



Gas Monitoring

Technical Memorandum

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Alaska Department of Environmental Conservation
Division of Environmental Health
Solid Waste Program

Landfill gases are a result of microbial decomposition of solid waste. The gases produced include methane, carbon dioxide, and lesser amounts of other gases such as hydrogen, hydrogen sulfide, and volatile organic compounds. Methane concentrations are the primary concern when evaluating landfill gas generation because methane is odorless, highly combustible, and explosive at between 5% and 15% by volume in air. The accumulation of methane in confined spaces or structures, particularly structures that may be inhabited, presents a significant health and safety concern.

Explosive gas monitoring is required in accordance with Title 18, Chapter 60, section 805 [18 AAC 60.805] at Class I and Class II municipal solid waste facilities. The Alaska Department of Environmental Conservation (ADEC) may also require gas monitoring at any other solid waste facility at which the Solid Waste Program determines that a potential landfill gas hazard exists due to the waste disposed in the landfill or conditions present at the facility.



Monitoring Plan

All facilities subject to 18 AAC 60.805 should have a gas monitoring plan approved by the Solid Waste Program. The plan, at a minimum, should include all of the information in the ADEC *Solid Waste Program Gas Monitoring Plan Checklist*.



Monitoring Schedule

Monitoring should be conducted at least quarterly. More frequent monitoring may be required based on LEL exceedances, soil conditions, hydraulic and hydrogeologic conditions underlying the facility and adjacent property, changing landfill conditions that might affect the landfill gas migration rate, the proximity of the facility structures and property boundaries to the nearest source of landfill gas, and ensuring the safety and welfare of site workers.



Monitoring System

Gas monitoring at landfills should be conducted in all structures, gas wells/vents, and gas probes around the site. If gas probes are not currently installed at the landfill, ambient air should be monitored at regular pre-approved intervals between the waste and the property boundary and/or along the facility boundary until gas probes can be installed. The Solid Waste Program requires the use of gas probes to sample methane concentrations in the soil at the property boundary. ADEC also recommends that gas probes be placed and sampled between the waste mass and any structures to which gas migration may pose a danger.



Class I and II landfills are required to ensure that methane concentrations do not exceed 25% of the lower explosive limit (LEL) in facility structures, and do not exceed the LEL at the facility property boundary.

Gas Probes

The overall design of gas probes must be certified by a registered engineer and several factors should be considered in the design and placement of the probes.

- Probes should be constructed with longer, rather than shorter, screen segments. Longer screens reduce the risk of probe blockage from dirt, roots, and other organic material.
- Gas wells and probes should be properly labelled and easily identified.
- The depth of the probes in relation to the water table or other impermeable barriers should be a consideration in the design of the monitoring system. Probes should not be installed to depths below the water table.
- If seasonally-high water table conditions may intersect the probe, the screened interval must be placed such that most of the screen will always be within unsaturated soil.
- Care should be taken when choosing probe locations to avoid areas with dense vegetation due to the high potential for root intrusion and blockage.

The number and location of gas probes along the property boundary is site-specific and is highly dependent on subsurface conditions and on the location and design of facility structures. Coarse, porous soils, such as sand and gravel, allow for greater lateral migration of gases than do finer-grained soils. A site investigation may be needed, if not previously completed, to ensure that gas probes are installed so that the most permeable subsurface strata are being monitored. In some cases, soil conditions such as permafrost and wetlands may require placing gas probes in locations other than along the property boundary to detect any potentially migrating gases. In areas where gases could migrate laterally, the locations of inhabited structures on or near the landfill may also affect the number and location of gas probes installed at the site.

It is important to note that landfill gas in a closed landfill will have a greater tendency to migrate laterally if the final cover includes an impermeable geomembrane. The degree of lateral gas migration depends on the presence of active or passive gas control systems and on the nature of the soils surrounding the landfill. In closed landfills where the final cover does not include an impermeable geomembrane, gas migration may be lateral or vertical depending on the preferential pathways.



Monitoring

To fully characterize the presence of landfill gas within the facility, the owner or operator should monitor for landfill gas in facility structures where gas may accumulate, in gas wells and vents within the landfill, and in gas probes at the property boundary. Monitoring within the waste mass, though not required, is recommended as it helps determine whether the landfill is generating landfill gases and allows tracking of changes in those concentrations.

The concentrations of landfill gases within the gas probe can be directly measured using the gas meter. The gas meter should be connected to the valve on the gas probe and measurements should continue to be taken until the gas readings stabilize within 0.5% by volume. Achieving a stabilized reading may require slow purging of the probe using the meter's pump for an extended period of time. If performing ambient air monitoring the intake of the meter should be held at the ground surface or inserted in holes or cracks in the ground surface to minimize the impact of dilution in surrounding air.

