

**COMMONWEALTH OF VIRGINIA**  
**Department of Environmental Quality**

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**Subject:** Land Protection and Revitalization Guidance Memo No. LPR-SW-2017-01  
**Clarification of Landfill Gas Regulatory Requirements**

**To:** Regional Directors

**From:** Leslie Beckwith, Director, Office of Financial Responsibility & Waste Programs

**Date:** September 5, 2017

**Copies:** Deputy Regional Directors, Regional Land Protection Managers, Kathryn Perszyk, Priscilla Fisher

**Summary:**

In 2015, the DEQ assembled an internal Landfill Gas Process Improvement Workgroup to examine landfill gas issues from an overall perspective. Group tasks included evaluating current agency guidance, regulations and practices and developing a consistent framework for compliance, clear regulatory requirements, remediation objectives and consistency amongst regional offices. The workgroup developed this guidance and revised the existing Submission Instruction No. 13 and the Landfill Gas Exceedances Flowchart previously found in Attachment 10-1 of the Solid Waste Inspection Manual (SWIM) accordingly. This guidance also replaces the December 22, 2010 memorandum previously provided as SWIM attachment 10-2.

**Electronic Copy:**

An electronic copy of this guidance is available on the Virginia Regulatory Town Hall website at: <http://townhall.virginia.gov/L/GDocs.cfm?boardid=119>

**Contact Information:**

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**Disclaimer:**

*This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate any particular method nor does it prohibit any alternative method for the analysis of data, unless specifically required by the VSWMR. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.*



## Clarification of Landfill Gas Regulatory Requirements

### **I. Introduction**

Landfill gas is a natural by-product of the decomposition of organic material in landfills. Landfill gas is a mixture of methane, carbon dioxide, and small amounts of nitrogen, oxygen, ammonia, sulfides, hydrogen, carbon monoxide, and non-methane organic compounds. The quantity of landfill gas generated and the concentration of each of the gases in the mixture vary depending on site-specific factors such as types of wastes disposed, age of the buried waste, the presence of oxygen in the buried waste, and moisture content and temperature of the landfill. While air regulations focus on the emissions associated with landfill gas generation, collection, and control, solid waste regulations focus on the migration of landfill gas away from the landfill which may create public health and safety hazards due to the potential for asphyxiation and explosion from the buildup of landfill gas in structures.

Solid waste disposal facilities are required to have landfill gas management plans addressing the control of decomposition gas requirements outlined under 9 VAC 20-81-200 of the Virginia Solid Waste Management Regulations (VSWMR, 9 VAC 20-81). Per the VSWMR requirements, the design of landfill gas monitoring and control systems shall be implemented to prevent migration of landfill gas into structures or beyond the facility boundary and protect the landfill cap. All solid waste disposal facilities shall submit a landfill gas management plan with their permit application unless otherwise exempt per 9 VAC 20-81-130.K.

During routine landfill gas monitoring, if landfill gas is detected at/above the methane compliance level, a facility shall implement a landfill gas remediation plan to address the exceedance per the requirements of 9 VAC 20-81-200.C. Landfill gas remediation plans are initially self-implementing; however, plans shall be submitted to the Department for review and shall be approved and incorporated into the facility's permit through a minor permit modification.

This guidance was developed to clarify regulatory requirements applicable to facility landfill gas monitoring and remediation as well as improve existing guidance.

### **II. Background**

Submission Instructions for Solid Waste Management Facilities, including a submission instruction outlining requirements for Gas Management and Control System Facilities, were initially issued June 1, 1993, and subsequently revised April 23, 2002, and February 1, 2012, to update for statutory and regulatory changes. In addition to Submission Instruction No. 13, now titled "Landfill Gas Management, Remediation, and Odor Plans for Solid Waste Disposal Facilities," the Department has previously provided guidance on landfill gas requirements in the Solid Waste Inspection Manual (SWIM). The January 3, 2011, version of the SWIM included a flow chart outlining compliance and permitting responses to facility landfill gas exceedances and remediation actions and a memorandum dated December 22, 2010, titled "Selection of

Appropriate Enforcement Instrument for Alleged Violations of 9 VAC 20-81-200” in Attachment 10.

