


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

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**Subject:** Land Protection and Revitalization Guidance Memo No. LPR-SW-2019-01  
**Odor Guidance for Solid Waste Management Facilities**

**To:** Regional Land Protection Program Managers  
Regional Air Compliance Managers  
Regional Air Permit Managers

**From:** Justin Williams   
Director, Division of Land Protection and Revitalization

**Date:** September 20, 2019

**Copies:** Regional Solid Waste Permit Writers, Compliance Inspectors, and Coordinators  
Regional Air Permit Writers, Compliance Inspectors, and Coordinators

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**Summary:**

In 2017, the DEQ assembled a small stakeholder workgroup consisting of DEQ staff from both Land and Air Divisions, environmental consultants, and representatives from two facilities with on-going odor complaints. The focus of the group was to discuss DEQ complaint response and monitoring relating to landfill odors. The guidance consolidates information discussed during the workgroup sessions and establishes standard procedures for DEQ staff and solid waste facility operators to follow in response to odor complaints to ensure the protection of human health and the environment.

**Electronic Copy:**

Once effective, an electronic copy of this guidance is available on the Virginia Regulatory Town Hall under the Department of Environmental Quality at:  
<http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440>

**Contact Information:**

Please contact the solid waste permit coordinator, Kathryn Perszyk, at (703) 583-3856 or [kathryn.perszyk@deq.virginia.gov](mailto:kathryn.perszyk@deq.virginia.gov) with any questions regarding the application of this guidance.

**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 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.*



## Odor Guidance for Solid Waste Management Facilities

### I. Introduction

Due to the nature of the business, solid waste management facilities can be a source of nuisance odors. Odors are typically associated with solid waste disposal facilities (i.e. landfills); however, can also be present at other solid waste management facilities, such as compost, transfer station, material recovery, and waste to energy and incineration facilities. The guidance that follows focuses on controlling odors generated at solid waste disposal facilities; however, the assessments and remedial actions discussed herein can apply to other solid waste management facilities, as well as other types of operations that result in the generation of nuisance odors.

### II. Background

Solid waste management facilities are required to control odors in accordance with both the Virginia Solid Waste Management Regulations (VSWMR, 9 VAC 20-81) and the State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution (Rule 4-2: Existing Stationary Sources and Rule 5-2: New and Modified Stationary Sources). While the Air regulations are general in nature, applying to all facilities that emit odor, the VSWMR addresses the requirement for landfills to effectively control odors so they do not constitute nuisances or hazards. Both regulatory programs can require the development and implementation of an Odor Management Plan. These plans are required to outline the expected facility response to odor complaints by the DEQ or the public and must be reviewed by the facility on an annual basis and revised as necessary.

The Department has developed this guidance in addition to the Odor Management Plan template provided for solid waste disposal facilities in [Submission Instruction No. 13](#) to establish standard procedures for DEQ staff and solid waste facility operators to follow in response to odor complaints to ensure the protection of human health and the environment.

### III. Authority

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

This document provides guidance related to odor management activities at Municipal Solid Waste (MSW) landfills in accordance with the Air Pollution Control Board Regulations (specifically 9 VAC 5-40-5840, 9 VAC 5-40-5945, and Part II, Article 2, of 9 VAC 5-50). The authority for promulgation of these regulations and development of this guidance is contained in §10.1-1308 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. Key definitions applicable to this guidance from the VSWMR are identified below.

“Nuisance” means an activity that unreasonably interferes with an individual's or the public's comfort, convenience or enjoyment such that it interferes with the rights of others by causing damage, annoyance, or inconvenience (9 VAC 20-81-10).

## **V. Guidance Document**

Most landfill odors are associated with landfill gas. Landfill gas is the product of decomposition of organic material in landfills and consists mainly of methane and carbon dioxide which are odorless gases, but also includes trace amounts of sulfides, ammonia, and other non-methane organic compounds (NMOC). These trace amounts are the largest contributor to odors in landfill gas, often producing what is described as rotten-egg and pungent odors.

Other common sources of odors at a landfill are:

- Incoming trash being deposited at the working face;
- Specific wastes with strong odors such as sludge from wastewater treatment plants, manures, animal carcasses, and some industrial wastes;
- Specific wastes, such as gypsum wallboard, which are known to contribute to hydrogen sulfide production during decomposition;
- Storage and conveyance structures containing landfill leachate, which is the liquid collected from the bottom of a constructed landfill unit;
- Installation and maintenance of landfill gas collection and control (GCCS) systems; and
- Ancillary waste management activities occurring on site such as yard waste composting.

