Chapter 173-408 WAC
LANDFILL METHANE EMISSIONS

NEW SECTION

WAC 173-408-010 Policy and purpose. (1) Ecology's policy under chapter 70A.540 RCW is to reduce methane emissions from municipal solid waste (MSW) landfills.

(2) This rule establishes requirements to reduce methane emissions from both active and closed MSW landfills that have received solid waste after January 1, 1992.

(3) These rules are informed by landfill methane regulations adopted by the California Air Resources Board, the Oregon Environmental Quality Commission, and the United States Environmental Protection Agency.

NEW SECTION

WAC 173-408-020 Definitions. When used in this chapter, the following terms have the meanings given below. These definitions should not be interpreted to apply to any other chapter unless expressly provided for therein.

"Active mining" means actively excavating a landfill or a portion thereof using conventional mining technology to recover and reuse minerals and/or metals until such a time that the landfill cover is replaced.

"Active municipal solid waste (MSW) landfill" means a municipal solid waste landfill that has accepted or is accepting solid waste for disposal and has not been closed in accordance with the requirements set forth in WAC 173-351-500 as it existed on January 10, 2022.

"Air contaminant" has the same meaning as set forth in WAC 173-400-030.

"Air pollution" is presence in the outdoor atmosphere of one or more air contaminants in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interfere with enjoyment of life and property. For the purpose of this chapter, air pollution does not include air contaminants emitted in compliance with chapter 17.21 RCW.

"Ambient air" means the surrounding outside air.

"Authority" or "local authority" means any air pollution control agency whose jurisdictional boundaries are coextensive with the boundaries of one or more counties.

"CERCLA regulated landfill" means the portion of a municipal solid waste landfill that has been designated as on-site for purposes of a CERCLA response action(s).

"CERCLA response action" means a removal or remedial action conducted pursuant to 42 U.S.C. Sections 9604, 9606, 9620, 9621, or 9622.

"Closed municipal solid waste landfill" means a municipal solid waste landfill that is no longer accepting solid waste for disposal

and has been closed in accordance with the requirements set forth in WAC 173-351-500 as it existed on January 10, 2022.

"Component" means any equipment that is part of a gas collection and control system and that contains landfill gas including, but not limited to, wells, pipes, flanges, fittings, valves, flame arrestors, knock-out drums, sampling ports, blowers, compressors, or connectors.

"Component leak" means the concentration of methane measured one half of an inch or less from a component source that exceeds 500 parts per million by volume (ppmv), other than "nonrepeatable, momentary readings," as defined in this section. Measurements from any vault must be taken within three inches above the surface of the vault exposed to the ambient air.

"Continuous operation" means that a gas collection and control system is operated continuously, the existing gas collection wells are operating under vacuum while maintaining landfill gas flow, and the collected landfill gas is processed by a gas control system 24 hours per day.

"Department" means the department of ecology.

"Destruction efficiency" means a measure of the ability of a gas control device to combust, transform, or otherwise prevent emissions of methane into the ambient air.

"Emission" means a release of air contaminants into the ambient air.

"Enclosed combustor" means an enclosed firebox which maintains a relatively constant limited peak temperature generally using a limited supply of combustion air. An enclosed flare is considered an enclosed combustor.

"Energy recovery device" means any combustion device that uses landfill gas to recover energy in the form of steam or electricity including, but not limited to, gas turbines, internal combustion engines, boilers, and boiler-to-steam turbine systems.

"Exceedance" means the concentration of methane measured within three inches above the landfill surface that exceeds 500 ppmv, other than "nonrepeatable, momentary readings," as defined in this section, as determined by instantaneous surface emissions monitoring; or the average methane concentration measurements that exceed 25 ppmv, as determined by integrated surface emissions monitoring.

"Gas collection system" means any portion of a gas collection and control system that employs various gas collection wells and connected piping, and mechanical blowers, fans, pumps, or compressors to create a pressure gradient, actively extract landfill gas, and convey the gas to the gas control system.

"Gas control device" means any device used to dispose of or treat collected landfill gas including, but not limited to, enclosed flares, internal combustion engines, boilers and boiler-to-steam turbine systems, fuel cells, and gas turbines. A gas control device is a component used in a gas control system.

"Gas control system" means any portion of a gas collection and control system that disposes of or treats collected landfill gas by one or more of the following means: Combustion; gas treatment for subsequent sale, or sale for processing offsite, including for transportation fuel and injection into a natural gas pipeline.

"Hazardous waste" has the same meaning as set forth in RCW 70A.300.010.

"Heat input capacity (HIC)" means the hourly heat content available on a steady state basis in the form of landfill gas generated from a landfill's waste source material.

"Hydrocarbon detector" means an instrument used for the measurement of methane that meets the calibration, specifications, and performance criteria of EPA Reference Method 21, Determination of Volatile Organic Compound Leaks, 40 C.F.R. Part 60, Appendix A (in effect on the date in WAC 173-400-025).

"Inactive municipal solid waste landfill" means a municipal solid waste landfill that is no longer accepting solid waste for disposal and has been closed in accordance with the requirements set forth in chapter 173-304 WAC. For purposes of this rule, an inactive municipal solid waste landfill is subject to all requirements applicable to an active municipal solid waste landfill unless and until (a) the department or local authority determines the landfill is exempt in accordance with WAC 173-408-070 (4)(b)(ii); or (b) the owner or operator submits a closure notification in accordance with WAC 173-408-170(8).

"Increased meter reading" means a single or series of meter reading(s) above 200 ppm of methane.

"Inert waste or nondecomposable waste(s)" has the same meaning as "inert waste" in WAC 173-350-100.

"Landfill" has the same meaning as set forth in RCW 70A.205.015.

"Landfill gas" means any raw gas derived through a natural process from the decomposition of organic waste deposited in a MSW landfill, from the evolution of volatile species in the waste, or from chemical reactions of substances in the waste.

"Landfill surface" means the area of the landfill under which decomposable solid waste has been placed, excluding the working face.

"Limited purpose landfill" has the same meaning as set forth in WAC 173-350-100.

"Municipal solid waste (MSW)" means a subset of solid waste which includes unsegregated garbage, refuse and similar solid waste material discarded from residential, commercial, institutional, and industrial sources and community activities, including residue after recyclables have been separated. Solid waste that has been segregated by source and characteristic may qualify for management as a non-MSW solid waste, at a facility designed and operated to address the waste's characteristics and potential environmental impacts. The term MSW does not include:

(a) "Dangerous wastes," as defined in RCW 70A.300.010, other than wastes expressly excluded from the requirements of chapter 173-303 WAC, Dangerous waste regulations, as set forth in WAC 173-303-071, such as household hazardous wastes;

(b) Any solid waste, including contaminated soil and debris, generated by a "CERCLA response action," as defined in this section, or by a remedial action taken under the Model Toxics Control Act, chapters 70A.305 RCW and 173-340 WAC; nor

(c) Mixed or segregated recyclable material that has been source-separated from garbage, refuse and similar solid waste. However, the residual from source separated recyclables is MSW.

