COMMONWEALTH OF VIRGINIA
Department of Environmental Quality

Subject: Air Guidance Memo No. ACG-016 and Waste Guidance Memo No. LPR-SW-2026-01: Early Detection and Management of Elevated Temperature Landfills

To: DEQ Regional Air Permitting Managers; DEQ Regional Air Compliance Managers; DEQ Regional Land Protection Program Managers

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Summary:
Elevated temperature landfill (ETLF) conditions have recently occurred at multiple permitted municipal solid waste (or sanitary) landfills in Virginia. These landfills are performing required air and solid waste regulatory monitoring, but some did not respond to impending ETLF conditions when detected. This has resulted in noxious odors, unpermitted discharges of leachate to surface water, and skyrocketing costs beyond available financial assurance. Therefore, DEQ is taking a unified multi-media approach to address landfills with rising temperatures to ensure that ETLF conditions are recognized and addressed. The purpose of this guidance is to ensure early detection of ETLFs through proactive monitoring, to ensure appropriate financial assurance from owner/operators, and to establish appropriate corrective actions to avoid additional negative environmental impacts in Virginia.

Electronic Copy:
Once effective, an electronic copy of this guidance will be available on:

- The Virginia Regulatory Town Hall under the Department of Environmental Quality (DEQ) (http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440);
- DEQ's website at https://www.deq.virginia.gov/news-info/shortcuts/laws-regulations/land-waste.

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Certification:
As required by Subsection B of § 2.2-4002.1 of the APA, the agency certifies that this guidance document conforms to the definition of a guidance document in § 2.2-4101 of the Code of Virginia.

Disclaimer:
This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate or prohibit any particular action not otherwise required or prohibited by law or regulation. If alternative proposals are made, such proposals will be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

Table of Contents

I. Introduction and Scope

A. Air Regulations

Landfill gas (LFG) is generated from the decomposition of municipal solid waste (MSW). The generation of this gas, while a normal part of decomposition, can become out of control if a subsurface reaction results in higher temperatures in the landfill. These conditions are not a landfill fire; therefore, this scenario is referred to as an "elevated temperature landfill" or ETLF.

Applicable state and federal air regulations (9VAC5-40 Articles 43 and 43.1, 40 CFR 60 Subpart XXX (NSPS XXX), and 40 CFR 63 Subpart AAAA (MACT AAAA)) focus on collecting and controlling methane, non-methane organic compounds, hazardous air pollutants, and other regulated air pollutants found in LFG. While these air regulations do not regulate the design of the waste disposal area, they do require MSW landfills to develop and maintain a gas collection and control system (GCCS) design plan and to monitor the installed system to ensure proper operation and maintenance. To achieve proper operations and maintenance, each facility monitors specific LFG parameters and takes appropriate actions based on the results of that monitoring.

As a general operating parameter, air regulations use temperature thresholds to ensure proper landfill operations. With regard to ETLFs, temperature monitoring is of primary importance. Based on available, nationwide information, DEQ has identified landfills of larger size (waste capacity) as having the highest potential to become an ETLF. These landfills use the temperature requirements of MACT AAAA (145°F), which allow for the approval of higher operating values (HOVs) as outlined in 40 CFR 63.1958(c)(2). In the past, DEQ has approved HOVs (i.e., temperatures greater than 145°F) without additional monitoring requirements. Based on the proliferation of requests and increased incidence of ETLFs in Virginia, this approach is insufficient. DEQ has determined that monitoring of additional parameters is needed to ensure a proactive approach to managing, and potentially avoiding, an ETLF scenario.

B. Solid Waste Management Regulations, Permits and Modifications

The Virginia Solid Waste Management Regulations (VSWMR) (9VAC20-81) establish siting, design, construction, operation, monitoring, closure, post-closure care, and groundwater corrective action standards for landfills. All landfills are required to have a solid waste permit that incorporates a Design Report and Plans, Construction Quality Assurance Plan, Gas Management Plan, Leachate Management Plan, Groundwater Monitoring Plan, Closure Plan, and Post-Closure Care Plan. Landfills must also establish financial assurance (discussed further in Section I.C.). Submission instructions for these plans are available on the Virginia Regulatory Town Hall website. Landfills are also required to maintain an Operations Manual in the facility operating record which consists of an operations plan, an inspection plan, a health and safety plan, an unauthorized waste control plan, an emergency contingency plan, and a landscaping plan (9VAC20-81-485).