Odors are always going to be associated with landfill operation; however, there are operational strategies and improvements that landfill operators can employ to minimize odors and prevent migration offsite. These strategies and improvements are discussed herein.

### **A. Controlling Landfill Gas**

In addition to landfills being required to control odors as discussed above, landfills are separately required to control landfill gas in accordance with both Waste and Air regulations. In this case, Air regulations (Rule 4-43, Rule 4-43.1, and 40 CFR 60 Subparts WWW and XXX) only apply to Municipal Solid Waste (MSW) landfills meeting or exceeding a specified design capacity. Under these regulations, MSW landfills are required to calculate or measure actual emission rates of NMOCs, and if that rate is above the specified action threshold, the facility must install gas collection and control system (GCCS) components within regulatory timeframes.

Meanwhile, solid waste regulations apply to all landfills and focus on the subsurface 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. To comply with these requirements, facilities must install and monitor a network of subsurface perimeter monitoring probes at the facility boundary. If landfill gas is detected at the boundary above the lower explosive limit for methane (5% methane by volume), the facility is required to take remedial action to lower the methane concentration, which may involve the installation or expansion of GCCS components whether or not such a system is required under the air regulations.

## **B. Response to First Time Odor Complaints**

Given the above, the following outlines the expected facility response to odor complaints received either directly by the facility from the public or by DEQ staff.

### **1. Complaint Received by DEQ**

If a complaint is received from the public (through the online PREP portal, phone call, or email), DEQ staff will document the complaint in accordance with the procedures in the Solid Waste Inspection Manual, noting the address or general area where the odor is detected, time of day and weather conditions, as well as a description of the odor and its intensity. If the complaint can be tied to a specific facility, the documented complaint should be included in the facility file record. If multiple complaints are received, DEQ staff may document all complaints in a spreadsheet or other type of document to maintain a running log.

DEQ staff should then contact the facility (if known) to notify them of the complaint. DEQ staff may perform a focused compliance inspection at the facility or in the general vicinity of the complaint to further investigate and/or validate the complaint. Observations at the facility should be focused on the conditions that commonly contribute to the intensity of landfill odor sources, such as, but not limited to the:

- Size of the facility's working face;
- Condition of daily, intermediate, or other soil or alternate material covers;
- Presence and management of particularly odorous wastes;
- Operation of landfill gas collection and control systems;
- Operation and effectiveness of any odor masking or neutralizing systems;
- Management of leachate, including assessing recirculation activities, on-site treatment, storage units, and presence of leachate seeps; and
- Proper operation and maintenance of run-on/run-off controls to promote positive drainage and prevent ponding.

These areas should be assessed for compliance with applicable waste and air regulatory or permit requirements. The detection of an odor itself does not necessarily warrant the issuance of an alleged violation, but the migration of odors offsite may serve as an indicator that there is a problem with one of the above. DEQ solid waste staff should determine whether alleged violations should be issued based on if the facility is meeting the regulatory operational performance standards and permit conditions. Even if the facility is complying with applicable requirements, the inspector is encouraged to discuss with the operator any operational strategies that could help prevent odors from migrating offsite in the future. A focused compliance inspection report and appropriate cover letter should be prepared in accordance with the Solid Waste Inspection Manual and sent to the facility. If alleged violations are issued, the inspector should follow-up with the facility and track their return-to-compliance. If necessary, DEQ staff can also request the development of an Odor Management Plan in accordance with 9 VAC 20-81-200.D.

### **2. Complaint Received by Facility**

If the facility receives a complaint, either directly from the public or through contact by DEQ staff, facility staff shall document the complaint, noting the address or general area where the odor is detected, time of day and weather conditions, as well as a description of the odor and its intensity.

The facility shall then proceed to investigate the complaint to determine the potential source(s) of odor and remedial measures to control or minimize those odors. Facility staff shall also document all areas investigated, a summary of findings, and remedial actions taken. The documented complaint and response should be maintained in the facility's operating record.