"Municipal solid waste landfill" means a discrete area of land or an excavation that receives municipal solid waste, including household waste, and that is not a land application site, surface impoundment, injection well, or pile.

"Nonrepeatable, momentary readings" means indications of the presence of methane, which persist for less than five seconds and do not recur when the sampling probe of a portable gas detector is placed in the same location.

"Nozzle offset distance" means the horizontal distance between the "unmanned aerial system," as defined in this section, and the dis-

tal end of the nozzle when flown as a fixed above ground level (AGL) and a known nozzle tube length.

"On-site" has the same meaning as set forth in 40 C.F.R. 300.400(e)(1) (in effect on the date in WAC 173-400-025).

"Operator" means any "person," as defined in this section, that:

(a) Operates a MSW landfill;

(b) Is responsible for complying with any federal, state, or local requirements relating to methane emissions from a source located on real property used for MSW landfill purposes and subject to this chapter; or

(c) Operates any stationary equipment for the collection of landfill gas from a MSW landfill subject to this chapter.

"Owner" means any "person," as defined in this section, that:

(a) Holds title to any portion of the real property on which a MSW landfill subject to this chapter is located including, but not limited to, title held by joint tenancy, tenancy in common, community property, life estate, estate for years, lease, sublease, or assignment, except title held solely as security for a debt such as mortgage;

(b) Is responsible for complying with any federal, state, or local requirements relating to methane emissions from a source located on real property used for MSW landfill purposes and subject to this chapter; or

(c) Owns any stationary equipment for the collection of landfill gas from a MSW landfill subject to this chapter.

"Person" means an individual, firm, public or private corporation, association, partnership, political subdivision of the state, municipality, or governmental agency.

"Professional engineer" means an individual who is registered in Washington and holds a valid certificate to practice engineering in Washington as provided under chapter 18.43 RCW.

"Putrescible waste" means solid waste which contains material capable of being readily decomposed by microorganisms and which is likely to produce offensive odors.

"Solid waste" means all putrescible and nonputrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, commercial waste, swill, sewage sludge, demolition, and construction wastes, abandoned vehicles or parts thereof, discarded commodities and recyclable materials.

"Third-party owner or operator" means any "person," as defined in this section, that:

(a) Owns any stationary equipment for the collection of landfill gas from a MSW landfill subject to this chapter; or

(b) Purchases or otherwise obtains untreated landfill gas from an owner or operator of a MSW landfill subject to this chapter and owns any stationary equipment for the treatment and/or combustion of the landfill gas.

"Unmanned aerial system (UAS)," commonly known as a drone, means an aircraft without any human pilot, crew, or passengers on board. In this context, a UAS includes multiple rotors such that the minimum speed is not limited by stall and can be reduced all the way to zero (hover).

"Waste in place" means the total amount of solid waste placed in the MSW landfill estimated in tons. The solid waste density is assumed to be 1,300 pounds per cubic yard, and the decomposable fraction is assumed to be 70 percent by weight, unless the department or local authority approves alternative values.

"Working face" means the open area of a MSW landfill where solid waste is deposited daily and compacted with landfill equipment.

NEW SECTION

WAC 173-408-030 Applicability. Except as provided in subsection (1) of this section, this chapter applies to all MSW landfills that received solid waste after January 1, 1992.

(1) This chapter does not apply to the following landfills:

(a) Landfills that receive or received only "hazardous waste(s)" as defined in WAC 173-408-020;

(b) "CERCLA regulated landfill" as defined in WAC 173-408-020, if it meets the criteria for exemption set forth in WAC 173-408-040;

(c) Landfills that receive or received only "inert waste or non-decomposable waste(s)" as defined in WAC 173-408-020; or

(d) A "limited purpose landfill" as defined in WAC-173-408-020.

(2) Jurisdiction.

(a) The owner or operator of a landfill that is located within the jurisdiction of a local authority activated in accordance with chapter 70A.15 RCW must submit all reports and other information required by this chapter to the local authority unless otherwise stated in this chapter.

(b) The owner or operator of a landfill that is not located within any jurisdiction of a local authority activated in accordance with chapter 70A.15 RCW must submit all reports and other information required by this chapter to the department unless otherwise stated in this chapter.

NEW SECTION

WAC 173-408-040 CERCLA exemption. (1) CERCLA exemption process: This subsection establishes the process for an owner or operator of a CERCLA regulated landfill to claim an exemption from the requirements of this chapter. To claim exemption from the requirements of this chapter, the owner or operator of a CERCLA regulated landfill shall submit the following information to the department:

(a) The applicable CERCLA removal action memorandum or remedial action record of decision, including any amendments;

(b) A map of the portion of the landfill that has been designated as on-site for purposes of the CERCLA response action; and

(c) Additional information as needed to establish that the CERCLA regulated landfill meets the criteria for exemption set forth in subsection (2) of this section.

(2)(a) The department will review the submitted information and determine whether the CERCLA regulated landfill meets the following criteria for exemption from the requirements of this chapter:

(i) The CERCLA response action(s) must be currently under way at the CERCLA regulated landfill;

(ii) The owner or operator must demonstrate that complying with the requirements of this chapter would compromise the efficacy of the ongoing CERCLA response action(s);

(iii) The CERCLA response action(s) must require the installation or modification of a landfill gas collection and control system (GCCS); and

(iv) The owner or operator must demonstrate that the GCCS influences methane capture in the landfill.

(b) The department may consult with the U.S. Environmental Protection Agency while determining whether the CERCLA regulated landfill meets the above criteria for exemption from the requirements of this chapter.

(c) For zones or areas of a MSW landfill that are adjacent to but outside the area designated as on-site for purposes of the CERCLA response action(s), the substantive requirements of this chapter shall be considered as applicable or relevant and appropriate requirements (ARARs) in the selection of a removal or remedial action, and in evaluations of a removal or remedial action's compliance with ARARs during any subsequent five-year reviews required by CERCLA.

NEW SECTION

WAC 173-408-050 Request for demonstration. The department or local authority may request that any owner or operator of a MSW landfill demonstrate that the landfill does not meet the applicability criteria in WAC 173-408-030. Such a demonstration must be submitted to the department or local authority, as applicable, within 90 days of a written request received from the department or local authority.

NEW SECTION

WAC 173-408-060 Waste in place reporting. (1) Each owner or operator of a MSW landfill that received solid waste after January 1, 1992, must submit an initial waste in place report to the department in accordance with WAC 173-408-170(1).