Landfill permits are issued for the life of the landfill (through termination of post-closure care in accordance with 9VAC20-81-170.C.), and procedures for permit modifications are provided in 9VAC20-81-600. Permit modifications can be requested by the permittee, DEQ Director, or any interested person to incorporate changes in facility design, monitoring activities, regulatory requirements, or to address potential significant adverse effects to air, land, surface water, or groundwater. These modifications may include the incorporation of Gas Remediation or Groundwater Corrective Action Plans when monitoring results exceed established thresholds. Additionally, 9VAC20-81-430 of the VSWMR, specifies that the DEQ Director may include conditions in a solid waste permit that he finds necessary to protect public health or the environment or to ensure compliance with the VSWMR

Although the VSWMR does not directly specify standards to identify, monitor, or manage potential ETLF conditions, the VSWMR and existing solid waste permits do already address many aspects of landfill management

that are directly impacted by potential ETLF conditions including, but not limited to, leachate management, landfill gas monitoring, gas management and remediation, odor management, and cover installation and maintenance.

DEQ has determined that modifications to solid waste permits are appropriate to require monitoring of additional parameters to ensure a proactive approach to managing, and potentially avoiding, an ETLF scenario. This guidance document identifies the specific requirements that should be incorporated into solid waste permits for all landfills with gas collection and control systems required in accordance with the air regulations to facilitate early identification, monitoring, and management of potential ETLF conditions. DEQ Director initiated permit modifications for applicable landfill permits will be completed in accordance with 9VAC20-81-430 and 9VAC20-81-600 to add site-specific conditions consistent with this guidance document. Owners and operators will be expected to implement the standards specified in their permit immediately upon permit issuance, or in accordance with the specified compliance schedule (9VAC20-81-490.H.1.).

C. Financial Assurance Regulations

The Financial Assurance Regulations for Solid Waste Disposal, Transfer and Treatment Facilities (FAR) (9VAC20-70) require that owners and operators of permitted waste management facilities be financially responsible for closure, post-closure care, and corrective action at their facilities. Facility owners and operators demonstrate financial assurance by obtaining one, or a combination of, allowable financial assurance mechanisms in the amount equal to the landfill closure, post-closure, and groundwater corrective action cost estimates approved by DEQ. Whenever there is a change in operations that affects the cost estimates for landfill closure, post-closure care, or groundwater corrective action, the amount of financial assurance demonstrated by a permittee must be adjusted to cover those costs (9VAC20-70-111 through 113).

As discussed in Section B. above, ETLFs experience numerous issues which add to higher operational, closure, and post-closure costs. Because of these increased operational costs and risk of bankruptcy and facility abandonment by the owner or operator of the ETLF, closure and post-closure costs must be adjusted as needed to address additional monitoring and maintenance costs.

D. How to Use this Guidance Document

This guidance applies only to MSW landfills required to comply with MACT AAAA temperature standards for operating the GCCS. This guidance identifies operational and permitting activities under the Air, Solid Waste, and Financial Assurance programs to detect and manage ETLF conditions. Landfills and associated activities have been divided into three, tiered categories based on the risk of developing ETLF conditions:

1. Category 1
   Landfills required to comply with the operational standard for temperature in 40 CFR 63.1958(c), which do not have an approved temperature HOV greater than 145°F.

2. Category 2
   Landfills with MACT AAAA HOV demonstration approvals between 150°F and 170°F, but no approved allowance to operate above 170°F.

3. Category 3
   Landfills with MACT AAAA applicable gas collection wells exhibiting hydrogen (H_2) greater than 5% or temperatures greater than 170°F which cannot be corrected within 15 days.

The criteria and thresholds for each category are based on the landfill's applicability to the operational standard for temperature in 40 CFR 63.1958(c), the need for HOVs for temperature in gas collection wells, and the results from gas collection well monitoring.

DEQ considers landfills in Category 1 to have the lowest risk for developing ETLF conditions. Additional gas and leachate monitoring for landfills in Category 1 are appropriate to collect data and evaluate trends that could provide early identification of potential ETLF conditions. Modifications to solid waste permits should be used to establish additional monitoring and reporting requirements. Financial assurance adjustments (as required under the current regulations) should be requested to adjust for these additional monitoring and maintenance activities.

Landfills in Category 2 are more likely to develop ETLF conditions if proactive measures are not enacted. Additional monitoring and management strategies to prepare for and react to potential ETLF conditions are appropriate for these facilities. HOV approvals for temperatures between 150°F and 170°F should be used to specify additional gas monitoring and evaluation of gas well construction materials. Modifications to solid waste permits should be used to establish additional leachate monitoring and management strategies and incorporate gas management plan updates for consistency with changes under the Air program. Financial assurance adjustments (as required under the current regulations) should be requested to adjust for these additional monitoring and maintenance activities.

