. the completed landfill is graded in a manner that facilitates surface drainage and is consistent with the surrounding topography;

b. the completed landfill is completely covered by final cover in accordance with section 2 of this document;

c. the closure of the landfill does not in any way interfere with the proper drainage of adjacent lands or concentrate run-off waters on adjacent areas;

d. the landfill has an explosive gas control system, as outlined in section 3(3) of this document; and

e. the landfill has an operative environmental monitoring system designed and implemented in accordance with section 4 of this document.

(6) Closure Procedures for Residuals Landfills. *Closure of landfills shall consist of two (2) phases; Closure Construction and Termination of Closure.*

a. Closure Construction. Closure construction consists of the construction of the final cover. During this phase the operator shall:

1. notify the Department in writing two weeks prior to the start of construction of the impermeable cap as detailed in section 2 of this document. Work on the drainage layer and vegetative support layer as outlined in section 2 shall not commence until the impermeable cap has been inspected and approved by the Department;

2. notify the Department in writing two weeks prior to the completion of construction of the final cover;

3. hire an independent professional engineer knowledgeable in matters of landfill design and closure who shall oversee all closure activities. The engineer shall:

(a) determine the final grades of the landfill and the extent of its conformance to the approved final closure plan;

(b) inspect and certify subbase construction prior to the installation of the impermeable cap;

(c) oversee the installation and certify construction of the impermeable cap in accordance with approved plans, manufacturer's specifications and an approved QA/QC plan; and

(d) certify that the landfill is closed and covered in accordance with the approved final closure plans; and

(e) submit a copy of the engineer's certification to the Department. Following the receipt of the engineers certification the Department shall inspect the landfill and

*(1) issue a determination of Construction Completion;
or*

(2) *issue a letter citing deficiencies and requiring corrective action.*

b. Termination of closure marks the beginning of the post-closure period. A facility should be deemed closed on the date of the Department's written determination that the closure of the facility has been completed in accordance with the final closure plan approved by the Department.

(7) Record Notice of Landfill Operation.

a. Notification that a residuals landfill has been operated on the site shall be recorded in the registry of deeds or in the registry section of the land court for the district wherein the land lies. The notification should contain the following information:

- 1. identification of record owners of the property;*
- 2. a description of the landfill site, by metes and bounds and by reference to an appropriate map or plan to be recorded therewith, signed by a qualified professional engineer or a land surveyor, depicting the boundaries of the filled area and the location of any and all leachate collection devices and gas or ground water monitoring wells associated with the site;*
- 3. a detailed description of the type and extent of the final cap and cover on the landfill; and*
- 4. a description of the nature and duration of post closure maintenance and monitoring systems.*
- 5. notification that said premises shall not be used for any purpose other than as a landfill without the prior written approval of the Department of Environmental Protection (DEP). Continued operation of the site as a landfill requires prior written approval of the Department.*

2. Landfill Capping and Final Cover Criteria.

(1) General. *All landfills and portions thereof shall be covered with final cover, as soon as possible, but no later than ninety (90) days after reaching final approved elevations. When greater than thirty (30) days of the ninety day period falls between November 1 and March 1, the ninety (90) day period shall begin the following March 2.*

Final cover shall be applied to a section of the landfill under each of the following circumstances:

- a. whenever a new lift has not or will not be applied within a one year period;*
- b. whenever approved final elevations have been reached;*
- c. whenever the permit terminates or is revoked.*

(2) Performance Standard. *The final cover should be designed, constructed, and maintained to:*

- a. minimize infiltration of liquid into the landfill;*
- b. promote proper drainage;*
- c. minimize erosion of the landfill;*
- d. accommodate settling and subsidence of the landfill;*
- e. ensure isolation of the landfill wastes from the environment; and*
- f. facilitate the control of air pollutants.*

(3) Components. *The final cover should consist of:*

- a. a subgrade layer;*
- b. an impermeable layer;*
- c. a drainage layer or system;*
- d. a layer capable of supporting vegetative cover; and*
- e. the vegetative cover.*

(4) Design Standards. *The final cover should:*

- a. have a final top slope of not less than five (5%) percent and side slopes no greater than three (3) horizontal to one (1) vertical (3:1);*
- b. be constructed in accordance with a quality assurance/quality control plan approved by the Department under direction of the supervising field engineer;*

c. be tested in accordance with the Department's approved testing procedures as detailed in Appendix A of this document; and

d. be repaired immediately upon the detection of any failure which may result in the imminent or future release of pollutants to the environment.