(2) Each owner or operator of an active MSW landfill having fewer than 450,000 tons of waste in place must submit an annual waste in place report to the department and local authority in accordance with WAC 173-408-170 (3) and (4) until either:

(a) The active MSW landfill reaches a size of greater than or equal to 450,000 tons of waste in place; or

(b) The owner or operator submits a closure notification under WAC 173-408-170(8).

NEW SECTION

WAC 173-408-070 Landfill gas heat input capacity (HIC). (1) This section applies to each owner or operator of:

(a) An active MSW landfill having waste in place of 450,000 tons or greater; or

(b) A closed MSW landfill having waste in place of 750,000 tons or greater.

(2) Each owner or operator subject to this section must submit an initial landfill gas HIC report to the department in accordance with WAC 173-408-170(2).

(3) Each owner or operator subject to this section must submit an annual landfill gas HIC report to the department and local authority in accordance with WAC 173-408-170 (3) and (5) until either:

(a) The MSW landfill reaches a HIC of 3,000,000 British thermal units per hour recovered or greater; or

(b) The owner or operator submits a closure notification under WAC 173-408-170(8).

(4) Each owner or operator of a MSW landfill that has a HIC of 3,000,000 British thermal units per hour recovered or greater must either:

(a) Meet the requirements of WAC 173-408-080; or

(b) Demonstrate to the satisfaction of the department or local authority that after four consecutive quarterly monitoring periods there is no measured concentration of 200 parts per million by volume or greater of methane using the instantaneous surface monitoring procedures specified in WAC 173-408-120 (3)(b). If there is no measured concentration of 200 parts per million by volume or greater of methane, then the following apply:

(i) The owner or operator of an active MSW landfill must recalculate the HIC annually and submit an annual landfill gas HIC report in accordance with subsection (3) of this section, until such time that the owner or operator submits a closure notification under WAC 173-408-170(8).

(ii) The owner or operator of a closed or inactive MSW landfill that meets the requirements of this subsection no longer has to comply with any other requirements of this chapter, provided that the following information is submitted to and approved by the department or local authority:

(A) A waste in place report prepared in accordance with WAC 173-408-170 (3) and (4); and

(B) All instantaneous surface monitoring records.

NEW SECTION

WAC 173-408-080 Gas collection and control systems. (1) General requirements: Except as provided by (a) of this subsection, any owner or operator of a MSW landfill that exceeds the HIC threshold specified in WAC 173-408-070(4) must install a gas collection and control system that meets the requirements of this section.

(a) This section does not apply if, in accordance with WAC 173-408-070 (4)(b), the owner or operator has demonstrated to the satisfaction of the department or local authority that after four consecutive quarterly monitoring periods there is no measured concentration of 200 parts per million by volume or greater of methane, using the instantaneous surface monitoring procedures specified in WAC 173-408-120 (3)(b).

(b) If a MSW landfill partners with a "third-party owner or operator," as defined in WAC 173-408-020, to operate all or a portion of the gas collection and control system or energy recovery device, the

owner or operator of the relevant portion of the gas collection and control system or energy recovery device is the responsible party obligated to comply with the requirements of this chapter.

(2) Design plan and installation: If a gas collection and control system that meets the requirements of either subsection (3), (4), or (5) of this section has not been installed, the owner or operator of a MSW landfill must submit a design plan to the department or local authority within one year after the effective date of this chapter, or within one year of detecting any leak on the landfill surface exceeding a methane concentration of 200 ppmv, in accordance with WAC 173-408-070 (3)(b). The department or local authority must review and either approve or disapprove the design plan within 120 days of receipt. The department or local authority may request that the owner or operator submit additional information as part of the review of the design plan.

(a) The design plan must meet the following requirements:

(i) The design plan must be prepared and certified by a "professional engineer," as defined in WAC 173-408-020;

(ii) The following issues must be addressed in the design plan: Depths of solid waste; solid waste gas generation rates and flow characteristics; cover properties; gas system expandability; leachate and condensate management; accessibility; compatibility with filling operations; integration with closure end use; air intrusion control; corrosion resistance; fill settlement; resistance to the solid waste decomposition heat; and ability to isolate individual components or sections for repair or troubleshooting without shutting down the entire collection system;

(iii) A description of the density of wells, horizontal collectors, surface collectors, or other gas extraction devices necessary to achieve compliance with the concentration limits set forth in WAC 173-408-100(2);

(iv) The design plan must include approved equipment maintenance, calibrations, and schedules according to 40 C.F.R. Part 60, Appendix A (in effect on the date in WAC 173-400-025), as well as vendor specifications;

(v) The design plan must provide for the control of the collected gas through the use of a gas collection and control system meeting the requirements of either subsection (3), (4), or (5) of this section;

(vi) The design plan must include any proposed alternatives to the applicable test methods, procedures, compliance measures, or monitoring requirements, under WAC 173-408-130;

(vii) The design plan must include a description of potential mitigation measures to be used to prevent the release of methane or other air pollutants into the ambient air from the working face; during the installation or preparation of wells, piping, or other equipment; during repairs or the temporary shutdown of gas collection system components; when solid waste is to be excavated and moved; during active mining activities; to prevent or extinguish landfill fires; or, during law enforcement activities requiring excavation;

(viii) For active MSW landfills, the design plan must identify areas of the landfill that are closed;

(ix) The design plan must demonstrate how the gas collection and control system will handle the expected gas generation flow rate from the entire area of the MSW landfill and collect gas at an extraction rate to comply with the surface methane emission limits in WAC 173-408-100(2) and the component leak standard in subsection (3)(b) of

this section. The expected gas generation flow rate from the MSW landfill must be calculated in accordance with WAC 173-408-120(5).

Any areas of the landfill that contain only "inert waste or nondecomposable waste(s)," as defined in WAC 173-408-020, may be excluded from gas collection provided that the owner or operator submits documentation to the department or local authority containing the nature, date of deposition, location and amount of inert waste or nondecomposable waste(s) deposited in the area. This documentation may be included as part of the design plan;

(x) The owner or operator must develop acceptable pressure limits for the wellheads and include them in the design plan;

(xi) The owner or operator must place each well or design component as specified in the approved design plan. Following initial construction, each new component must be installed no later than 60 days after the date on which the area controlled by the well is required to be controlled pursuant to this chapter;

(xii) Any owner or operator of an active MSW landfill must install and operate a gas collection and control system not later than 18 months after the date that the landfill is required to comply with this rule, and in accordance with the approved design plan;

(xiii) Any owner or operator of a closed MSW landfill must install and operate a gas collection and control system not later than 30 months after the date that the landfill is required to comply with this rule, and in accordance with the approved design plan;

(xiv) If an owner or operator is modifying an existing gas collection and control system to meet the requirements of this chapter, the existing design plan must be amended to include any necessary updates or addenda and must be certified by a professional engineer;

(xv) An amended design plan must be submitted to the department or local authority within 90 days of any event that warrants a change to the design plan; and

(xvi) The gas collection and control system must be operated, maintained, and expanded in accordance with the procedures and schedules in the approved design plan.

