

PERMIT MODULE III SANITARY LANDFILL DESIGN

III.A. LINER DESIGN

The configuration of the bottom liner for cells 5 and 12 includes the following components (from top to bottom):

- 12" protective layer of VDOT No. 10 stone;
- Leachate collection layer of VDOT No. 57 stone;
- Soil liner consisting of two feet of compacted soil with a permeability of $k = 1.0 \times 10^{-3}$ cm/sec;
- 8 oz/sy non-woven geotextile filter fabric;
- Geonet comprised of HDPE drainage netting;
- Synthetic flexible membrane liner consisting of dual textured 60-mil HDPE geomembrane; and
- 12" bedding layer comprised of rock dust.

For cells 6 through 11 and 15 through 21, the bottom liner system consists of the following composite liner components (from top to bottom):

- 12" protective layer;
- 4 oz/sy non-woven geotextile fabric;
- 18" drainage layer consisting of soils with a permeability $k = 1.0 \times 10^{-3}$ cm/sec;
- 8 oz/sy non-woven geotextile fabric;
- Synthetic flexible membrane liner consisting of dual textured 60-mil HDPE geomembrane; and
- Soil liner consisting of two feet of compacted soil with a permeability of $k = 1.0 \times 10^{-3}$ cm/sec.

For Cells 22 through 24, the bottom liner system consists of the following alternate liner components (from top to bottom):

- 18" granular drainage layer consisting of soils with a permeability of $k = 1.0 \times 10^{-3}$ cm/sec (on the side slopes, the drainage layer will be replaced by an 18" protective soil layer);
- Geocomposite drainage medium;
- Synthetic flexible membrane liner consisting of dual textured 60-mil HDPE geomembrane;
- Geosynthetic clay liner (GCL); and
- Soil liner consisting of one foot of compacted soil subbase with unspecified permeability.

For Cells 25 through 27, the bottom liner system will consist of the following alternate liner components (from top to bottom):

- 18" granular drainage layer consisting of soils with a permeability of $k \approx 1.0 \times 10^{-3}$ cm/sec (on the side slopes, the drainage layer will be replaced by an 18" protective soil layer);
- Geocomposite drainage medium;
- Synthetic flexible membrane liner consisting of dual textured 60-mil HDPE geomembrane;
- Geosynthetic clay liner (GCL); and
- Soil liner consisting of one foot of compacted soil subbase with unspecified permeability.

The reconfigured MSE Berm Liner System consists of the liner system on the bottom of the berm, which overlies either natural materials or existing waste. The base liner system consists of the following layers, from top to bottom:

- MSE Berm Fill;
- Geocomposite Drainage Layer;
- 60-mil thick high-density polyethylene (HDPE) geomembrane liner;
- Geosynthetic Clay Liner; and
- Prepared subgrade.

The MSE Berm interior liner system is the liner system that lies on top of the back slope of the MSE berm. The MSE berm interior liner system also functions as the proposed waste containment liner system. The interior liner consists of the following (from top to bottom):

- 18-inch thick drainage layer;
- Geocomposite Drainage Layer;
- 60-mil thick HDPE Geomembrane Liner;
- Geosynthetic Clay liner; and
- MSE Berm Fill.

The MSE berm top liner system is the liner system that lies on the top of the MSE berm, overlaying the MSE berm fill, where the access road and stormwater ditch are located. The top liner consists of the following (from top to bottom):

- Structural Fill/Gravel;
- Geocomposite Drainage Layer;
- 60-mil HDPE Geomembrane Liner;
- Geosynthetic clay Liner; and
- MSE Berm Fill.

The Quarry (Cell 28) bottom liner system consists of the following (from top to bottom):

(Subtitle D Liner)

- 18-inch drainage layer;
- Geocomposite Drainage Net (GDN);
- 60-mil thick HDPE Textured Geomembrane liner;

- 24-inch thick Compacted Soil Liner;
- Woven Geotextile;
- 12-inch minimum Aggregate Underdrain;
- Subgrade

Or...