Landfills in Category 3 are considered to be ETLFs. Additional gas and leachate monitoring to track the spread of ETLF conditions as well as corrective actions to manage and control ETLF conditions are appropriate for these facilities. Modifications to the Gas Collection and Control System (GCCS) Design Plan and solid waste permits should be used to reflect additional monitoring and corrective actions. Financial assurance adjustments (as required under the current regulations) should be requested to adjust for these additional monitoring and maintenance activities.

II. Authority

This document provides guidance related to DEQ air compliance activities at MSW landfills in accordance with the air regulations, specifically 9VAC5-40 Part II Article 43, 9VAC5-40 Part II Article 43.1, 9VAC5-50 Part II Article 5 (delegation of NSPS XXX), and 9VAC5-60 Part II Article 2 (delegation of MACT AAAA). The authority for promulgation of these regulations and development of this guidance is contained in § 10.1-1308 of the Code of Virginia.

This document also provides guidance related to DEQ solid waste permitting, compliance, and financial assurance demonstrations for ETLF monitoring and management activities at solid waste disposal facilities in accordance with the VSWMR (9VAC20-81) and the FAR (9VAC20-70). The authority for promulgation of these regulations and development of this guidance is contained in § 10.1-1402 of the Code of Virginia. This section also authorizes the collection of data necessary to conduct the state waste programs, including data on resource recovery and the identification and amounts of waste generated, transported, stored, treated or disposed. Va. Code § 10.1-1458 provides that every person that DEQ has reason to believe is generating, storing, transporting, disposing of, or treating waste shall, on request of DEQ, furnish such plans, specifications, and information as DEQ may require in the discharge of its duties under the Act. Landfill solid waste permits (in Module I) also require the permittee to furnish to the Director, within a reasonable time, any relevant information that the Director may request to determine compliance with the permit, regulations, or Waste Management Act.

III. Definitions

The definitions in the following statutes and regulations apply to the implementation of these procedures:

- § 10.1-1300 of the Code of Virginia (Air Pollution Control Board)
- § 10.1-1400 of the Code of Virginia (Waste Management Act)
- 9VAC5-10 (General Definitions)
- 9VAC5-40-5810, 9VAC5-40-5930 (Existing MSW Landfills)
- 40 CFR 63.1990 (MACT AAAA)

- 40 CFR 60.671 (NSPS XXX definitions)
- 9VAC20-70-10 of the FAR
- 9VAC20-81-10 of the VSWMR

Key statutory and regulatory definitions applicable to this guidance, as well as additional definitions specific to this guidance, are provided below.

“Elevated Temperature Landfill” or “ETLF” means (for the purpose of this document) a municipal solid waste (MSW) landfill that exhibits temperatures above regulatory thresholds due to abnormal reactions within the waste mass. These reactions can lead to changes in landfill gas composition, noxious odors, rapid waste settlement, degradation of leachate quality, and increased leachate production. Elevated temperature landfills are not landfills that have experienced a fire; ETLFs are characterized by conditions that require different management strategies compared to typical MSW landfills.

“Facility” means solid waste management facility unless the context clearly indicates otherwise (9VAC20-81-10).

“Financial Assurance” means a financial mechanism(s) provided by the permittee to ensure that sufficient funds are available to cover costs associated with landfill closure, post-closure care, and groundwater corrective action if the owner or operator is unable or unwilling to perform closure, post-closure care, or corrective action. Allowable financial mechanisms are found in 9VAC20-70-120 through 250 of the FAR.

“Higher Operating Value Demonstration” or “HOV Demonstration” means (for the purpose of this document) a process that allows an owner or operator of an MSW landfill to establish a higher operating temperature value at a particular gas collection well. This demonstration is necessary to ensure that the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens, and must demonstrate such with supporting data.

“Leachate” means a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials from such waste. Leachate and any material with which it is mixed is solid waste; except that leachate that is pumped from a collection tank for transportation to disposal in an offsite facility is regulated as septage, leachate discharged into a waste water collection system is regulated as industrial waste water and leachate that has contaminated groundwater is regulated as contaminated groundwater (9VAC20-81-10).

“MACT AAAA” means National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills. MACT AAAA sets specific requirements for controlling emissions of hazardous air pollutants (HAPs) from municipal solid waste (MSW) landfills.