(3) Gas collection and control system requirements: The owner or operator must satisfy the following requirements when operating a gas collection and control system:

(a) Route the collected gas to a gas control device or devices and operate the gas collection and control system continuously except as provided in subsections (7), (8), and (9) of this section, and WAC 173-408-090.

(b) Operate the gas collection and control system so that there is no landfill gas leak that exceeds 500 ppmv, measured as methane, at any component under positive pressure.

(c) The gas collection system must be designed and operated to draw all the gas toward the gas control device or devices.

(d) The landfill gas extraction components must be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: Convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system must extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors must be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations must be situated with regard to the need to prevent excessive air infiltration.

(e) Vertical wells must be placed so as not to endanger underlying liners and must address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors must be of sufficient cross-section to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices must be designed so as not to allow indirect short circuiting of air into the cover, into the solid waste, into the collection system, or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.

(f) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly must include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices must be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.

(4) Requirements for flares: An MSW landfill owner or operator who operates a flare must ensure the gas collection and control system achieves a methane destruction efficiency of at least 99 percent by weight. The owner or operator must satisfy the following requirements:

(a) Route the collected gas to an enclosed flare that meets the following requirements:

(i) Is equipped with automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors.

(ii) During restart or startup there must be sufficient flow of propane or commercial natural gas to the burners to prevent unburned collected methane from being emitted to the ambient air.

(iii) The gas control device must be operated within the parameter ranges established during the initial or most recent source test.

(b) Route the collected gas to an open flare that meets the following requirements:

(i) The open flare must meet the requirements of 40 C.F.R. 60.18 (in effect on the date in WAC 173-400-025);

(ii) An open flare installed and operating prior to December 31, 2022, may operate until January 1, 2032, unless the owner or operator demonstrates to the satisfaction of the department or local authority that the landfill gas HIC is less than 3,000,000 British thermal units per hour in accordance with WAC 173-408-120(2), and is insufficient to support the continuous operation of an enclosed flare or other gas control device; and

(iii) The owner or operator may temporarily operate an open flare during the repair or maintenance of the gas control system, or while awaiting the installation of an enclosed flare, or to address offsite gas migration issues. Any owner or operator seeking to temporarily operate an open flare must submit a written request to the department or local authority in accordance with WAC 173-408-130.

(5) Requirements of gas control devices other than flares: An MSW landfill owner or operator who operates a gas control device other than a flare must satisfy one of the following requirements:

(a) If a gas collection and control system routes the collected gas to an energy recovery device or devices, the owner or operator of the energy recovery device or devices must comply with the following requirements:

(i) The device or devices must achieve a methane destruction efficiency of at least 97 percent by weight, except for lean-burn internal combustion engines that were installed and operating prior to January 1, 2022, which must reduce the outlet methane concentration to

less than 3,000 parts per million by volume, dry basis corrected to 15 percent oxygen; and

(ii) If a boiler or a process heater is used as the gas control device, the landfill gas stream must be introduced into the flame zone, except that where the landfill gas is not the primary fuel for the boiler or process heater, introduction of the landfill gas stream into the flame zone is not required.

(iii) The gas control device must be operated within the parameter ranges established during the initial or most recent source test.

(b) If a gas collection and control system routes the collected gas to a treatment system that processes the collected gas for subsequent sale or use, the owner or operator of the treatment system must ensure the system achieves a methane leak rate of three percent or less by weight. Venting of processed landfill gas to the ambient air is not allowed. If the processed landfill gas cannot be routed for subsequent sale or use, then the treated landfill gas must be controlled according to this subsection (5).

(6) Source test requirements: The owner or operator of a MSW landfill must conduct a source test for any gas control device or devices subject to subsection (4)(a) or (5)(a) of this section using the test methods identified in WAC 173-408-120(6). The gas control device or devices must meet the following requirements:

(a) An initial source test must be conducted within 180 days of initial start-up of the gas collection and control system;

(b) If a gas control device was in compliance with source testing requirements as of June 9, 2022, the owner or operator must conduct the source test no less frequently than once every five years; and

(c) If a gas control device was not in compliance with source testing requirements as of June 9, 2022, or if a subsequent source test shows the gas control device is out of compliance, the owner or operator must conduct the source test no less frequently than once per year until two subsequent consecutive tests both show compliance. Upon two subsequent consecutive compliant tests, the owner or operator may return to conducting the source test no less frequently than once every five years.

(7) Wellhead gauge pressure requirement: Each wellhead must be operated under a vacuum (negative pressure), except as provided in subsections (8) and (9) of this section, WAC 173-408-090, or under any of the following conditions:

(a) Use of a geomembrane or synthetic cover; or

(b) A decommissioned well.

(8) Gas collection well casing extension: The requirements of subsections (3)(a) and (b) and (7) of this section do not apply to individual wells involved in well raising, provided the following requirements are met:

(a) New fill is being added or compacted in the immediate vicinity around the well; and

(b) Once installed, a gas collection well extension is sealed and capped until the raised well is reconnected to a vacuum source.

(9) Repairs and temporary shutdown of gas collection system components: The requirements of subsections (3)(a) and (b) and (7) of this section do not apply to individual landfill gas collection system components that must be temporarily shut down to repair or modify components of the gas collection system, to connect new landfill gas collection system components to the existing system, to prevent or extinguish landfill fires, or if the MSW landfill engages in construction,

active mining, or law enforcement activities, provided the following requirements are met:

(a) Methane emissions are minimized during shutdown under subsection (2)(a)(vii) of this section;

(b) In the event the collection or control system is inoperable, the gas mover system shall be shut down and all valves in the collection and control system contributing to venting of the gas to the atmosphere shall be closed within one hour of the collection or control system not operating.

Efforts to repair the collection or control system must be initiated and completed to minimize downtime, and the collection and control system must be returned to operation no more than five calendar days following initial shutdown. In the event the collection and control system cannot be returned to operation in five calendar days following initial shutdown, the owner or operator must submit a notification to the department or local authority in accordance with WAC 173-408-140; and

(c) Records are kept on the actions being taken, in accordance with WAC 173-408-160 (1)(a)(xiv), (xv), and (xvi).