The purpose of indoor air monitoring is to check for the presence of landfill gas and evaluate the risk it poses to the building occupants. When sampling inside facility structures, extra caution should be taken, and OSHA requirements followed, whenever entry into a confined space is needed to complete the indoor air monitoring. The use of a



continuous-read or programmable monitor with remote read-outs is preferred for monitoring in hard-to-reach or confined spaces. To ensure indoor air monitoring is effective, a comprehensive ADEC approved monitoring plan is essential. This plan should include the frequency, specific locations, and rationale for all monitoring within each structure. Special attention should be paid to crawl spaces, basements, electrical boxes, and areas where plumbing or other conduits enter the structures, as these are areas through which methane typically migrates and in which methane typically accumulates.



Reporting Requirements

Explosive gas monitoring results should be placed in the operating record and, if required by the permit or approved monitoring plan, reported to the Solid Waste Program within 60 days.

If methane gas levels exceeding the maximum allowable levels are detected in facility structures or at the facility boundary, the owner or operator shall immediately notify the Solid Waste Program by telephone and in writing and shall take all necessary steps to reduce or dissipate the concentrations of methane to ensure public health, safety, and welfare. The Solid Waste Program recommends that landfill owners/operators plan ahead for how to quickly reduce or dissipate methane when an exceedance is detected.



Remediation Plan

Within 30 days after detecting an exceedance of any landfill gas standard anywhere on the facility, the owner or operator shall submit to ADEC a long-term remediation plan for the landfill gas release. No later than 60 days after detecting the exceedance or upon approval of the plan, whichever comes first, the owner or operator shall implement a Solid Waste Program approved long-term remediation plan for the landfill gas release, place a copy of the approved plan in the operating record, and submit written notification to the Solid Waste Program that the plan has been implemented.

The remediation plan should describe the extent and nature of the problem as well as a proposed remedy. To adequately characterize the problem, the landfill owner/operator may need to conduct further subsurface investigations in the area where an exceedance was noted. The investigation should consider all possible causes including landfill operations, gas control system failures, climatic conditions, closure activity, construction activity, etc. To help ensure compliance with the 60-day timeline, the Solid Waste Program recommends that landfill owner/operators pre-plan for the various potential corrective actions that may be applicable to and available at their site.



Monitoring for Other Landfill Gases

In addition to methane, the Solid Waste Program recommends collecting and recording concentration data for oxygen, carbon dioxide, and other trace gases (such as hydrogen sulfide) that may be a concern, and tracking water presence and level, gas probe pressure, ambient temperature, barometric pressure, and the occurrence of precipitation during sampling. These data will provide useful information when assessing the monitoring results and may also prove useful in evaluating any odor complaints caused by landfill gas from the facility.

Under 18 AAC 60.805, the Solid Waste Program can require landfill gas monitoring for gases other than methane if ADEC determines that a potential landfill gas hazard exists at the facility due to the waste disposed in the landfill or conditions present at the landfill.



Other Gas Monitoring Requirements

For other gas monitoring requirements pertaining to the Federal Clean Air Act, greenhouse gas monitoring, or Title V permits, please contact the ADEC Air Quality Program or the Region 10 U.S. Environmental Protection Agency office.

References

- EPA. November 1993. Solid Waste Disposal Facility Criteria – Technical Manual (<https://nepis.epa.gov/Exe/ZyPDF.cgi/P1003F0V.PDF?Dockey=P1003F0V.PDF>)
- EPA. September 2005. Guidance for Evaluating Landfill Gas Emissions from Closed or Abandoned Facilities (<https://nepis.epa.gov/Exe/ZyPDF.cgi/P1000BRN.PDF?Dockey=P1000BRN.PDF>)
- Oklahoma Department of Environmental Quality. Guidance on Methane Gas Monitoring (<http://www.deq.state.ok/wp-content/uploads/land-division/Methane-Gas-Monitoring-Guidance.pdf>)
- Missouri Department of Natural Resources. June 2014. Procedures for Sampling Landfill Methane Gas Inside Buildings (<https://dnr.mo.gov/document-search/procedures-sampling-methane-gas-inside-buildings-pub2052/pub2052>)
- Missouri Department of Natural Resources. September 1999. Sampling of Landfill Gas Monitoring Wells (<https://p2infohouse.org/ref/17/16642.pdf>)
- SWANA. March 1997. Landfill Gas Operation & Maintenance – Manual of Practice (https://digital.library.unt.edu/ark:/67531/metadc676186/m2/1/high_res_d/314156.pdf)