In response to concerns from regional solid waste permitting and compliance staff regarding landfill gas issues, the Department assembled an internal Landfill Gas Process Improvement Workgroup in 2015 to examine landfill gas issues from an overall perspective. Group tasks included evaluating current agency guidance (those documents listed above), regulations and practices and developing a consistent framework for compliance, remediation objectives and consistency amongst regional offices. This guidance document was developed by the workgroup, and includes revised Submission Instruction No. 13 and a revised Landfill Gas Exceedances Flowchart (previously SWIM Attachment 10-1) as attachments. This guidance also replaces the December 22, 2010 memorandum previously provided as SWIM Attachment 10-2.

### **III. Authority**

This document provides guidance to implement the VSWMR (9 VAC 20-81) related to DEQ solid waste permitting and compliance of landfill gas management activities at solid waste disposal facilities. The authority for promulgation of these regulations and development of this guidance is contained in § [10.1-1402](#) of the Code of Virginia.

### **IV. Definitions**

The definitions in § [10.1-1400](#) of the Code of Virginia and [9 VAC 20-81-10](#) of the VSWMR apply to the implementation of these procedures. Additional definitions specific to this guidance are provided below.

“Action level exceedance” means a measurement of methane at or above 25% of its lower explosive limit (LEL, or 1.25% methane) in landfill structures (excluding gas control or recovery system components) or at or above 80% but below 100% of its LEL (or 4 to 4.99% methane) at the facility boundary.

“Barometric pressure” means the pressure exerted by the earth's atmosphere as measured by a barometer. Barometric pressure should be recorded from an onsite weather station or online source of weather data from a nearby weather station.

“Compliance level exceedance” means a measurement of methane at or above 25% of its LEL (or 1.25% methane) in landfill structures (excluding gas control or recovery system components) or at or above its LEL (or 5% methane) at the facility boundary.

“Monthly” means an interval corresponding to approximately 30 days. Facilities monitoring on a monthly frequency should perform one monitoring event during each calendar month. To fit the monthly definition, monitoring should be completed within a window of 23-37 days from the prior event.

“Quarterly” means an interval corresponding to approximately 90 days. Facilities monitoring on a quarterly frequency should perform one monitoring event during each calendar quarter (Jan. – March, April – June, July – Sept., and Oct. – Dec.) for a minimum of 4 gas monitoring events

performed per calendar year. To fit the quarterly definition, monitoring should be completed within a window of 60-120 days from the prior event.

"Weekly" means an interval corresponding to approximately 7 days. Facilities monitoring on a weekly frequency should perform one monitoring event during each calendar week.

## **V. Guidance Document**

### **A. Landfill Gas Compliance Monitoring**

Landfill gas monitoring should occur when the potential for landfill gas migration is highest. Landfill gas tends to migrate along the path of least resistance, and moves from high pressure and concentration areas to low pressure and concentration areas. Migration is also affected by the permeability of the compacted waste, landfill cover material, and surrounding soils, as well as the height of the groundwater table. Barometric pressure also influences landfill gas migration, and low or falling barometric pressure may allow methane to migrate out of the landfill and into surrounding areas. Additionally, saturated or frozen soils on the surface of a landfill tend to impede surface migration and therefore increase the likelihood of lateral migration below the surface. However, subsurface migration of landfill gas is difficult to predict. Therefore, a monitoring program should include events that occur during varying weather conditions, including during periods of a falling barometer, prolonged low pressure or prolonged steady barometric pressure events.

In addition, gas monitoring of all facility probes/structures should be conducted on the same day where possible. If the monitoring is conducted over multiple days, the monitoring report should reflect the atmospheric conditions for each day of monitoring.