NEW SECTION

WAC 173-408-090 Permanent shutdown and removal of the gas collection and control system. The owner or operator of a closed MSW landfill may propose to the department or local authority that a gas collection and control system be decommissioned and removed provided the following requirements are met:

(1)(a) The gas collection and control system has been in operation for at least 15 years after an owner or operator has submitted a closure notification that has been approved, pursuant to WAC 173-408-170(8), or the owner or operator demonstrates to the satisfaction of the department or local authority that, due to declining gas flow, the MSW landfill will be unable to operate the gas collection and control system for a 15-year period after closure; and

(b) The landfill has had no exceedance of the methane concentration limits, as determined by surface emissions monitoring conducted in accordance with WAC 173-408-100(2), on three successive test dates. The test dates must be no less than 90 days apart, and no more than 180 days apart.

(2) The owner or operator conducts a provisional shutdown of the gas collection and control system meeting the following conditions:

(a) The owner or operator of the landfill shuts down the collection and control system and conducts surface emissions monitoring over the portion of the landfill served by the shut-down gas collection and control system, in accordance with WAC 173-408-120(3) and (b) of this subsection, for at least eight consecutive calendar quarters;

(b) During the provisional shutdown period, the surface emissions monitoring walking grid described in WAC 173-408-120 (3)(a)(ii) may be increased to 100-foot spacing so long as the walking grid is offset by 25 feet each quarter so that by the end of one year of monitoring, the entire surface area has been monitored every 25 feet; and

(c) During the provisional shutdown period, if any measured concentration of methane from the surface of the closed landfill exceeds the applicable limit specified in WAC 173-408-100(2), the owner or op-

erator must restart the shut-down portion of the gas collection and control system.

(3) If no surface emissions monitoring result exceeds the applicable limit specified in WAC 173-408-100(2) during the provisional shutdown period, and with the approval of the department or local authority, the owner or operator may proceed with permanent shutdown and removal of the gas collection and control system.

(4) Following approval by the department or local authority for a permanent shutdown of the gas collection and control system, the owner or operator may decommission and remove the gas collection and control system and must submit an equipment removal report to the department or local authority in accordance with WAC 173-408-170(9).

(5) Subsequent to permanent shutdown of the gas collection and control system, any exceedance of the surface methane concentration limits may be cause for the department or local authority to require an owner or operator to control surface methane emissions. The required actions may include reestablishing a gas collection and control system.

(6) Nothing in this subsection may be interpreted to modify or supersede requirements related to the capping or removal of gas collection and control systems that may exist under the state Clean Air Act, the Federal Clean Air Act, or rules adopted pursuant to either the state Clean Air Act or the Federal Clean Air Act.

NEW SECTION

WAC 173-408-100 Methane concentration limits. (1) Except as provided in WAC 173-408-080, the methane concentration limits set forth in subsection (2) of this section apply to a MSW landfill subject to this chapter beginning on whichever of the following dates is later:

(a) January 1, 2025;

(b) Upon commencing operation of a newly installed gas collection and control system or modification of an existing gas collection and control system pursuant to WAC 173-408-080; or

(c) A date established by the department to accommodate significant technological improvements, which may include the installation of an energy recovery device or devices, which does not exceed 24 months after the department adopts rules to implement this chapter.

(2) No location on a MSW landfill surface may exceed the following methane concentration limits, dependent upon whether the owner or operator of the MSW landfill conducts instantaneous surface emissions monitoring or integrated surface emissions monitoring in accordance with WAC 173-408-110(1):

(a) Five hundred parts per million by volume, other than when measured by nonrepeatable, momentary readings, as determined by instantaneous surface emissions monitoring; or

(b) An average methane concentration limit of 25 parts per million by volume as determined by integrated surface emissions monitoring.

(3) Any reading exceeding the applicable limit set forth in subsection (2) of this section must be recorded as an exceedance and the following actions must be taken:

(a) The owner or operator must record the date, location, and value of each exceedance, along with retest dates and results. The location of each exceedance must be clearly marked and identified on a topographic map, at a minimum, of the MSW landfill, drawn to scale, with the location of both the monitoring grids and the gas collection system clearly identified;

(b) The owner or operator must take corrective action, which may include, but not be limited to, maintenance or repair of the cover, and well vacuum adjustments. The location or locations of any exceedance must be remonitored within 10 calendar days of a measured exceedance; and

(c) The owner or operator must notify the department or local authority in accordance with WAC 173-408-110 (1)(b).

(4) The requirements of this section do not apply to the following areas, provided that the owner or operator ensures these areas are no larger in size and no longer in duration than is necessary for the specified activity:

(a) The "working face" of the landfill, as defined in WAC 173-408-020;

(b) Areas of the landfill surface where the landfill cover material has been removed for the purpose of installing, expanding, replacing, or repairing components of the landfill cover system, the landfill gas collection and control system, the leachate collection and removal system, or a landfill gas condensate collection and removal system;

(c) Areas of the landfill in which the owner or operator, or a designee, which is a person or entity that has express, written permission from the owner or operator, is engaged in active mining for minerals or metals; or

(d) Areas of the landfill surface where the landfill cover material has been removed for law enforcement activities requiring excavation.

NEW SECTION

WAC 173-408-110 Monitoring. (1) Surface emissions monitoring: The owner or operator of a MSW landfill with a gas collection and control system must conduct quarterly instantaneous or integrated surface monitoring of the entire landfill surface according to this subsection and the procedures in WAC 173-408-120(3).

(a) A surface monitoring design plan must be developed that includes a topographical map that, at a minimum, clearly identifies the monitoring traverse and the working face, and describes the rationale for any site-specific deviations. The plan must be updated quarterly if changes are made to the monitoring traverse or working face, and the surface monitoring design plan must be provided upon request by the department or local authority.

(b) The owner or operator of a MSW landfill must notify the department or local authority within two working days after all corrective actions and remonitoring taken to address exceedances detected under (c) or (d) of this subsection, and subsection (2)(c) of this section. The notification must include a description of the corrective actions taken. The owner or operator of a MSW landfill may request al-

ternative compliance measures to replace the requirements of this subsection in accordance with WAC 173-408-130.

(c) Instantaneous surface monitoring: Any reading exceeding the limit in WAC 173-408-100 (2)(a) must be recorded and reported as an exceedance and the following actions must be taken:

(i) The owner or operator must record the date, location, and value of each exceedance, along with retest dates and results. The location of each exceedance must be clearly marked and identified on a topographic map, at a minimum, of the MSW landfill, drawn to scale with the location of both the grids and the gas collection system clearly identified.

(ii) Corrective action must be taken by the owner or operator such as, but not limited to, cover maintenance or repair, and well vacuum adjustments, and the location must be remonitored within 10 calendar days of a measured exceedance.