“VSWMR” means Virginia Solid Waste Management Regulations (9VAC20-81)

IV. Category 1: Landfills required to comply with the operational standard for temperature in 40 CFR 63.1958(c), which do not have an approved temperature HOV greater than 145°F

A. Gas Monitoring for All MACT AAAA Regulated Gas Collection Wells

Due to the increasing frequency of ETLFs, operators of all Category 1 landfills should monitor each regulated wellhead monthly for methane, carbon dioxide, and the methane to carbon dioxide ratio (CH_4:CO_2). By the end of each calendar month, the methane, carbon dioxide, and methane to carbon dioxide ratio data for the previous month should be reported to DEQ electronically, in addition to the standards required by 40 CFR 63.1960(a). If the ratio of methane to carbon dioxide in any wellhead is below 0.9 in any given month, the owner or operator should notify

DEQ within 30 days from the date of monitoring and include an evaluation regarding if the lowered ratio is due to a normal decline of methane production over time or an indicator of potential ETLF conditions. The data should also be submitted to DEQ within the semi-annual report required by 40 CFR 63.1981(h). These requirements should be incorporated through site specific solid waste permit conditions.

B. Leachate Monitoring and Management

Increases or decreases in leachate volume can signal operational issues such as poor daily, intermediate, or final cover performance, leachate pump failures, leachate line blockages, or unidentified releases. Potential ETLFs may exhibit increasing volumes of leachate, which can lead to leachate seeps, leachate head exceedances on the bottom liner, slope instability, leachate discharges to surface water, pressurized leachate (geysers), inefficiencies in landfill gas collection systems, and increased costs to manage and dispose of leachate. Increased leachate volumes or changes in leachate quality may also cause issues at the receiving wastewater treatment plant (WWTP), which could result in the WWTP rejecting some or all leachate for disposal.

While WWTPs receiving landfill leachate typically require sampling and analysis for specified constituents, the VSWMR has no specific monitoring or reporting requirements for leachate quantity or quality. Landfill solid waste permits do require facilities to maintain leachate monitoring records, including documentation of the authorization to discharge leachate into the receiving WWTP, the volume of leachate sent to the WWTP, and periodic leachate sampling analytical results. However, many existing solid waste permits do not specify the exact type or frequency of leachate sampling and analysis to occur. This guidance document identifies leachate monitoring and reporting activities associated with ETLF conditions that should be incorporated into applicable solid waste permits.

Depending on where and how leachate is collected and monitored, leachate volumes and sampling results may include other liquids such as landfill gas condensate, contact stormwater, and non-contact stormwater. Leachate volume and quality should be monitored independent of other landfill liquid discharges if possible.

1. Leachate Generation Rate

   Owners and operators of all Category 1 landfills should record leachate volumes sent to the WWTP, or other approved treatment facility, at a regular frequency (daily, weekly, monthly, or per discharge). Pump and haul volume should be recorded for each truckload. Facilities with continual direct discharge should have a flow meter recording volumes of leachate discharged and tabulate data daily, weekly, and monthly. If discharge is not continuous, then flows should be recorded per discharge. Facilities with gravity discharge systems and/or without flow meters should consider adding a device to record discharge volumes. The monthly leachate generation rate for each calendar month of the year for the last 60 months (on a rolling basis) should be graphed. Five years of data is being requested to allow differentiation between seasonal variations and potential changes in operating conditions, such as cells opening/closing. These records should meet the requirements of 9VAC20-81-530.

   Leachate generation rates should be recorded until the operator receives written authorization by DEQ to discontinue. Recording these volumes is important as it allows the facility to monitor trends in the data. Increases or decreases in volumes can be correlated to the size of landfill areas that remain open (versus those which are capped) and amount of rainfall allowed to infiltrate through cover.

2. Leachate Sampling and Analysis

   Sampling Constituents. Owners and operators of all Category 1 landfills should record the results of all leachate sampling and analysis conducted for or by the landfill, WWTP, or other leachate receiving facility. If no routine sampling is currently required by the WWTP or leachate receiving facility, then owners and operators of Category 1 landfills should ensure that leachate is sampled and analyzed for the following constituents, at a minimum:

- Acetone
- Ammonia
- Biological Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- BOD:COD ratio
- pH
- Total Suspended Solids (TSS)

Sampling Frequency. At a minimum, the leachate sampling frequency should be annually. DEQ may request more frequent monitoring when results indicate that leachate constituents are exceeding established thresholds for acceptance by the receiving WWTP or other leachate receiving facility. Sampling should continue until the operator receives written authorization by DEQ to sample at a reduced frequency or discontinue sampling.