If a facility fails to perform compliance monitoring within the calendar quarter, the first occurrence is a Severity Level (SL) II alleged violation and staff should prepare and issue a Warning Letter (WL). However, if the quarterly monitoring is performed within the calendar quarter, but completed outside the 60-120 day window since the last monitoring event, the first occurrence is a SL I alleged violation and staff should prepare and issue a Deficiency Letter (DL). In the case of subsequent consecutive missed or late monitoring events, the severity level of the alleged violation (and resulting enforcement mechanism) should be increased in accordance with the matrix in the Solid Waste Inspection Manual.

### **B. Reporting of Gas Exceedances and Unusual Conditions**

The regulation (9 VAC 20-81-200.C.1.b.) outlines that in response to an action level exceedance, the facility shall notify the department in writing within five working days and indicate what has been done or is planned to be done to resolve the problem.

In response to a compliance level exceedance **OR** unusual condition that may endanger human health and the environment, 9 VAC 20-81-200.C.5. specifies that the landfill shall notify the department in accordance with 9 VAC 20-81-530.C.3., which includes 24-hr oral notification with a follow-up written notification within five working days.

The following incidents related to landfill gas should also be reported as unusual conditions in accordance with the 24-hour oral and 5-working day written notification requirements.

- Compliance level exceedances detected during routine or non-routine maintenance activities;
- Planned or unplanned shutdowns of active gas control or remediation systems lasting longer than 48 hours; and
- Other noncompliance or unusual conditions that may endanger health or environment, such as when a system is not operating in a manner to maintain compliance.

A separate notification is required for each action and compliance level exceedance, unless the facility is directed otherwise by DEQ staff for ongoing exceedances. An email will suffice for either/both the 24-hr (oral) and 5-working day (written) notification requirement as long as the email contains the information required by the regulation. A separate 5-day email is needed only if the initial 24-hr notification email does not contain all requirements for the written submittal. Failure to notify the DEQ within 24 hours and five working days is a SL III alleged violation and staff should issue a Notice of Alleged Violation (NOV) with a referral to Enforcement.

Exceeding the compliance level for methane is a SL II alleged violation, and staff should prepare and issue a WL. This alleged violation will be deemed unresolved while the facility develops and implements a landfill gas remediation plan (see [Section C](#)) and remain unresolved until methane concentrations are below compliance levels in accordance with the return to compliance monitoring (see [Section E](#)). However, if the operator fails to notify the DEQ within the reporting timeliness outlined in 9 VAC 20-81-530.C.3., staff should prepare and send a NOV with a referral to Enforcement for the gas exceedance and the missed notification.

### **C. Gas Remediation Plan Development and Implementation following Exceedances**

In accordance with 9 VAC 20-81-200.C., responses to compliance level exceedances also require the implementation of a Landfill Gas Remediation Plan (LFGRP) and submittal of a permit modification request. The plan shall describe the nature and extent of the problem and the proposed remedy. Section III of Submission Instruction No. 13 provides a format and details for the information that should be addressed in the LFGRP. The regulation requires that this plan be implemented within 60 days of the exceedance. Should the facility desire feedback on the LFGRP prior to implementation, the facility may request a meeting with the regional DEQ staff and/or submit the plan to the regional DEQ office prior to the 60-day implementation deadline. If the facility fails to implement and submit the LFGRP within 60 days, staff should prepare and send a NOV with a referral to Enforcement.

The LFGRP shall include an implementation schedule in accordance with 9 VAC 20-81-200.C.2. The schedule should specify timeframes for implementing the proposed remedial actions, evaluating the effectiveness of such remedial actions, and milestones

for proceeding with additional phases of the remediation plan, if necessary. Schedules for facilities that have detected an exceedance along the property boundary where offsite receptors are within 1000 ft of the waste management boundary should be accelerated to address the gas migration and protect public health and safety. The schedule should be provided in tabular form and include monitoring and evaluation periods following installation or implementation of each remedial action or remediation plan phase. Monitoring and evaluation periods following installation of a remedial action or remediation plan phase should not exceed 60 days or an alternate timeframe as approved by the Department. Alternate monitoring and evaluation periods should be based on the facility's proximity to sensitive receptors or migration pathways (e.g. occupied structures, utility right-of-ways, etc.), the concentration of methane detected, and type of remediation being implemented. If methane concentrations do not return to compliance or show decreasing trends within the specified timeframe, then the next phase of the remediation plan should be implemented. Proposed remedial actions and implementation schedules should attempt to resolve landfill gas exceedances within 18 months of the initial compliance level exceedance.