(Alternate Liner System)

- 18-inch drainage layer;
- Geocomposite Drainage Net (GDN)
- 60-mil thick HDPE Textured Geomembrane Liner;
- Geosynthetic Clay Liner;
- 40-mil thick HDPE Liner;
- 12-in soil subbase
- Woven Geotextile
- 12-inch minimum Aggregate Underdrain
- Subgrade

The liner system for the Quarry sidewalls is comprised of two basic elements: sidewall bench configuration and sidewall vertical configuration. Each of these configuration elements has two (2) liner system options. See Permit Drawing Nos. 75A, 75B, and 75C.

The Sidewall Bench Configuration (from top to bottom):

- Woven Geotextile
- Geocomposite Drainage Net
- 60-mil thick HDPE Textured Geomembrane
- Geosynthetic Clay Liner
- Concrete Structural Support

Or...

- Woven Geotextile
- Geocomposite Drainage Net (GDN);
- 60-mil thick HDPE Textured Geomembrane;
- 12-inch Compacted Soil Liner

The Sidewall Vertical Configuration (from inside to outside):

- Woven Geotextile;
- Geocomposite Drainage Net (GDN);
- 60-mil thick HDPE Textured Geomembrane;
- Concrete or Vinyl Structural Support

Or...

- Woven Geotextile;

- Geocomposite Drainage Net (GDN);
- 60-mil thick HDPE Textured Geomembrane;
- Soil Subbase/Berm

III.B. LINER CONSTRUCTION & CERTIFICATION

The landfill base liner shall be constructed in accordance with the approved Design Plans, Technical Specifications, and Construction Quality Assurance Plan.

Prior to expansion into each new Phase, the permittee shall submit all required certification documents as indicated in Permit Module I Section I.D.1 – 3 as required by 9 VAC 20-81-490.A. Once this documentation has been submitted and approved by the Department, and a site inspection of the new Phase has been conducted, a Certificate to Operate (CTO) must be issued by the Regional Office prior to the facility accepting waste in the newly constructed Phase.

III.C. LANDFILL GAS MANAGEMENT SYSTEM

III.C.1. The facility shall implement and maintain a gas management plan in accordance with 9 VAC 20-81-200 to provide for the protection of public health, safety, and the environment during the periods of operation, closure, and post-closure care, in accordance with the following requirements:

III.C.1.a. The concentration of methane gas generated by the facility shall not exceed 25 percent of the lower explosive limit for methane (1.25% methane) in facility structures (excluding gas control or recovery system components); and

III.C.1.b. The concentration of methane gas shall not exceed the lower explosive limit for methane (5.0% methane) at the facility boundary.

III.C.2. The facility shall perform quarterly landfill gas monitoring of the perimeter gas monitoring network and facility structures in accordance with 9 VAC 20-81-200.B.4.

III.C.3. The facility shall make any necessary repairs to the gas monitoring network (including, but not limited to, dewatering if necessary because probes cannot be routinely monitored or making repairs to the concrete pad, cap, lock, or cover) and gas management and remediation systems prior to the next gas quarterly monitoring event unless an alternate repair timeframe is requested and approved.

III.C.4. Perimeter Gas Monitoring Network

III.C.4.a. The facility shall install and maintain perimeter gas monitoring probes at the locations specified in the Landfill Gas Management Plan. The current perimeter gas monitoring network consists of a series of five

landfill gas monitoring probes [GP-3, GP-7, GP-8, GP-9R and GP-10R] located along the southern and southwestern property boundaries. Two additional landfill gas monitoring probes [GP-11 and GP-12] are proposed to be installed with Cell 27.

- III.C.4.b. If the perimeter gas monitoring network is expanded with the installation of new or replacement gas monitoring wells, the facility shall submit copies of the well boring logs and probe as-builts for inclusion in within 30 days following construction completion.
- III.C.4.c. All existing and future onsite structures shall be monitored in accordance with condition III.C.2 or have explosive gas monitoring equipment installed.