Sampling Locations. Leachate samples should be collected directly from leachate storage tanks or the discharge point into leachate pond or lagoons. Leachate samples should not be taken directly from leachate ponds or lagoons, where dilution and mixing from falling precipitation has occurred. The owner or operator should document whether leachate sources are mixed with gas condensate, leachate collected from gas extraction wells, contact stormwater, or non-contact stormwater.

Sampling Methods. The owner or operator should ensure that sampling and analytical methods used are appropriate for leachate sampling and accurately measure solid waste constituents in the samples. Samples should not be filtered prior to laboratory analysis. Sampling analysis should be conducted by a certified or accredited laboratory in accordance with the Virginia Environmental Laboratory Accreditation Program (VELAP). To ensure that analytical results provide a valid representation of the sample tested, consideration must be given to sample collection techniques (e.g., grab vs. composite), the container(s) in which a sample is collected, preservation and shipment procedures, holding times, and chain of custody documentation. Guidance as to appropriate sample containers and handling may be obtained from the analytical laboratory. EPA guidelines for test procedures, containers, preservations techniques, and holding times are found in 40 CFR 136.3 and Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA Publication SW846, if available. DEQ may request resampling if there is any indication that samples were not properly sampled or analyzed.

3. Leachate Recordkeeping & Reporting

The owner or operator should maintain the records of leachate generation and the results of all leachate sampling and analysis in the facility's operating record. The records should include:

a. The monthly leachate generation rate with a graph showing the last 60 months (on a rolling basis);
b. The documentation of date and time of leachate sampling, the names of leachate sampling personnel, apparatus utilized, and a brief description of the methods used;
c. A map and numbering system to correlate leachate monitoring results to a corresponding sampling location and identification of sources for leachate monitored at that location (i.e., leachate from landfill liner, gas system condensate, toe drain or leachate seep collection systems, liquids pumped from gas extraction wells, etc.);
d. The analytical results of each leachate sampling parameter as measured at each sampling location, with a graph of the leachate constituent concentrations for each sampling location for each sampling event for the last 60 months (on a rolling basis).
e. Copies of original laboratory analytical reports for all leachate sampling and analysis conducted for or by the landfill, WWTP, or other leachate receiving facility;
f. A listing of all WWTPs or other leachate receiving facilities that have received the landfill's leachate along with their criteria for leachate acceptance (established thresholds for leachate

constituent concentrations and leachate volumes), and an indication of whether the landfill has exceeded any of those thresholds.

Each Category 1 landfill should report the leachate monitoring data electronically to DEQ.

4. Leachate Notifications

In accordance with 9VAC20-81-530.C.3, the owner or operator must notify DEQ within 24 hours (verbally) and 5 working days (written follow-up) of any unusual condition that may endanger human health and the environment, such as when any leachate constituents or leachate volumes are exceeding established thresholds for acceptance by the receiving WWTP or other leachate receiving facility. The written submission shall contain 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.

C. Financial Assurance Adjustments

The facility's financial assurance cost estimates should be revised to adjust for the increased landfill gas and leachate monitoring costs associated with IV.A. and IV.B. Once estimates are approved by DEQ, the owner or operator shall increase the amount of financial assurance provided within 30 days in accordance with 9VAC20-70-111 through 113.

V. Category 2: Landfills with MACT AAAA HOV Demonstration Approvals Between 150°F and 170°F, but no approved allowance to operate above 170°F

A. Gas Monitoring for MACT AAAA Regulated Collection Wells with Approved HOVs

Landfill owners or operators may establish a higher operating temperature value at a particular well, as allowed by 40 CFR 63.1958(c)(2). Once a temperature HOV is approved, the facility must follow the monitoring provisions in the HOV approval, as outlined in 40 CFR 63.1961(a)(5)(ix).

Previously, temperature HOVs have been approved by DEQ without specifying monitoring provisions. To maintain approval for temperature HOVs, facilities should begin conducting the following monthly monitoring at the applicable collection device starting the month after the effective date of this document.

- Methane (CH_4)
- Carbon Dioxide (CO_2)
- Methane to Carbon Dioxide Ratio (CH_4:CO_2)
- Carbon Monoxide (CO)
- Hydrogen (H_2)

Additionally, if the monitored oxygen level is 2% or greater, with a temperature above 145°F, the facility should conduct weekly monitoring as outlined in 40 CFR 63.1961(a)(5). This monitoring is no longer required once the oxygen level drops to below 2% or the temperature drops below 145°F.