While the facility implements the LFGRP, landfill gas concentrations will most likely continue to exceed compliance levels. Provided the facility continues to implement the LFGRP according to the approved timetable, DEQ staff may acknowledge ongoing gas exceedances by providing a general comment under the Decomposition Gas Control items on the compliance inspection report using the following recommended language:

*“On Month DD, 20YY, the facility exceeded the compliance level for methane at gas monitoring probe(s) [list probe IDs]. An alleged violation was previously issued on Month DD, 20YY and remains unresolved due to the ongoing exceedance(s). The facility submitted a gas remediation plan within 60 days of the initial exceedance and is implementing the plan in accordance with the approved timetable.”*

The checklist items may be marked as “in compliance,” and staff should send a No Deficiency letter (NDL) with the compliance inspection report.

Failure to implement the LFGRP or implement additional remedial actions as outlined in the LFGRP in accordance with the approved timetable is a SL III alleged violation, and DEQ staff should issue an NOV with a referral to Enforcement. If after 18 months of the initial compliance level exceedance, landfill gas concentrations continue to be above the compliance level due to insufficient remedial actions (such as not implementing the next prescribed phase of the LFGRP), staff should issue an alleged violation and NOV with referral to Enforcement for the continued gas exceedance. Department staff can delay issuance of an NOV based on site-specific considerations (e.g. for facilities that have followed their LFGRP schedule but are awaiting funding approvals or working through an RFP process for remedial action implementation; when advance notice and reasonable explanation is provided in advance of a delay; when landfills do not have offsite receptors within 1000 ft of the waste management boundary in the area of the exceedance; or when landfill gas monitoring results indicate that methane concentrations are consistently

decreasing at a rate sufficient to resolve the exceedance without advancing to the next phase of the remediation plan).

A new or revised LFGRP or plan addendum outlining additional remedial actions and an extended schedule is required if the facility works through all remedial actions or remediation plan phases in the approved LFGRP but methane levels continue to be above compliance levels. The revision or addendum should be submitted 60-90 days following implementation of the last remediation plan phase or alternate timeframe as approved by the Department.

#### **D. Gas Monitoring Network Evaluations following Exceedances**

Section I.D.3. of Submission Instruction No. 13 previously stated, “lateral spacing between adjacent monitoring probes should not exceed 250 feet, unless the applicant shows that such spacing would be unwarranted based on the site-specific factors. The spacing between the probes shall be reduced as necessary to protect persons and structures threatened by decomposition gas migration.”

While reviewing Landfill Gas Management and Remediation Plans and working with facilities after compliance level exceedances, it has been determined that there are facilities whose lateral spacing between probes within the perimeter landfill gas network exceed the 250 feet spacing. Site-specific spacing decisions were likely made following the promulgation of the 1988 Solid Waste Management Regulations for older landfills or during the permitting process that took place for newer landfills following promulgation of EPA’s Subtitle D rules for municipal solid waste landfills in the early 1990s. With offsite development encroaching on landfills, especially those with older landfill gas networks, DEQ is requiring reassessment of the entire perimeter landfill gas network spacing following a compliance level exceedance to identify whether additional perimeter probes are needed. Section I.I.3. of the Submission Instruction has been revised to indicate that in response to a compliance level exceedance, the facility should assess the lateral spacing of the entire perimeter landfill gas network and include the installation of additional perimeter probes/wells to satisfy the spacing requirement as part of the LFGRP and permit modification unless the facility can show that such spacing continues to be unwarranted based on site-specific factors.