III.C.5. Active Landfill Gas Management

The existing and planned gas control system at the landfill consists of the following main elements:

- III.C.5.a. A series of vertical gas extraction wells installed more than 75% of the depth of waste (but no closer than 15 feet from top of liner system) and spaced at approximately 300-foot to 400-foot intervals which equates to having a theoretical radius of influence about 2.5 times the well depth.
- III.C.5.b. A series of horizontal collectors installed on the landfill to augment gas collection via the vertical extraction wells. The main gas collection header pipe is 24" diameter HDPE and the lateral connection lines are 6" diameter HDPE.
- III.C.5.c. A network of header and lateral piping installed to connect the vertical extraction wells and horizontal collectors, and to direct the collected gas to the 16 MW Energy Recovery Facility (ERF) and/or 3 Utility Flares.
- III.C.5.d. A condensate control system consisting of condensate traps located at low points in the piping network and will be pumped or drained directly into the leachate collection manholes located at the site and ultimately connect to the Chesterfield County sanitary sewer and discharge to Proctors Creek Wastewater Treatment Plant.

III.C.6. Landfill Gas Remediation

- III.C.6.a. Should the results of landfill gas monitoring indicate concentrations of methane in excess of the methane action level (4% methane or 80% of the lower explosive limit (LEL) at the facility boundary or 1.25% or 25% LEL in facility structures), the Operator shall:

- i. Take all immediate steps necessary to protect public health and safety (safety precautions should include evacuation of occupied structures, if affected; notifying local fire/safety officials of potential landfill gas migration; and coordinating for off-site monitoring of structures located within 1,000 feet of the facility boundary);
 - ii. Investigate any active or passive gas control or remediation systems for proper connections and operation and make adjustments to vacuum, flow, or control valves, remove condensate, or make any other adjustments or repairs necessary to ensure proper operation, if applicable;
 - iii. Provide written notification within 5 working days of the methane action level exceedance indicating what has been done or is planned to be done to resolve the problem; additionally, the facility shall implement a remediation plan within 60 days and submit the plan to DEQ for approval.
- III.C.6.b. Should the results of landfill gas monitoring indicate concentrations of methane in excess of the methane compliance level (5% methane or 100% of the LEL at the facility boundary or 1.25% methane or 25% LEL in facility structures), the Operator shall:
- i. Perform the response actions outlined under III.C.6.a.i. and a.ii.;
 - ii. Provide 24-hour oral notification of the methane compliance level exceedance;
 - iii. Provide written notification within 5 working days of the methane compliance level exceedance containing a description of the circumstances and its cause; the period of occurrence, including exact dates and times, and, if the circumstance has not been corrected, the anticipated time it is expected to continue. It shall also contain steps taken or planned to reduce, eliminate, and prevent reoccurrence of the circumstances resulting in an unusual condition or noncompliance;
 - iv. Increase the gas monitoring frequency per the requirements of III.C.6.c.
 - v. Implement the next phase of the approved remediation plan within 60 days or implement a revised remediation plan and submit the plan to DEQ for approval; *and*
 - vi. Assess the spacing of the entire perimeter monitoring network. If the spacing between any probes exceeds 250 foot spacing, the facility shall install additional perimeter probes unless the facility can show that such spacing is unwarranted based on site-specific

factors.

- III.C.6.c. The facility shall monitor a subset of the perimeter monitoring network consisting of the exceeding probe(s) and structure(s) and those probes/structures immediately adjacent, such that at least one (1) probe on either side of each exceeding probe/structure is being monitored at the increased frequency.
- i. The increased monitoring frequency shall be weekly unless an alternate frequency is approved by the Department.
 - ii. Weekly monitoring shall continue until three (3) consecutive monthly readings yield methane concentrations below 80% LEL at the facility boundary or 25% LEL in facility structures. At that time, the facility shall implement monthly monitoring of the network subset until three (3) consecutive monthly readings yield methane concentrations below 80% LEL at the facility boundary or 25% LEL in facility structures. At that time, the facility can return to quarterly monitoring.
 - iii. Once the required minimum number of consecutive monitoring events resulting in gas concentrations below action level are completed per III.C.6.c.ii. to justify returning to a lesser monitoring frequency, the facility shall submit monitoring data for ALL monitoring events since the implementation of the remedial action or remediation plan phase in order to assess progress towards return to compliance. If the return to a lesser monitoring frequency takes longer than six (6) months, monitoring data shall be submitted in tabular form with an accompanying graph to clearly document trends in data over time to justify the change in monitoring frequency.