Monthly wellhead monitoring data required by 40 CFR 63.1960(a)(3) and 40 CFR 63.1960(a)(4) as well as the monitoring provisions related to temperature HOV approvals (CO_2, CO, CH_4, CH_4:CO_2 ratio, and H_2) should be reported electronically to DEQ on a monthly basis. If a well with a temperature HOV is monitored to have Hydrogen (H_2) levels of greater than 5%, please reference Section VI.A of this document. A facility may cancel an

approved HOV by notifying the applicable DEQ Regional Office. The HOV will not apply starting the month after DEQ has been notified. The well must then continue to be operated and monitored in accordance with the provisions of MACT AAAA.

Landfill gas collection and control systems can also be required by the VSWMR for methane gas remediation to protect public health and safety. If landfill gas collection well materials (such as PVC) are at risk of degradation due to higher operating temperatures, the facility should have a plan in place to replace or repair those wells before they fail. If the efficiency of the gas collection system decreases, it can impact gas remediation efforts and potentially contribute to subsurface methane migration beyond the facility boundary. This could create public health and safety hazards due to the potential for asphyxiation and explosion from the buildup of methane in nearby structures (homes, businesses). When HOV demonstration requests prompt replacement of gas collection wells based on construction material ratings and temperature impacts, or upgrades to add dewatering pumps, a concurrent solid waste permit modification is needed to update the Gas Management and Remediation Plan for consistency.

B. Leachate Monitoring and Management

Owners or operators of all Category 2 landfills should submit a request for a solid waste permit modification and a new or updated Leachate Management Plan (in accordance with 9VAC20-81-210.A.1 and 9VAC20-81-470.B.2) to DEQ to outline a leachate sampling and analysis plan to monitor potential ETLF conditions at the landfill. The new or updated Leachate Management Plan should reflect the following:

1. Leachate Generation Rate

   Continue following the leachate generation rate protocols described in Section IV.B.1 above.

2. Leachate Sampling and Analysis

   Sampling Constituents. Continue following the leachate sampling and analysis protocols described in Section IV.B.2 above. In addition, owners and operators of all Category 2 Landfills should ensure that leachate is sampled and analyzed for the following constituents (new constituents from Category 1 highlighted in **bold**), which are indicator parameters for ETLF conditions:

   - Acetone
   - Ammonia
   - **Benzene**
   - BOD
   - COD
   - BOD:COD ratio
   - **Methyl ethyl ketone (MEK)**
   - pH
   - **Phenol**
   - TSS

   Potential ETLFs may exhibit increasing trends in acetone, ammonia, benzene, BOD, COD, BOD:COD ratio, MEK, phenol, and/or TSS, and decreasing trends in pH in the leachate. Organics such as acetone, benzene, MEK, and phenol may be of significantly higher concentrations in ETLF leachate than in non-ETLF leachate. ETLFs typically have a BOD:COD ratio of approximately 1. Decreased pH can indicate more corrosive leachate, which can cause damage to leachate collection system components. Increased TSS, organic and inorganic concentrations can contribute to thicker, more viscous leachate containing substantial accumulations of grit, debris and solids, hard scale, black goo or “flubber,” blockages in leachate conveyance systems, blockages in gas extraction wells (“watered-in” wells and the need for dewatering), and damage to leachate pumps and other leachate collection system components. Changes in

constituent concentrations can also cause issues at the receiving WWTP, which could result in the plant rejecting some or a portion of the leachate for disposal. Inability to discharge or remove excess fluids from the landfill can exacerbate ETLF conditions.

Sampling Frequency. The leachate sampling frequency should increase to quarterly. DEQ may request more frequent monitoring (such as monthly monitoring) when results indicate that leachate constituents are exceeding established thresholds for acceptance by the receiving WWTP. Sampling should continue until the operator receives written authorization by DEQ to sample at a reduced frequency or discontinue sampling. Authorization to cease leachate monitoring should be based on a demonstration by the owner or operator that there is no longer a potential for ETLF conditions or that ETLF conditions have been reversed.

Sampling Locations. Evaluate the current leachate sampling locations and determine additional appropriate locations. In addition to sampling from the leachate storage tank or discharge point into the leachate pond or lagoon, leachate samples should be collected directly from each leachate sump (e.g., side slope riser) corresponding with landfill cells or phases with gas collection wells with HOV approvals. If not possible, samples should be collected from a point nearest to where leachate leaves the affected landfill area, such as a sampling port where leachate is discharged, or pumped and hauled, to a WWTP. If leachate samples cannot be collected from individual landfill cells or phases, then samples may continue to be collected only from leachate storage tanks, ponds or lagoons as outlined in IV.B.2.