(5) Subgrade Preparation and Certification. *Prior to the placement of the impermeable layer, the subgrade should be prepared according to approved plan. The subgrade should be designed and constructed to provide adequate support for the final cover and be free from materials that may damage or abrade the impermeable layer. The subgrade preparation shall be inspected by the supervising engineer and certified as to the conformance of the subgrade to the approved plan.*

(6) Low Permeability Layer. *The low permeability layer of the final cover may be composed of natural, admixed, or amended soils, a flexible membrane, or any combination of the above, with Department prior approval. It shall be constructed in accordance with a construction plan approved by the Department and promote the positive drainage of the landfill final cover system and prevent erosion. It shall also minimize the movement or percolation of water into the landfill.*

a. Clay or other natural or amended soils used as the low permeability layer, shall:

- 1. have a minimum compacted thickness of 18 inches;*
- 2. be constructed using materials and procedures that result in a maximum in-place hydraulic capacity of 1×10^{-7} cm/sec throughout the entire thickness of the layer;*
- 3. be compacted to minimize void spaces and support the weight imposed by the post closure use without settling so as to cause or to contribute to the failure of the low permeability layer;*
- 4. be free of materials that, because of their physical, chemical, or biological characteristics, may cause or contribute to an increase in the permeability of the layer or otherwise cause failure of the layer;*

b. Flexible membrane liners shall:

- 1. have an underlying base that will support the weight of the final cover and not abrade or puncture the flexible membrane;*

2. *be capable of being seamed to produce leak-tight, high strength seams that retain their integrity during final cover installation and the post-closure period;*
3. *have a minimum thickness of 30 mils.;*
4. *have sufficient flexibility and strength for the proposed application, taking into consideration tensile strength, puncturability, stress cracking, and chemical compatibility;*
5. *be constructed to ensure that the seams connecting synthetic membrane panels are of equal or greater strength than the panels themselves and be oriented parallel to the slope and not across the slope (a QA/QC plan should be submitted as part of the closure plan).*

(7) Drainage Layer or System. *The drainage layer or system shall meet the following criteria:*

- a. *be placed above the impermeable cap;*
- b. *be of sufficient thickness and hydraulic conductivity or capacity to drain the immediate and up-gradient areas of the final cover;*

c. be composed of either:

1. *a soil material that has a minimum thickness of six inches and have a hydraulic conductivity equal to, or greater than 1×10^{-3} cm/sec; or*
2. *when allowed by the Department, synthetic drainage material (geonet) that shall:*
 - (a) *be of sufficient strength to prevent deformation and impairment of function by the weight of vehicles or the final cover;*
 - (b) *have sufficient flow capability;*
 - (c) *be properly oriented for proper function; and*
 - (d) *be bound on its upper surface with filter material where needed to prevent the infiltration of fine material and to maintain the integrity of the layer; and*

(e) be maintained to prevent conditions that could compromise the integrity of the landfill or cause erosion.

(8) Filter Material. *Filter material, where placed, shall be capable of preventing migration of fine soil particles into the drainage or venting layer.*

(9) Vegetative Support/Protection Layer. *The vegetative support/protection layer shall:*

a. be of sufficient thickness and composition to support the selected vegetation and protect underlying layers from the adverse effects of desiccation, extremes in temperature, including frost effects and erosion.

b. there shall be at least 18 inches of soil material above the low permeability layer. This 18 inches may be composed of soil in the drainage layer and the vegetative support/protection layer. The vegetative layer alone must be at least must be a minimum of twelve (12) inches thick and be comprised of soil capable of supporting the selected vegetation.