Site investigations and remedial actions should include, but are not limited to:

- Surveying the landfill (active working face and inactive areas) and assessing size of the current working face. Apply soil or approved alternate cover material as necessary to cover odorous wastes and repair cracks or erosion in existing cover soils.
- Surveying citizen use areas, stockpiles, composting, or ancillary waste activities at the facility that may be the source of odors.
- Investigating performance and connections of GCCS Systems which may include:
  - Checking for changes in gas quality and quantity;
  - Inspecting for and repairing leaks in landfill gas collection piping and condensate tanks; and
  - Ensuring blower vacuum, flare components, and/or landfill gas to energy components are operational/maximized.
- Investigating performance and connections of leachate conveyance and storage components which may include:
  - Inspecting for and repairing leaks in leachate piping;
  - Operating aeration or other controls in storage tanks or impoundments to reduce odors;
  - Connecting the leachate collection system to the GCCS to collect and manage landfill gas that may be collected and stored in leachate collection and storage units; and
  - Inspecting for and repairing any leachate seeps.
- Inspecting the run-on/run-off control system for ponding and restoring positive drainage.
- Investigating the address or general area of the odor complaint and assess weather conditions (wind direction) to help confirm whether the landfill is the source. This investigation may also help determine the type of landfill odor (new incoming waste or landfill gas) or if the odor may be caused by another source such as the sanitary sewer or an industrial operation in the vicinity.

Following the initial investigation and remedial action, the facility shall continue to investigate and employ remedial actions in response to any subsequent odor complaints. If and when required by DEQ, the facility shall develop and implement an Odor Management Plan in accordance with 9 VAC 20-81-200.D. to identify complaint handling procedures and remedial measures. The Plan shall be placed in the facility's operating record and submitted to the Department within 90 days. An example format for this plan is provided in Section IV of [Submission Instruction No. 13: Landfill Gas Management, Remediation, and Odor Plans for Solid Waste Disposal Facilities](#). Facilities operating under an Odor Management Plan shall notify the Department within 24 hours of receiving an odor complaint from the public and follow-up in writing within 5 days in accordance with 9 VAC 20-81-530.C.3.

Depending on the source, intensity, and longevity of the identified odor, the facility may also need to implement additional operating procedures or make investments to improve landfill gas and odor control. For example, if the source of odor is the receipt of particularly odorous wastes, the facility should implement communication procedures which could include requiring the waste generator to provide advance notification or schedule waste delivery. The scale house can then notify working face operators of incoming odorous wastes so an area can be prepped for immediate burial and covering prior to the truck arriving at the working face. Another operational change may include locating the active working face in areas that account for seasonal weather patterns and wind directions if feasible. If the source of odor is identified as landfill gas or leachate related, the facility will need to maximize the use of any existing control systems, but may also need to start investing in improvements to landfill GCCS, leachate aeration, or odor neutralizing systems, which may require capital expense and time to construct. While facilities need to respond to all types of odor complaints, landfill operators should focus their efforts to minimize the presence of persistent odors.

### **C. Response to On-Going Odor Complaints**

If odor problems persist and the DEQ and/or facility continues to receive odor complaints, the facility must continue to follow its Odor Management Plan and document, investigate, and respond to complaints accordingly. Again, depending on the source, intensity, and longevity of the identified odor, the facility may need to invest in improvements to landfill GCCS, leachate aeration, or odor neutralizing systems. Odor masking agents have been used with mixed success, and are not ideal for a long-term solution. Facilities may also need to consider more robust intermediate cover solutions or installing interim or final cover as a means to reduce odors. At a minimum, the Odor Management Plan shall be reviewed and updated by the facility annually to address ongoing odor management issues in accordance with 9 VAC 20-81-200.D.3.

If odors persist at a landfill, the facility may consider or may be required to perform additional investigations that may help pinpoint the source of trace compounds causing the odor complaints to help better determine an appropriate course of action. These investigations may include, but are not limited to the following:

- Regular off-site odor surveys performed by facility staff or a third-party to determine the time of day and/or locations that are most problematic. Surveys can be as simple as sending staff out to smell and rank observed odors to more formal surveys using calibrated equipment to detect levels of methane, hydrogen sulfide, or other trace gases.
- Collecting grab samples of gases in the vicinity of complaints. For comparison purposes, it is best if these types of samples can be collected both when odors are present and when they are not.
- Perform air dispersion modeling and/or analysis of data trends based on logged odor complaints. Data to consider are time of day of complaints, weather conditions, wind speed and direction, terrain, and reported types and intensity of odors. These types of analyses may help the facility direct its odor mitigation strategies to specific areas of the landfill to prevent odor nuisances.

Data collected can be used to confirm whether or not there is a health risk associated with the level of trace gases detected by comparing to National Institute for Occupational Safety and Health (NIOSH) standards available from the Centers for Disease Control. The Virginia Department of Health (VDH) is responsible for making such determinations based upon levels of trace constituents detected.