(A) If the remonitoring of the location shows a second exceedance, additional corrective action must be taken, and the location must be remonitored again within 10 calendar days of the second exceedance.

(B) If the remonitoring required by (c)(ii)(A) of this subsection shows a third exceedance, the owner or operator must install a new or replacement well, or an alternative active methane control approved by the department or local authority, as needed to achieve compliance no later than 120 calendar days after detecting the third exceedance.

(iii) Any closed MSW landfill that has no monitored exceedances of the limit in WAC 173-408-100 (2)(a) after four consecutive quarterly monitoring periods may monitor annually. Any exceedances of the limit in WAC 173-408-100 (2)(a) detected during the annual monitoring will result in a return to quarterly monitoring of the landfill.

(iv) Any exceedances of the limit in WAC 173-408-100 (2)(a) detected during any compliance inspections will result in a return to quarterly monitoring of the landfill.

(d) Integrated surface monitoring: Any reading exceeding the limit in WAC 173-408-100 (2)(b) must be recorded and reported as an exceedance and the following actions must be taken:

(i) The owner or operator must record the average surface methane concentration measured for each grid along with retest dates and results. The location of the grids and the gas collection system must be clearly marked and identified on a topographic map, at a minimum, of the MSW landfill drawn to scale.

(ii) Within 10 calendar days of a measured exceedance, corrective action must be taken by the owner or operator such as, but not limited to, cover maintenance or repair, and well vacuum adjustments, and the grid must be remonitored.

(A) If the remonitoring of the grid shows a second exceedance, additional corrective action must be taken, and the location must be remonitored again within 10 calendar days after the second exceedance.

(B) If the remonitoring required by (d)(ii)(A) of this subsection shows a third exceedance, the owner or operator must install a new or replacement well, or an alternative active methane control approved by the department or local authority, as needed to achieve compliance no later than 120 calendar days after detecting the third exceedance.

(iii) Any closed MSW landfill that has no monitored exceedances of the limit in WAC 173-408-100 (2)(b) after four consecutive quarterly monitoring periods may monitor annually. Any exceedances of the limit in WAC 173-408-100 (2)(b) detected during the annual monitoring event will result in a return to quarterly monitoring of the landfill.

(iv) Any exceedances of the limit in WAC 173-408-100 (2)(b) detected during any compliance inspections will result in a return to quarterly monitoring of the landfill.

(e) An owner or operator of a closed MSW landfill that can demonstrate that, in the three years before the effective date of this chapter, there were no exceedances of the limit in WAC 173-408-100(2), as measured by annual or quarterly monitoring, may monitor annually. Any exceedances of the limit in WAC 173-408-100(2) detected during the annual monitoring event will result in a return to quarterly monitoring of the landfill.

(2) Gas control system equipment monitoring: The owner or operator, or third-party owner or operator, of a MSW landfill with a gas collection and control system must monitor the system according to the following procedures:

(a) For enclosed flares, the following equipment must be installed, calibrated, maintained, and operated according to the manufacturer's specifications:

(i) A temperature monitoring device equipped with a continuous recorder which has an accuracy of plus or minus (±) one percent of the temperature being measured expressed in degrees Celsius or Fahrenheit, which may be recorded in 15-minute average increments.

(ii) At least one gas flow rate measuring device which must record the flow to the control device(s) at least every 15 minutes.

(b) For a gas control device other than an enclosed flare, the owner or operator must demonstrate compliance by providing information describing the operation of the gas control device, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The owner or operator, or third-party owner or operator, may request alternative compliance measures to replace the requirements of this subsection in accordance with WAC 173-408-130. The department may specify additional monitoring procedures as a condition of approving alternative compliance measures.

(c) Components containing landfill gas must be monitored quarterly for leaks. Any component leak must be tagged, repaired, and remonitored within 10 calendar days, and the department or local authority must be notified in accordance with subsection (1)(b) of this section.

At facilities which combust landfill gas for energy production, or which treat landfill gas for other beneficial uses, and which are located at MSW landfills subject to this chapter, component leak testing may be conducted prior to scheduled maintenance or planned outage periods, if the maintenance or planned outage periods would conflict with the quarterly monitoring schedule.

(3) Wellhead monitoring: The owner or operator of a MSW landfill with a gas collection and control system must monitor each individual wellhead monthly to determine the gauge pressure. If there is any positive pressure reading other than as provided in WAC 173-408-080(7), the owner or operator must take the following actions:

(a) Initiate corrective action within five calendar days of the positive pressure measurement;

(b) If the problem is not corrected within 15 days of the date the positive pressure was first measured, the owner or operator must initiate further corrective action including, but not limited to, any necessary expansion of the gas collection system, to mitigate any positive pressure readings; and

(c) Corrective actions, including any expansion of the gas collection and control system, must be completed and any new wells must

be operating within 120 days of the date the positive pressure was first measured.

NEW SECTION

WAC 173-408-120 Test methods and procedures. (1) Hydrocarbon detector specifications: Any instrument used for the measurement of methane must be a hydrocarbon detector or other equivalent instrument approved by the department or local authority that meets the following calibration, specifications, and performance criteria, as applicable:

(a) EPA Reference Method 21, Determination of Volatile Organic Compound Leaks, 40 C.F.R. Part 60, Appendix A (in effect on the date in WAC 173-400-025), which is incorporated by reference herein, except as follows:

(i) "Methane" replaces all references to volatile organic compounds (VOC).

(ii) The calibration gas shall be methane.

(b) EPA Other Test Method 51 (OTM-51) as specified in WAC 173-408-990 (Appendix II) of this chapter.

(c) Other approved EPA test methods with concurrent department or local authority approval.

(2) Determination of landfill gas heat input capacity: The landfill gas HIC must be determined in accordance with this subsection:

(a) MSW landfills without carbon adsorption or passive venting systems: The HIC must be calculated using the procedure as specified in WAC 173-408-980 (Appendix I). Additional information may be requested by the department or local authority as necessary to verify the HIC from the MSW landfill. Site-specific data may be substituted when available.

(b) MSW landfills with carbon adsorption systems: The landfill gas HIC at a MSW landfill with a carbon adsorption system must be determined by measuring:

(i) The actual total landfill gas flow rate, in standard cubic feet per minute (scfm), using a flow meter or other flow measuring device such as a standard pitot tube; and

(ii) The methane concentration (percent by volume) using a hydrocarbon detector meeting the requirements of subsection (1) of this section. The total landfill gas flow rate must be multiplied by the methane concentration and then multiplied by the gross heating value (GHV) of methane of 1,012 Btu/scf to determine the landfill gas HIC.