Any agreement by DEQ that a larger spacing is sufficient will be based on adjacent property use and distance to on and offsite structures (including underground utility lines, sewers and water mains, and above or below ground structures) in addition to local soil/rock conditions and hydrogeological and hydraulic conditions. Spacing approvals will also be caveated to take into account future potential development on adjacent property (see condition C.4.a. of Attachment 3 for example language). Under no circumstances should bar punches be used in place of constructed landfill gas probes to satisfy the 250 ft spacing requirement.

## **E. Return to Compliance Gas Monitoring Procedures**

In order to closely monitor landfill gas migration and determine when methane levels necessitate additional action, landfills should increase the gas monitoring frequency following an action level exceedance when any of the following conditions apply:

- (1) Where offsite receptors are within 1000 ft of the waste management boundary;
- (2) Where terrain, such as karst topography, or other conduit may provide pathways for migration of landfill gas that can pose hazards to public health and safety and the environment; or
- (3) Where facility permits or approved Landfill Gas Management or Remediation Plans outline a schedule for increased monitoring frequency following an action level exceedance.

All other landfills should increase the gas monitoring frequency following a compliance level exceedance.

The increased monitoring frequency need only apply to the portion of the perimeter landfill gas monitoring network to include 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.

The increased monitoring frequency should be weekly at landfills in urban areas, those where offsite receptors are within 1000 feet of the waste management boundary in the area of the exceedance, or those where terrain, such as karst topography, or other conduit may provide pathways for migration of landfill gas than can pose hazards to public health and safety and the environment. Monthly monitoring is appropriate for landfills in rural areas or those without offsite receptors within 1000 feet of the waste management boundary in the area of the compliance level exceedance. Any other frequency or condition regarding when increased monitoring frequency should start should be outlined in the facility's Landfill Gas Management or Remediation Plan and approved by the Department.

In order to return to the required minimum quarterly monitoring schedule, the facility needs to perform weekly monitoring, if required, of the affected probe/structure subset until consecutive weekly readings are below the action level for a month (i.e. four (4) consecutive weeks of data showing methane concentrations below the action level). As discussed in [Section V.A.](#) of this guidance, a monitoring program should include events that occur during varying weather conditions, including during periods of falling barometer, prolonged low pressure or prolonged steady barometric pressure. If possible, weekly return to compliance monitoring should be performed under varying conditions.

Once the weekly monitoring condition is satisfied, the facility may transition to monthly monitoring of the probe/structure subset. The facility should perform monthly monitoring of the affected probe/structure subset until consecutive monthly readings are below the action level for a quarter (i.e. three (3) consecutive months of data showing methane concentrations below the action level). Again, if possible, monthly return to compliance monitoring should be performed during varying weather conditions,

including periods of falling barometric pressure, prolonged low pressure, or prolonged steady barometric pressure. Once the monthly monitoring condition is satisfied, the facility may return to quarterly monitoring.

The facility should follow the response and reporting requirements outlined in [Section V.B.](#) of the guidance when performing increased frequency monitoring to return to compliance.

If monitoring results show methane concentrations are below the action level, required oral and/or written notifications as discussed in [Section V.B.](#) are not required for that particular monitoring event. However, once a facility has completed the required minimum number of consecutive monitoring events resulting in gas concentrations below action level to justify returning to a lesser monitoring frequency (i.e. monthly or quarterly) as outlined in Section III.D. of the Submission Instruction, DEQ requests that the facility 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 should be submitted in tabular form with an accompanying graph to clearly document trends in data over time to justify the change in monitoring frequency.

Late or missed return-to-compliance monitoring events should be assessed as indicated in [Section V.A.](#)

## **F. Alternate Gas Source Demonstrations**

Section D has been added to the existing Section II of Submission Instruction No. 13 (Landfill Gas Demonstration) to address alternate gas source demonstrations. In recent years the Department has received a handful of requests to remove compliance monitoring points from the landfill gas monitoring network based on sampling data showing the landfill is not the source of methane detected. It is important to note that until the demonstration described herein is completed and approved, DEQ's assumption is that methane detected within facility structures or the gas monitoring network is originating from the landfill. The addition to the Submission Instruction is being made to bring some consistency to such demonstrations that are submitted for Department approval.