III.D. LEACHATE MANAGEMENT

III.D.1. Leachate Storage

The leachate collection system for the landfill area will discharge via the sideslope riser pumps into a force main to the on-site lift station and ultimately into the sanitary sewer system. The quarry design incorporates an optional above grade leachate storage tank farm to store leachate which must be sent to the on-site wastewater pre-treatment system prior to entering into the sanitary sewer system.

III.D.2. Leachate Treatment and Disposal

All leachate will be collected and pumped via forcemain to the on-site wastewater pre-treatment system and then directly discharged to Chesterfield County's Sanitary Sewer and ultimately to the Proctors Creek Wastewater

Treatment Plant.

III.D.2. Leachate Contingency

An Emergency Generator shall be installed to provide back-up power as contingency in the event of an extended power outage.

III.E UNDERDRAIN SYSTEM SAMPLING ANALYSIS

III.E.1. Underdrain System Description

This facility includes an underdrain system as part of the landfill design. The purpose of the underdrain system is to provide temporary or intermittent relief of hydrostatic pressure that may build up beneath the landfill liner. The underdrain system includes 10 underdrains: UD-7E, UD-7W, UD-8E, UD-8W, UD-9, UD-15, UD-22, UD-24, UD-26, and UD-27. These underdrains each discharge through outfalls around the perimeter of the landfill.

III.E.2. Underdrain System Performance Requirement

The landfill, including any discharge of water collected in an underdrain system, may not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act (33 USC § 1251 et seq.), including, but not limited to, VPDES requirements and Virginia Water Quality Standards (9VAC25-260).

III.E.3. Underdrain System Performance Sampling

III.E.3.a. To ensure the underdrain system is operating as designed, the collected water shall be sampled at the 10 underdrain outfall locations on a quarterly basis during the facility's active life and post-closure care period, but only if there is sufficient flow to allow proper sampling. The purpose of the sampling is to detect whether or not landfill constituents have gained entry into the system

III.E.3.b. The Samples shall be collected prior to pipe discharge and not in the receiving channel. The samples shall be collected, handled, and transported in a manner consistent with applicable USEPA RCRA guidance including Chain-of-Custody procedures. The collected water shall be analyzed for the constituent list provided below using USEPA SW-846 methods, unless an alternate method has been approved by the Department.

III.E.3.c. Both the method used and the laboratory completing the work must be VELAP certified/accredited (1 VAC 30-45 & 36). Laboratory LOQ's must be equivalent to those achieved during the groundwater

monitoring well compliance sampling undertaken for 9 VAC 20-81-250.B or C and Permit Modules X and XI.

III.E.4 Underdrain System Sampling List

The collected water from the underdrains shall be analyzed for the Table 3.1 Column A list of volatile organic compounds (VOC' s) under 9 VAC 20-81-250.B which can be analyzed under Method 8260.

III.E.5 Underdrain System Sampling Evaluation

III.E.5.a. If any VOC is found at quantifiable levels (equal to or above the LOQ) in the underdrain sample, the Permittee must notify the Director within 15 days of receipt of final laboratory analytical results.

III.E.5.b. The notification must include: a plan to obtain a single verification sample within 15-days of the notification, a plan to submit an Alternate Source Demonstration within 60-days of the notification if the identified constituents are proven to be from a laboratory error or cross-contaminants sourced from something other than the solid waste, or a statement that the underdrain discharge containing landfill constituents will be handled in a manner consistent with the requirements of 9 VAC 20-81-210.D.

III.E.5.c If the underdrain discharge is found to contain landfill constituents, then the discharge shall be collected for treatment until such time as the facility obtains Department approval in order to discharge the impacted underdrain(s) to surface water.

III.E.6 Underdrain System Remediation

The results of the underdrain sampling and analysis shall be maintained on site in the facility Operating Record during the active life and post-closure care period.

III.E.7 Underdrain System Sample Record Keeping

The results of the underdrain sampling and analysis shall be maintained on site in the facility Operating Record during the active life and post-closure care period.