(c) MSW landfills with passive venting systems: The landfill gas HIC at a MSW landfill with a passive venting system must be determined using both of the following, and is the higher of those determined values:

(i) The calculation described in (a) of this subsection; and

(ii) The owner or operator must measure:

(A) The actual landfill gas flow rates (in units of scfm), using a flow meter or other flow measuring device such as a standard pitot tube; and

(B) The methane concentration (percent by volume), using a hydrocarbon detector meeting the requirements of subsection (1) of this section, from each venting pipe that is within the waste mass. Each gas flow rate must then be multiplied by its corresponding methane concentration to obtain the individual methane flow rate. The individ-

ual methane flow rates must be added together and then multiplied by the GHV of methane of 1,012 Btu/scf to determine the landfill gas HIC.

(3) Surface emissions monitoring procedures: The owner or operator of a MSW landfill must measure the landfill surface concentration of methane using a hydrocarbon detector meeting the requirements of subsection (1) of this section. The landfill surface must be inspected using the following procedures:

(a) Monitoring area: The entire landfill surface must be divided into individually identified 50,000 square foot grids. The grids must be used for both instantaneous and integrated surface emissions monitoring.

(i) Testing must be performed by holding the hydrocarbon detector's probe within three inches of the landfill surface while traversing the grid, except where alternatives to EPA Reference Method 21 are used.

(ii) The walking pattern must be no more than 25-foot spacing intervals and must traverse each monitoring grid.

(A) If the owner or operator measures no exceedances of the limits in WAC 173-408-100(2), after any four consecutive quarterly monitoring periods, the walking pattern spacing may be increased to 100-foot intervals. The owner or operator must return to a 25-foot spacing interval upon detection of any exceedances of the limits in WAC 173-408-100(2) that cannot be remediated within 10 calendar days or upon any exceedances detected during a compliance inspection.

(B) If an owner or operator of a MSW landfill can demonstrate that in the three years before the effective date of this chapter that there were no measured exceedances of the limits in WAC 173-408-100(2), by annual or quarterly instantaneous surface emissions monitoring, the owner or operator may increase the walking pattern spacing to 100-foot intervals. The owner or operator must return to a 25-foot spacing interval upon detection of any exceedances of the limits in WAC 173-408-100(2) that cannot be remediated within 10 calendar days, or upon any exceedances detected during a compliance inspection. The demonstration must prove to the satisfaction of the department or local authority that any instrument used for methane detection meets the requirements of subsection (1) of this section.

(iii) Surface testing must be terminated when the average wind speed exceeds five miles per hour, or the instantaneous wind speed exceeds 10 miles per hour. Surface testing can continue when the average wind speed is five miles per hour or less. The department or local authority may approve alternatives to this wind speed surface testing termination for MSW landfills consistently having measured winds in excess of these specified limits. Average wind speed must be determined on a 15-minute average using an on-site anemometer with a continuous recorder for the entire duration of the monitoring event.

(iv) Surface emissions testing must be conducted only when there has been no measurable precipitation in the preceding 72 hours. The department or local authority may approve alternatives to this procedure for MSW landfills that cannot meet the requirements of this subsection.

(v) Monitoring should be conducted during average barometric pressure conditions to the extent possible.

(b) Instantaneous surface emissions monitoring procedures:

(i) The owner or operator must record any instantaneous surface readings of methane 200 ppmv or greater, other than those measured by "nonrepeatable, momentary readings," as defined in WAC 173-408-020;

(ii) Surface areas of the MSW landfill that exceed a methane concentration limit of 500 ppmv must be marked and remediated in accordance with WAC 173-408-110 (1)(b) and (c);

(iii) The entirety of landfill surface areas with cover penetrations, distressed vegetation, cracks, or seeps must also be inspected visually and with a hydrocarbon detector that meets the requirements of subsection (1) of this section. Exceedances of a methane concentration limit of 500 ppmv must be marked and remediated in accordance with WAC 173-408-110 (1)(b) and (c);

(iv) The location of each monitored exceedance must be marked, and the location and concentration recorded. The location must be recorded using an instrument with an accuracy of at least 14 feet. The coordinated must be in decimal degrees with at least five decimal places; and

(v) The wind speed and barometric pressure must be recorded during the sampling period.

(c) Integrated surface emissions monitoring procedures:

(i) Integrated surface readings must be recorded and then averaged for each grid;

(ii) Individual monitoring grids that exceed an average methane concentration of 25 ppmv must be identified and remediated in accordance with WAC 173-408-110 (1)(b) and (d); and

(iii) The wind speed and barometric pressure must be recorded during the sampling period.

(4) Gas collection and control system leak procedures: The owner or operator of a MSW landfill, or third-party owner or operator of a landfill gas control system, must measure leaks using a hydrocarbon detector meeting the requirements of subsection (1) of this section.

(5) Determination of expected gas generation flow rate: The expected gas generation flow rate must be determined as prescribed by the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Chapter 3, which is incorporated by reference herein, using a recovery rate of 75 percent.

(6) Control device destruction efficiency determination: The control device destruction efficiency must be determined according to the following methods:

(a) Enclosed combustors: One of the following test methods in 40 C.F.R., Part 60, Appendix A (in effect on the date in WAC 173-400-025), must be used to determine the efficiency of the control device:

(i) U.S. EPA Reference Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography (in effect on the date in WAC 173-400-025);

(ii) U.S. EPA Reference Method 25, Determination of Total Gaseous Nonmethane Organic Emissions as Carbon (in effect on the date in WAC 173-400-025);

(iii) U.S. EPA Reference Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer (in effect on the date in WAC 173-400-025); or

(iv) U.S. EPA Reference Method 25C, Determination of Nonmethane Organic Compounds in Landfill Gases (in effect on the date in WAC 173-400-025).

(v) The following equation must be used to calculate destruction efficiency:

$$Destruction\ Efficiency\ = \left[1 - \left(\frac{Mass\ of\ Methane\ -\ Outlet}{Mass\ of\ Methane - Inlet}\right)\right] x\ 100\%$$

(b) Open flares: Open flares must meet the requirements of 40 C.F.R. 60.18 (in effect on the date in WAC 173-400-025).

(7) Determination of gauge pressure: Gauge pressure must be determined using a hand-held manometer, magnehelic gauge, or other pressure measuring device approved by the department or local authority. The device must be calibrated and operated in accordance with the manufacturer's specifications.

(8) Alternative test methods: Alternative test methods may be used if they are approved in writing by the department or local authority.

NEW SECTION

WAC 173-408-130 Alternative compliance measures. (1) The owner or operator of a MSW landfill, or third-party owner or operator, may request alternatives to the compliance measures, monitoring requirements, and test methods and procedures set forth in WAC 173-408-080, 173-408-110, and 173-408-120. Any alternatives requested by the owner or operator must be submitted in writing to the department.