At a minimum, alternate gas source demonstrations should include a gas fingerprinting analysis for EPA Method TO-15 organics, siloxanes, and sulfur compounds. Additional or alternate constituents may be appropriate based on types of wastes disposed. Gas samples for fingerprinting should be collected from the exceeding probes as well as from landfill gas sources that can be definitively tied to the landfill (i.e. extraction wells, leachate collection sumps, or other areas as appropriate). Field comparison of the concentrations of methane, carbon dioxide, oxygen, and gas pressure at each of the sampling points is also appropriate for correlation. Additional demonstration procedures may also be requested.

If the demonstration is successful, the facility will need to propose an alternate source of the methane detected. The successful demonstration that the gas is not from the regulated landfill may not alleviate the facility from managing the methane source, as the presence of methane at or above the defined landfill gas compliance level is one of the safety criteria for open dump classification of solid waste disposal facilities under 40 CFR 257.3-8 as incorporated under 9 VAC 20-81-45.B. For example, if the source of methane is determined to be an onsite unregulated (pre-88) landfill unit or from fill material existing or brought onsite as part of landfill operations or property maintenance, the source should be addressed by the facility / property owner. If the source is determined to be from offsite, the property owner of the detected methane source will be responsible for management and remediation as appropriate to protect public health and safety.

### **G. Guidance Implementation**

Compliance related changes to policy and procedure outlined in this document and its attachments, including assessment of alleged violations for late or missed compliance or return to compliance monitoring events (see Section V.A. and V.E.), failure to notify (see Section V.B.), and for failure to implement a LFGRP or additional remedial actions (see Section V.C.), will be enforced beginning January 1, 2018.

Landfill Gas Management and Remediation Plans should be updated to address revisions in Submission Instruction No. 13 during the next revision of the respective plan. If a Landfill Gas Management or Remediation Plan is under DEQ review for permit modification as of the date of guidance issuance, the plan should be revised to follow the Submission Instruction prior to DEQ approval and permit modification. Facilities with previously approved plans do not have to submit a plan revision upon guidance issuance only to address the new guidance. However, a new compliance level exceedance that prompts a revision of the Gas Remediation Plan would require updating to conform to the new guidance, including a reassessment of probe spacing at that time.

## **VI. Collaboration Process**

A Landfill Gas Workgroup consisting of Regional Land Protection Managers, Solid Waste Permit Writers, Solid Waste Compliance Inspectors, and the Central Office Solid Waste Permitting and Compliance Coordinators was formed in July 2015 to examine landfill gas issues. The task of the workgroup was to evaluate current agency guidance, regulations, and practices to provide a consistent framework for compliance, clear regulatory requirements, remediation objectives and consistency amongst regional offices. The group began discussions in June 2016, which resulted in the development of this guidance and the attached revised Submission Instruction No. 13, revised Landfill Gas Exceedances Flowchart, and revised landfill gas management system permit conditions.

Other DEQ Central Office and Regional staff were given opportunity to comment during development. Additionally, comments from interested parties were solicited and considered in the final version.