III.F GRADIENT CONTROL SYSTEM SAMPLING AND ANALYSIS

III.F.1 Gradient Control System Description

This facility includes a groundwater inward gradient control system as part of the landfill design for the quarry disposal unit. The purpose of the inward gradient pumping system is to eliminate any upward pressure from the groundwater potentiometric head on the landfill liner. The groundwater gradient control system for the quarry disposal unit consists of one gradient control sampling point (GC-1), and four "mezzanine" collection sampling points (GC-2m, GC-3m, GC-4m, and GC-5m) located at varied elevations along the quarry benches. GC-2m and GC-3m are designed to discharge into GC-1, which is then pumped into a perimeter sediment basin. GC-4m and GC-5m are designed to discharge through separate outfalls around the perimeter of the landfill. All gradient control points are designed with the ability to obtain samples prior to mixing with discharge from the other gradient control points.

III.F.2 Gradient Control System Performance Requirement

The landfill, including any discharge of water collected in a gradient control or mezzanine collection system, may not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act (33 USC § 1251 et seq.), including but not limited to, VPDES requirements and Virginia Water Quality Standards (9VAC25-260).

III.F.3. Gradient Control System Performance Sampling

III.F.3.a. To ensure the gradient control and mezzanine collection system is operating as designed, the collected water shall be sampled at the designated gradient control and mezzanine collection points on a quarterly basis during the facility's active life and post-closure care period, but only if there is sufficient flow to allow proper sampling. The purpose of the sampling is to detect whether or not landfill constituents have gained entry into the system.

III.F.3.b. The Samples shall be collected prior to pipe discharge and not in the receiving channel. The samples shall be collected, handled, and transported in a manner consistent with applicable USEPA RCRA guidance including Chain-of-Custody procedures. The collected water shall be analyzed for the constituent list provided below using USEPA SW-846 methods, unless an alternate method has been approved by the Department.

III.F.3.c Both the method used and the laboratory completing the work must be VELAP certified/accredited (1 VAC 30-45 &

36). Laboratory LOQ's must be equivalent to those achieved during the groundwater monitoring well compliance sampling undertaken for 9 VAC 20-81-250.B or C and Permit Modules X and XI.

III.F.4 Gradient Control System Sampling List

The collected water from the gradient control and mezzanine collection system shall be analyzed for the Table 3.1 Column A list of volatile organic compounds (VOC 's) under 9 VAC 20-81-250.B which can be analyzed under Method 8260.

III.F.5. Gradient Control System Sample Evaluation

III.F.5.a. GC-2m and GC-3m are designed to drain into the gradient control system and can be sampled upon mixing with GC-1. However, GC-2m and GC-3m shall be sampled separately for the initial sampling event upon operation of the quarry disposal unit. If there are no detections of VOC's above the limit of quantification (LOQ) during the initial sampling event, then the discharge from GC-2m and GC-3m can be drained into the gradient control system and thenceforward sampled from GC-1 only. GC-4m and GC-5m do not discharge into the gradient control system and therefore must be routinely sampled separately.

III.F.5.b. If any VOC is found at quantifiable levels (equal to or above the LOQ) in the gradient control and mezzanine collection system samples, the Permittee must notify the Director within 15 days of receipt of final laboratory analytical results.

III.F.5.c. The notification must include: a plan to obtain a single verification sample within 15-days of the notification, a plan to submit an Alternate Source Demonstration within 60-days of the notification if the identified constituents are proven to be from a laboratory error or cross-contaminants sourced from something other than the solid waste, or a statement that the gradient control and mezzanine collection system discharge containing landfill constituents will be handled in a manner consistent with the requirements of 9 VAC 20-81-210.D.

III.F.5.d. If the gradient control and mezzanine collection system discharge is found to contain landfill constituents, then the discharge shall be collected for treatment until such time as the facility obtains Department approval in order to

discharge the impacted gradient control and mezzanine collection system to surface water.

III.F.6. Gradient Control System Remediation

The Director may require the Permittee to undertake an assessment of options to remediate the condition(s) causing the release of solid waste constituents into the gradient control and mezzanine collection system. If the proposed remediation or actions related to the collection/disposal of the discharge from the gradient control and mezzanine collection system requires modification of the Permit or associated Permit Document, the proposed modifications shall be submitted to the Department within 30 days of the notification.

III.F.7. Gradient Control System Record Keeping

The results of the gradient control and mezzanine collection system sampling and analysis shall be maintained on site in the facility Operating Record during the active life and post-closure care period.

END OF MODULE III