Sampling Methods. Continue following the leachate sampling method protocols described in Section IV.B.2 above.

3. Leachate Recordkeeping & Reporting

Continue following the leachate recordkeeping protocols described in Section IV.B.3 above. Recordkeeping should be expanded to include the sampling results and graphical display of the additional leachate constituents (benzene, MEK, and phenol). Completed laboratory analytical reports should also be maintained in the facility's operating record.

Continue following the electronic reporting protocols described in Section IV.B.3 above. The additional leachate monitoring results should be electronically reported.

4. Leachate Notifications

Continue following the leachate notification protocols described in Section IV.B.4 above.

5. Leachate Management Strategies (Ceasing Leachate Recirculation)

Category 2 landfill owners or operators should evaluate existing leachate management strategies at the associated landfill such as leachate recirculation. If the landfill is showing impacts of liquids to landfill gas extraction, increases in the volume of leachate being generated at a facility, or decreases in the leachate quality such as decreasing pH, increasing TSS, ammonia, BOD, COD, BOD:COD ratio, VOCs (e.g., acetone, benzene, MEK), or SVOCs (e.g., phenol), then recirculation of leachate should be stopped. The owner or operator should evaluate whether recirculation should be discontinued across the entire site or could be restricted to certain areas. Leachate recirculation should be terminated in impacted areas until such time as potential ETLF conditions are adequately controlled. Note that the landfilling of solids/residuals generated from leachate concentrators can continue. The landfill solid waste permit should be modified to reflect any changes to leachate recirculation as a means of leachate management.

C. Financial Assurance Adjustments

The facility's financial assurance cost estimates should be revised to adjust for the increased landfill gas and leachate monitoring costs associated with V.A. and V.B. This includes changes to gas and leachate monitoring, including the type and frequency of the monitoring. It also includes changes and additions to the gas collection and control system, leachate collection system, leachate disposal method, addition or removal of leachate storage units or capacity (e.g., tanks, or impoundments), changes to the odor control system, additional maintenance and repairs to landfill gas and leachate system components, and installation or maintenance of interim or final cover. Installation of new gas extraction wells or leachate collection infrastructure to withstand higher operating temperatures or leachate quality/quantity should be incorporated into the closure cost estimate and may be removed during future cost estimate updates once those items have been installed. Increased monitoring for leachate and gas, leachate disposal, and maintenance of landfill gas and leachate collection systems, and final cap maintenance costs shall be incorporated into the post-closure cost estimate. Once estimates are approved by DEQ, the owner or operator shall increase the amount of financial assurance provided within 30 days in accordance with 9VAC20-70-111 through 113.

VI. Category 3: Landfills with MACT AAAA Applicable Gas Collection Wells Exhibiting Hydrogen (H_2) Greater than 5% or Temperatures Greater than 170°F which cannot be corrected within 15 days

A. Gas Collection and Control System Design Plan Updates

Temperature HOVs for greater than 170°F will no longer be approved by DEQ and those previously approved will be considered expired after 6 months from the date of this document. Going forward, if a facility wishes to operate gas collection wells above 170°F without conducting the corrective actions and reporting requirements of 40 CFR 63.1960(a)(4)(i) or the enhanced monitoring required by 40 CFR 63.1961(a)(5), an amendment to the Gas Collection and Control System (GCCS) Design Plan must be submitted as outlined in 40 CFR 63.1981(e) to include alternatives as outlined in 40 CFR 63.1981(d)(2). The amended plan must be submitted no later 120 days from the date of exceedance. The amended plan should establish the elevated temperature area, describe the design, including material suitability, and operation of the collection system in that area, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. Examples of what may be included in the amended design plan are weekly cover integrity checks and monthly GCCS component inspections in the impacted area, procedures for redrilling of failed collection wells, procedures for sounding and dewatering collection wells, and downwell monitoring and reporting. DEQ may specify additional appropriate monitoring procedures as allowed by 40 CFR 63.1961(e).

Measured Hydrogen (H_2) in a gas collection device is an indicator of a potential subsurface exothermic reaction. When a collector is found to have a Hydrogen (H_2) level of greater than 5%, that well should be added to an established ETLF area of a GCCS design plan which accounts for ETLF conditions. If the current design plan has not yet been amended to reflect ETLF conditions, it should be amended to anticipate potential ETLF connections and submitted as outlined in 40 CFR 63.1981(e) within 120 days.