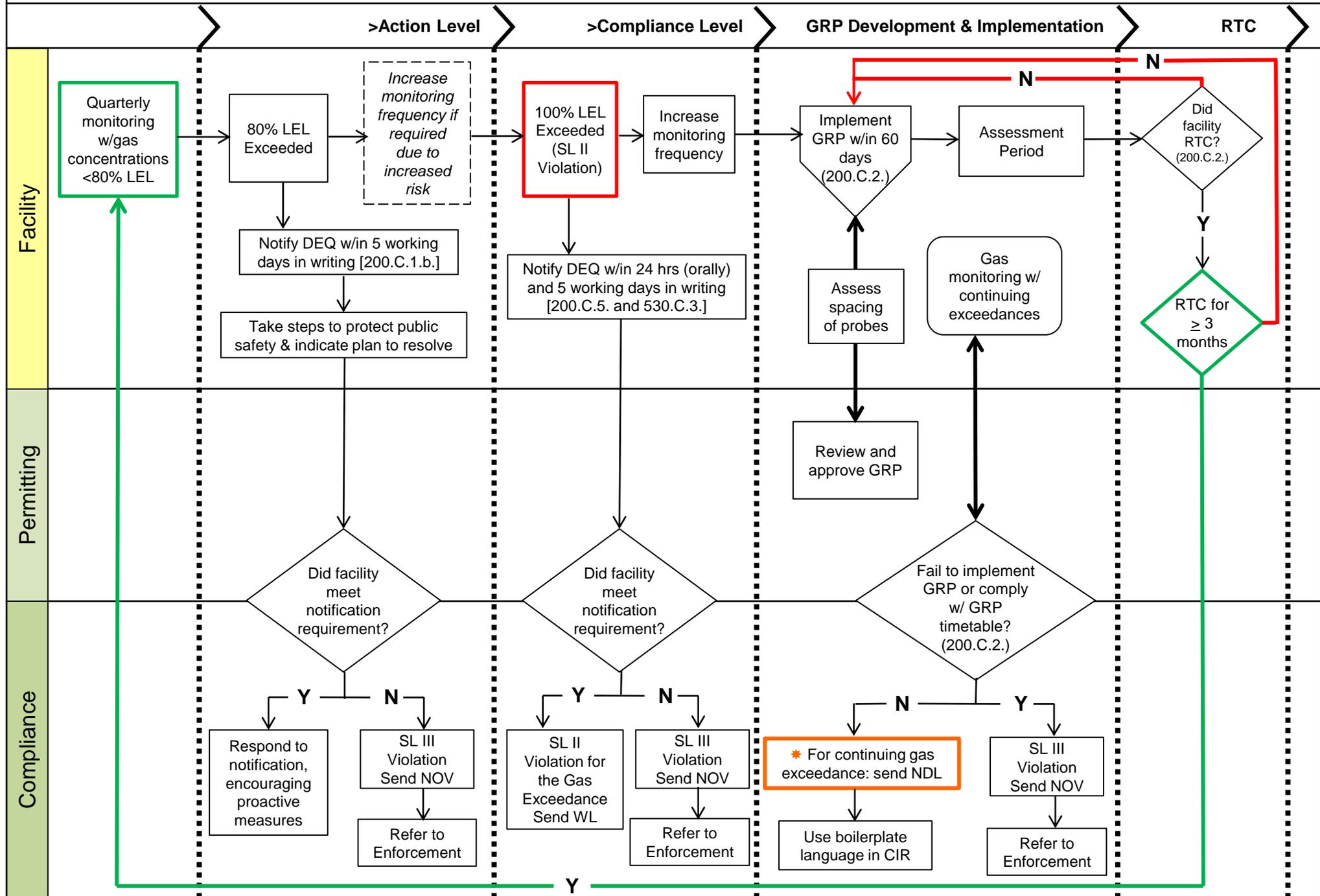
## **VII. Attachments**

- 1. Submission Instruction No. 13: Landfill Gas Management, Remediation, and Odor**

**Plans for Solid Waste Disposal Facilities** (revised 08/2017)

Found online here: <http://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=2137>

2. **Landfill Gas Exceedances Flowchart** (Previously Attachment 10-1 of the Solid Waste Inspection Manual, revised 08/2017)
3. **Landfill Gas Management and Remediation Applicable Permit Conditions** (excerpts from Modules III, IV, and V)



\* If after **18 months** from the initial exceedance, concentrations continue to be above compliance level due to insufficient remedial actions (e.g. not implementing the next prescribed phase of the LFGRP), staff should issue an alleged violation and NOV w/referral to Enforcement. See Guidance for more info regarding NOV issuances.