Facilities that have been dealing with persistent odor complaints may find it helpful to meet regularly with the community or local government to keep them updated on facility actions to minimize odors. It may also be helpful for facilities to maintain a distribution list to provide notification to the community and local government to keep citizens abreast of facility actions that may lead to a short term odor nuisance, such as new cell construction with tie-ins to liner and leachate collection systems of existing cells or the installation of new or additional landfill gas extraction components that will require excavation of existing trash.

Any or all of the above actions or investigations may be implemented proactively by the facility through the facility's Odor Management Plan or required by the DEQ through a letter of agreement, consent order, or other mechanism developed pursuant to a compliance response or through an agency-initiated permit action. As stated in response to an initial odor complaint, the detection of an odor itself does not necessarily warrant the issuance of an alleged violation; however, if the off-site detection is on-going, the DEQ should assess the level of work and effort performed by the facility since the initial complaint to determine whether an alleged violation is warranted. It is likely that an alleged violation for odor (see 9 VAC 20-81-140.A.10.) would be accompanied by alleged violations for a facility failing to meet the regulatory operational performance standards or permit conditions for the identified odor sources (e.g. daily cover, GCCS, leachate management, etc.).

DEQ staff should consider whether previous approvals for alternate daily cover, special waste acceptance, or other operational allowances may be contributing to the existing odor complaints. If applicable, DEQ may require monitoring for methane and/or site-specific trace constituents (e.g. hydrogen sulfide). Any requirements to routinely survey or monitor the facility and impacted neighborhoods or collect samples of surface and ambient air for analysis should be site-specific. For example, DEQ has recently required odor evaluations of alternate daily and intermediate covers in use at a couple of sites. The evaluation was modeled after the surface emissions monitoring requirement of the air regulations, but was focused on evaluating the effectiveness of those covers in preventing the escape of odors in accordance with 9 VAC 20-81-140.B.1.c. If monitoring determines an odor impact, DEQ staff should either rewrite the previous alternate cover approval to include new limitations to minimize odor complaints or revoke the previous approval.

#### **D. Closing out Odor Compliance Issues**

DEQ should be able to terminate a compliance order or agreement once all conditions therein are satisfied. The following should be confirmed when considering termination:

1. The facility has an Odor Management Plan in its operating record that has been revised annually. The plan must contain steps outlining an appropriate response to odor complaints received with a procedure for monitoring on a regular basis and/or in response to odor complaints.

2. The facility has installed or expanded a landfill gas collection and control system. The GCCS must conform to New Source Performance Standards (NSPS), Emission Guidelines (EGs), and any Air permit conditions, if applicable. Otherwise, GCCSs must exist to prevent subsurface migration and control odors. A facility with a GCCS that includes the passive or active venting of landfill gas may need to install a flare or other gas destruction equipment to control odors.
3. The facility has operational controls in place for the management of odorous wastes, and consistently operates an appropriately sized working face, employs and maintains adequate daily and intermediate cover, and repairs erosion or cracks in cover soils.
4. The facility has installed or improved odor controls associated with the leachate management system. These controls may include limitations on leachate aeration, recirculation, or evaporation activities.
5. The facility has performed all required investigations, monitoring, and analyses and VDH has determined that the odor does not constitute a health hazard. If a health hazard has been identified, then the above identified controls and improvements must have been made to reduce the odors such that VDH no longer considers the odors to be a health hazard.
6. The frequency of odor complaints received by the facility and/or DEQ has decreased.
7. And finally, the facility appears to be in compliance with all other air and waste regulations and permit conditions.

Odors are typically associated with landfill operation; however, if operational improvements as listed above have been installed or improved to minimize the migration of those odors to the maximum extent feasible, the DEQ can consider termination of a compliance order or agreement, even if a facility continues to receive sporadic odor complaints.

## **VI. Collaboration Process**

This guidance was developed based on input from a small stakeholder workgroup consisting of DEQ staff from both Land and Air Divisions, environmental consultants, and representatives from two facilities with on-going odor complaints. Additionally, comments from DEQ staff and interested parties were solicited and considered in the final version.

## **VI. Other Applicable Information**

The following guidance documents also pertain to landfill gas and odors:

[Submission Instruction No. 13: Landfill Gas Management, Remediation, and Odor Plans for Solid Waste Disposal Facilities](#)

[Land Protection & Revitalization Guidance Memo No. LPR-SW-2017-01: Clarification of Landfill Gas Regulatory Requirements](#)

[Air Pollution Guidance-553A: Landfill Review Procedures for New Source Review and Title V Permitting](#)