A facility may cancel an approved HOV by notifying the applicable DEQ Regional Office. The HOV will not apply starting the month after DEQ has been notified. The well must then continue to be operated and monitored in accordance with the provisions of MACT AAAA. The landfill has an obligation to maintain a sufficient density of gas collectors, as outlined in 40 CFR 63.1962(a). Turning off gas collection devices may exacerbate ETLF conditions and increases the likelihood of subsurface migration. The removal of landfill gas removes heat and pressure from the landfill, which is essential to managing an ETLF area. Failure to remove landfill gas at a sufficient extraction rate as required by 40 CFR 63.1959(b)(2)(ii)(B)(3) or conduct corrective action, required monitoring, or reporting may lead to enforcement.

B. Odor Management Plan Updates

Landfills often have a requirement in their Minor New Source Review Permit to maintain and follow an Odor Management Plan (OMP). The landfill may also be required to maintain and follow an OMP in accordance with the VSWMR. If the facility has an OMP and updates their GCCS Design Plan to account for ETLF conditions, the OMP must also be updated to account for the increased odors which accompany ETLF conditions.

C. Elevated Temperature Landfill Corrective Action Plan

Category 3 landfills should develop and implement an ETLF Corrective Action Plan (ETLF CAP). The owner or operator should submit a request to DEQ for a minor solid waste permit modification to incorporate the ETLF CAP into the permit. The plan should establish the area(s) of the landfill exhibiting ETLF conditions and evaluate corrective actions to be taken to remediate and manage ETLF conditions, including information in the Gas Collection and Control System Design Plan. The plan should also include an implementation schedule specifying timeframes for implementing ETLF corrective actions, an evaluation of the effectiveness of such corrective actions, and milestones for proceeding in implementation of additional corrective actions, if necessary. Example ETLF corrective action measures may include:

- increasing landfill gas collection (installation of additional gas collection wells),
- replacing impacted landfill infrastructure, such as gas collection and control system components, with materials rated to withstand elevated temperatures,
- additional down-well monitoring in gas collection wells,
- sounding and dewatering gas collection wells,
- ceasing leachate recirculation,
- increasing leachate removal from the landfill,
- replacing leachate pumps,
- adding leachate storage capacity,
- pre-treating leachate prior to disposal,
- additional leachate sampling and analysis,
- additional control of odors,
- implementing systems and protocols to track and respond to odor complaints,
- operational changes to management of waste streams suspected to cause ETLF conditions,
- termination of waste placement in impacted and contiguous areas, and
- interim or final cover in impacted and contiguous areas.

Category 3 landfill owners and operators should update the Leachate Management Plan to increase leachate monitoring. The landfill should collect individual grab samples from each independent area that can be sampled rather than leachate tank, pond, or lagoon, if possible. If leachate samples cannot be collected from individual landfill cells or phases, then samples may continue to be collected from leachate storage tanks, ponds or lagoons as outlined in IV.B.2. Individual samples better inform which landfill areas and liquids are affected and whether leachate from various sources may need to be segregated for separate management and/or disposal options. DEQ may also require more frequent sampling, such as monthly sampling instead of quarterly sampling.

Waste placement in the impacted area should also cease, and temporary or final capping of the area should be performed to minimize liquids. The facility should submit a request to DEQ for a minor solid waste permit modification for temporary capping (i.e., interim cover) in the affected area including design drawings, technical specifications and construction quality assurance (CQA) report.

Note: It is highly recommended that landfill owners and operators maintain operational control of their gas collection and control systems rather than contracting or selling operational rights. Regardless of contractual agreements, permittees are still accountable for landfill operations and compliance relating to the gas collection and control system.

D. Financial Assurance Adjustments

The facility's financial assurance cost estimates should be revised to adjust for the increased costs associated with VI.A., VI.B., and VI.C. Because of these increased operational costs and risk of facility abandonment by the owner or operator of the ETLF, increased financial assurance should be submitted by the owner or operator. The updated cost estimate and financial assurance associated with the ETLF CAP should include costs associated with increased monitoring, leachate management, landfill gas collection, odor control, and overall landfill maintenance to prevent ponding, leachate discharges, and landfill instability. Once estimates are approved by DEQ, the owner or operator shall increase the amount of financial assurance provided within 30 days in accordance with 9VAC20-70-111 through 113.