**PERMIT MODULE III/IV/V**  
**SANITARY/CDD/INDUSTRIAL LANDFILL DESIGN**

C. LANDFILL GAS MANAGEMENT SYSTEM

- 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:
- 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
  - C.1.b. The concentration of methane gas shall not exceed the lower explosive limit for methane (5.0% methane) at the facility boundary.
- 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.
- 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.
- C.4. Perimeter Gas Monitoring Network
- C.4.a. The facility shall install and maintain perimeter gas monitoring probes at the locations specified in the [cite drawing, e.g. Landfill Gas Management Plan on Drawing 1]. The current perimeter gas monitoring network consists of [insert #] landfill gas monitoring probes designated [list probes] located [describe location, e.g. along the southern and southwestern property boundaries]. *[If spacing exceeds 250ft along any boundary]* Additional perimeter gas monitoring probes [describe location, e.g. along northern boundary] shall be added to the network if onsite or offsite property development encroaches within 1000 feet of the waste management boundary along that property boundary.
  - 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 [state location in LFGMP e.g. Appendix D of the

### Attachment 3. Landfill Gas Management and Remediation Applicable Permit Conditions

Landfill Gas Management Plan] within 30 days following construction completion.

C.4.c. All existing and future onsite structures shall be monitored in accordance with condition C.2 or have explosive gas monitoring equipment installed.

#### C.5. Landfill Gas Control Components

The existing and planned gas control system at the landfill consists of the following main elements [describe elements of system as described in LFGMP/LFGRP, example provided below]:

C.5.a. A series of vertical gas extraction wells installed no more than 75% of the waste depth with a minimum of 15 feet of separation from the bottom of the landfill, spaced at approximately 150-foot to 250-foot intervals. The current extraction well network consists of five perimeter extraction wells [PEW-1, PEW-2R, PEW-3, PEW-4R, and PEW-5R], six Ballfield extraction wells [BEW-1 through BEW-6], and a connection of extraction wells installed within the Existing Landfill and Phase I Parts 1 and 2. Future extraction wells are planned for Phase I Parts 3 and 4, and Phases II and III.

C.5.b. A series of horizontal collectors installed on the landfill to augment gas collection via the vertical extraction wells. Currently the landfill has installed two vent trenches (approximately 1,900 feet and 600 feet long, respectively) to control subsurface gas migration along the southern perimeter of the 4.2 acre parcel, known as the Venable property, acquired by the County in 2000 and along State Route 234.

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 Energy Recovery Facility (ERF) and the Utility Flare; and

C.5.d. A condensate control system consisting of self-draining condensate traps located at low points in the piping network and a vessel equipped with a demister pad, drainage port, and manual shutoff valve at the Energy Recovery Facility and Utility Flare.

C.5.e. An Energy Recovery Facility, Utility Flare, and enclosed ground flare to manage the treated (compressed, cooled, and filtered) gas collected via the active gas collection system. These components are subject to the conditions of the facility's Title V Operating Permit.

### Attachment 3. Landfill Gas Management and Remediation Applicable Permit Conditions

#### C.6. Landfill Gas Monitoring Response and Remediation

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; and
- iv. *[Include only if increased monitoring frequency applies pursuant to guidance recommendations (Guidance Memo 2017-01 and Submission Instruction No. 13)]* Increase the gas monitoring frequency per the requirements of C.6.c.

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 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 C.6.c.
- v. *[If a facility already has a LFGRP]* Implement the next phase of

### Attachment 3. Landfill Gas Management and Remediation Applicable Permit Conditions

the approved remediation plan within 60 days or implement a revised remediation plan and submit the plan to DEQ for approval; *[If a facility does NOT already have a LFGRP]* Implement a remediation plan within 60 days 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.

C.6.c. *[Note: choose monitoring frequency suitable for return to compliance based on guidance recommendations (Guidance Memo 2017-01 and Submission Instruction No. 13)]* 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/monthly** unless an alternate frequency is approved by the Department.
- ii. **Weekly/Monthly** monitoring shall continue until **four (4) consecutive weekly/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 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.