(10) Vegetative Cover. *The vegetative cover shall:*

a. provide complete coverage of the landfill;

b. have root systems that shall not compromise the drainage layer or the low permeability layer;

c. be composed of plants which shall be capable of self propagation;

d. minimize erosion of the underlying material;

e. promote evapotranspiration of water to the maximum practicable extent; and

f. provide for an effective and permanent cover compatible with the site.

(11) Alternative Designs. *Landfill final cover systems designed using components, materials, technologies or methodologies other than those provided for in this document may be approved by the Department provided that either the proponent demonstrates to the Department's satisfaction that the alternative final cover system design meets the standards established in this document and adequately protects the public health, safety, and the environment.*

3. Environmental Protection Systems.

- (1) **Storm Water Control.** *Storm water control systems shall be designed to prevent erosion, discharge of pollutants, and protect the physical integrity of the landfill. Controls shall also be designed to prevent flow onto the active portion of the landfill during the peak discharge from a 24 hour, 25 year storm. Controls shall also be designed to control the run-off from the active portion of the landfill of at least the water volume resulting from the 24 hour, 25 year storm.*

- (2) **Surface and Groundwater Protection.** *Landfills shall prevent direct discharge of contaminated run-off or leachate from the landfill to any surface water bodies or to the groundwater, except in accordance with a Massachusetts Surface Water Discharge Permit or Groundwater Discharge Permit issued by the Department pursuant to 314 CMR 5.00 or 7.00, respectively, and the National Pollution Discharge Elimination System permit issued jointly by the U.S. Environmental Protection Agency and the Department.*

- (3) **Air Quality Protection System.** *Landfills shall control the concentration levels of explosive gas and malodorous gases and other air pollutants as necessary in order to maintain air quality and to prevent the occurrence of nuisance conditions or public health and safety problems. Air quality protection systems shall be designed to control the concentration of explosive gases to no greater than twenty-five percent (25%) of the Lower Explosive Limit (LEL) for individual components or total LEL detected in any on-site structure or at the property boundary at any time, excluding gas control or recovery system components or any leachate collection components.*
 - a. **Gas Vents.** *At a minimum, passive gas vents shall be provided at all facilities in all areas of the landfill over which final cover has been applied. Gas vents shall allow for the movement and adequate venting of landfill gases in order to prevent the buildup of explosive concentrations of gas and prevent lateral migration of gases beyond the boundaries of the landfill. Landfill gas vents must be designed:*
 1. *to maintain the integrity of the low permeability cap at the penetration of the cap;*
 2. *to provide adequate venting of landfill gases;*
 3. *with "T's", goosenecks or other equivalent cap at the top of the riser pipe to allow effective venting;*

4. to allow for retrofitting for active gas recovery or treatment at a later time if required;

5. to operate without clogging; and

6. to remain secure from vandalism.

b. Installation. *Gas vents shall be installed concurrently with the phased construction of a facility and in accordance with any permits or orders issued by the Department.*

4. Environmental Monitoring Systems.

(1) Ground Water Monitoring Systems.

a. Performance Standard. *A ground water monitoring system shall:*

1. be capable of yielding groundwater samples for analysis; and

2. consist of a sufficient number of wells properly located and screened at appropriate depths to detect the release of contaminants from the landfill into the groundwater.

b. Design Standard. *A ground water monitoring system shall:*

1. at a minimum be composed of one monitoring well or cluster of wells installed hydraulically upgradient from the limit of the filled or proposed fill area capable of yielding groundwater samples which are representative of background ground water quality;

2. at a minimum be composed of three (3) monitoring wells, or clusters of wells, installed hydraulically downgradient from the limit of the filled areas or areas proposed to be filled capable of detecting contaminants that migrate from the landfill to the groundwater;

3. be composed of wells drilled by a person licensed under Well Driller Regulations, 313 CMR 3.00;

4. *be composed of wells readily accessible to sampling equipment and located so that they do not interfere with routine facility operations; and*
5. *be composed of wells designed with locking caps and secured to prevent tampering with or vandalism.*
6. *be designed and constructed in accordance with DEP "Standard References for Monitoring Wells" (DEP Publication # WSC-310-91)*

(2) Surface Water Monitoring Systems.

- a. **Performance Standard.** *Where required by the Department, permanent surface water sampling location markers shall be established upstream and downstream of the residuals landfill facility in sufficient numbers and locations to adequately represent surface waters flowing through or past the facility.*
- b. **Design Standard.** *All surface water sampling stations shall be readily accessible to sampling equipment and located so that they do not interfere with routine facility operations.*

(3) Gas Monitoring Systems.

- a. **Performance Standard.** *Gas monitoring wells for the monitoring of explosive and other landfill gases shall be provided at all landfills to determine if gas is migrating beyond the boundaries of the landfill and shall:*
 1. *be capable of yielding representative air samples for analysis; and*
 2. *consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases.*

5. Environmental Monitoring Requirements.

(1) Surface and Ground Water Monitoring.

- a. *Sampling and analysis of surface and groundwater shall be conducted in accordance with methods approved by the Department.*
- b. *The owner/operator shall conduct surface and groundwater monitoring at sampling points approved by the Department.*

c. The owner/operator shall establish background surface water and groundwater quality at sampling points hydraulically upgradient of the landfill. Background water quality shall be determined by a minimum of four quarterly rounds of samples for each of the monitoring parameters listed in section 5(1)h below.

d. The owner/operator shall conduct surface and ground water monitoring on a schedule approved by the Department. At a minimum monitoring shall be performed semi-annually.

e. The Department may refuse to accept monitoring data where:

- 1. the sample was taken from a groundwater monitoring well for which the Department has not received and approved as-built construction plans, boring logs, and well locations;*
- 2. the sample was taken from a groundwater monitoring well constructed in a manner not approved by the Department;*
- 3. the analysis were performed by a laboratory other than a Massachusetts certified laboratory, unless the sample is accompanied by a complete QA/QC submittal; or*
- 4. the sample was not handled in accordance with the sampling and preservation requirements specified by the testing method.*

(f) All analytical results shall be submitted to the Department within 60 days after the scheduled sampling period or immediately upon receipt to the owner if earlier.

(g) Static ground water elevations shall be recorded prior to sampling whenever a monitoring well is to be sampled.

(h) At a minimum, surface and ground water samples shall be analyzed for the following parameters:

(1) general parameters:

- * pH (in situ);*
- * temperature (in situ);*
- * specific conductance (in situ);*
- * alkalinity;*
- * nitrogen series (TKN, ammonia-n, nitrate-n);*
- * total dissolved solids;*
- * chlorides;*

- * *iron;*
- * *manganese;*
- * *sulfate;*
- * *chemical oxygen demand (COD); and*
- * *dissolved oxygen*

(2) **inorganics:**

- * *arsenic;*
- * *barium;*
- * *cadmium;*
- * *chromium (total & cr⁺⁶)¹;*
- * *cyanide;*
- * *lead;*
- * *mercury;*
- * *selenium;*
- * *silver; and*
- * *zinc.*

(3) *all of the organic compounds included in EPA test method 624, as amended, and methyl ethyl ketone, xylenes, methyl isobutyl ketone, and acetone. In addition, unknown peaks having intensities greater than 5 times the background intensity shall be identified; and*

(4) *any additional priority pollutants as set forth under 40 CFR part 141, as amended, or required by the Department.*

(i) *Upon a determination by the Department that the facility may represent a threat to surface water or ground water, the Department may require the owner to conduct more frequent surface water or ground water sampling or to analyze for additional parameters than previously noted.*

(j) *If the concentrations of any of the parameters listed in section 8 of this document exceed the state or federal drinking water standards, Maximum Contaminant Levels (MCLs) or any alternative standards established by the Department, at any sampling point, the owner/operator shall:*

¹ *The Department may waive the requirement to analyze for hexavalent chromium provided that total chromium does not exceed 0.05 mg/l.*

(1) *notify the Department within fourteen (14) days of the finding;*

(2) *collect, analyze and submit to the Department another round of samples within 60 days of the prior date of sample collection and determine the concentration of all parameters identified above or as specified by the Department.*

(k) *Where the Department determines, based upon the ground and surface water analyses from a facility, that assessment and corrective actions shall be required, the operator shall undertake the assessment and corrective actions as determined by the Department.*

(2) **Leachate Monitoring.** *The owner/operator shall submit to the Department for review and approval a plan to properly sample and analyze leachate as deemed necessary by the Department. When leachate is discharged in accordance with a discharge permit issued by the Department the owner/operator shall monitor in accordance with the permit requirements. The owner/operator shall monitor the quantity and quality of leachate generated. The owner/operator shall submit the results of all leachate monitoring data to the Department with the inspection reports.*

(3) **Gas Monitoring.** *Gas monitoring shall be conducted as deemed necessary by the Department and on a frequency approved by the Department.*

6. Landfill Post Closure Requirements.

(1) **Post Closure Period.** *For the purposes of this section the post-closure period shall extend for a minimum of a thirty (30) year period. The Department may, upon request, reduce the post-closure period to less than 30 years if it finds that a shorter period will be sufficient to protect public health, safety, and the environment. The Department's review will include, but not be limited to, a consideration of the quantity and quality of leachate generated by the landfill, groundwater monitoring results, characteristics of the waste disposed, stability of the waste, design of the facility, and the location of the site. The Department also reserves the right to extend the post-closure period at any time prior to the time the post-closure period is due to expire where the Department finds an extension is necessary in order to ensure protection of public health, safety, or the environment or to mitigate adverse impacts.*

(2) Post-Closure Requirements. *During the post-closure period the owner/operator shall perform the following activities on any closed portion of the facility:*

a. take corrective actions to remediate and/or mitigate conditions that would compromise the integrity and purpose of the final cover;

b. maintain the integrity of the liner system and the final cover system;

c. collect leachate from and monitor and maintain the leachate collection system(s);

d. monitor and maintain the environmental monitoring systems for surface water, groundwater, and air quality;

e. maintain access roads;

f. maintain landfill gas control systems; and

g. protect and maintain surveyed benchmarks.

(3) Reporting Requirements. *The owner/operator, successors, or assigns shall submit a report every two years except as otherwise required by the Department during the post-closure period describing any activity at the site and summarizing the results of the environmental monitoring programs.*

(4) Termination of the Post-closure Period. *The post-closure period shall end on the date of the Department's written determination that the post-closure care, maintenance, and monitoring of the site are no longer required. Said determination in no way limits or absolves the owner of the liability for the site in the future.*

7. Post-closure Use of Residuals Landfills.

(1) Applicability. *No site on which a residuals landfill was operated shall be used for any other purpose without the prior written approval of the Department.*

(2) Submission of Post-Closure Use Plans. *Any person proposing to use a residuals landfill for any purpose following closure of a facility shall submit plans for the post closure use to the Department for review and approval.*

(3) Criteria for Approval of a Post-Closure Use. *Any post-closure use of a residuals landfill shall be accomplished such that:*

a. the final contours of the landfill are not altered, unless the Department determines:

1. the disturbance is necessary for the proposed use and that it will not result in an adverse impact on public health, safety, or the environment; or

2. the disturbance is necessary to reduce threats to public health, safety, or the environment;

b. the integrity of the final cover, the components of any containment system and the function of the facility's monitoring systems are not impaired;

c. drainage facilities, ponds, swales, ditches, or other erosion/sedimentation controls are maintained.

(4) Post-Closure Construction. *Construction during the post-closure phase shall be accomplished in accordance with the following:*

a. buildings shall be above grade structures. Any penetration of the landfill final cover shall be designed and constructed to ensure that the integrity of the final cover system is maintained. Construction of basements which penetrate the drainage layer or low permeability layer is prohibited;

b. buildings shall be constructed to prevent accumulation of gas within the structure. Buildings shall include gas monitoring and warning systems and may be required to include an active gas venting system; and

c. all utility connections shall be designed and constructed with flexible connections.