(2) The criteria that the department may use to evaluate alternative compliance measure requests include, but are not limited to:

(a) Compliance history;

(b) Documentation containing the landfill gas flow rate and measured methane concentrations for individual gas collection wells or components;

(c) Permits;

(d) Component testing and surface monitoring results;

(e) Gas collection and control system operation, maintenance, and inspection records;

(f) Historical meteorological data;

(g) Consistency with EPA-approved test methods and procedures; and

(h) Recommendation of the local authority, if applicable.

(3) The department will review the requested alternatives and either approve or disapprove the alternatives within 120 days of receipt of a complete request.

(a) The department may request that additional information be submitted as part of the review of the requested alternatives, including additional information requested by a local authority for purposes of providing a recommendation for the department's consideration under subsection (2)(h) of this section. Until the requested information is submitted, the request will be determined as incomplete, and no department actions will be taken to approve or deny the request.

(b) If the department denies a request for an alternative compliance option, the department will provide written reasons for the denial.

(c) The department must deny a request for alternative compliance measures if the request does not provide levels of performance, enfor-

ceability, or methane emissions control that are equivalent to those set forth in this chapter.

NEW SECTION

WAC 173-408-140 Communications and submittals format. Any communications, submittals, or requests required by this chapter must be in a format acceptable to the department or the local authority, as applicable.

NEW SECTION

WAC 173-408-150 Certification. Any application form, report, compliance certification, or other information submitted pursuant to this chapter shall contain the following written certifications made and signed by the person making the submission:

(1) "I certify under penalty of perjury under the laws of the state of Washington that I am duly authorized to make this submission on behalf of the party that is required to provide the information contained therein pursuant to Chapter 173-408 WAC."

(2) "I certify under penalty of perjury under the laws of the state of Washington that, based on information and belief formed after reasonable inquiry, all statements and information contained in the submitted document are true, accurate, and complete."

NEW SECTION

WAC 173-408-160 Recordkeeping requirements. (1) The owner or operator of a MSW landfill, or a third-party owner or operator, must maintain records as prescribed in this subsection. The records must be provided by the owner or operator to the department or local authority within five business days of a request. Records described in this subsection must be retained in the operating record required by WAC 173-351-200 (10)(a).

(a) An owner or operator must maintain the following records for at least five years:

(i) All surface emission monitoring plans and monitoring records.

(ii) All records of gas collection system downtime exceeding five calendar days, including individual well shutdown and disconnection times, and the reason for the downtime.

(iii) All records of gas control system downtime in excess of one hour, the reason for the downtime, and the length of time the gas control system was shutdown.

(iv) Expected gas generation flow rate calculated in accordance with WAC 173-408-120(5).

(v) Records of all instantaneous surface readings of 200 ppmv or greater, in accordance with WAC 173-408-120 (3)(b)(i).

(vi) All exceedances of the limits set forth in WAC 173-408-100(2), including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action(s) taken to repair the leak, date of repair, any required remonitoring and the remonitored concentration in ppmv, wind speed and barometric pressure during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion.

(vii) Records of any component leak exceedances and corrective actions taken, in accordance with WAC 173-408-110 (2)(c).

(viii) Records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken, in accordance with WAC 173-408-110(3).

(ix) Annual solid waste acceptance rate and the current amount of waste in place.

(x) Records of the nature, location, amount, and date of deposition of nondecomposable waste for any landfill areas excluded from the collection system.

(xi) Results of any source tests conducted pursuant to WAC 173-408-120(6).

(xii) Records describing the mitigation measures taken to prevent the release of methane or other emissions into the ambient air:

(A) When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment;

(B) During repairs or the temporary shutdown of gas collection system components; or

(C) When solid waste was excavated and moved.

(xiii) Records of the equipment operating parameters specified to be monitored under WAC 173-408-110 (2)(a) and (b), as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information:

(A) For enclosed flares, all three-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with WAC 173-408-080 (4) and (5) was determined.

(B) For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone pursuant to WAC 173-408-080 (5)(a)(ii).

(C) For any owner or operator who uses a boiler or process heater with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater to comply with WAC 173-408-080(5), all periods of operation of the boiler or process heater (e.g., steam use, fuel use, or monitoring data collected pursuant to other federal, state, or local regulatory requirements).

(xiv) Records of any actions involving disturbance or removal of areas of the landfill surface where the landfill cover material has been removed for the purpose of installing, expanding, replacing, or repairing components of the landfill cover system, the landfill gas collection and control system, the leachate collection and removal system, or a landfill gas condensate collection and removal system. The records must contain the following information:

(A) A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the

actions are required, and any landfill gas collection system components that will be affected by these actions.

(B) Disturbance or removal start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components.

(C) A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts.

(xv) Records of any active mining activities, as defined in WAC 173-408-020. The records must contain the following information:

(A) A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions.

(B) Active mining start and finish dates and projected shut down times for individual gas collection system components.

(C) A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts.

(xvi) Records of any law enforcement activities requiring excavation. The records must contain the following information:

(A) A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions.

(B) Law enforcement activity start and finish dates and projected shut down times for individual gas collection system components.

(C) A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts.

(b) The owner or operator must maintain the following records for the life of each gas control device, as measured during the initial source test or compliance determination:

(i) The control device vendor specifications.

(ii) The expected gas generation flow rate as calculated pursuant to WAC 173-408-120(5).

(iii) The percent reduction of methane achieved by the control device determined pursuant to WAC 173-408-120(6).

(iv) For a boiler or process heater, the description of the location at which the collected gas vent stream is introduced into the boiler or process heater over the same time-period of the performance test.

(v) For an open flare: The flare type (i.e., steam-assisted, air-assisted, or nonassisted); all visible emission readings, heat content determination, flow rate or bypass flow rate measurements, and exit velocity determinations made during the performance test as specified in 40 C.F.R. 60.18 (in effect on the date in WAC 173-400-025), which is incorporated by reference herein; and records of the flare pilot flame or flare flame monitoring and records of all periods of operations during which the pilot flame or the flare flame is absent.

NEW SECTION

WAC 173-408-170 Reporting requirements. The owner or operator of a MSW landfill must prepare and submit reports as prescribed in this section. Reports required by this subsection must be retained in the operating record required by WAC 173-351-200 (10)(a).

(1) Initial waste in place report: Each owner or operator of a MSW landfill that meets the requirements of WAC 173-408-060(1) must submit an initial waste in place report to the department. The report must be submitted within 90 days of the effective date of this chapter and include the following information:

(a) The landfill information set forth in subsection (3)(b)(i) of this section.

(b) The estimated waste in place, in tons, as of December 31st of the previous year.

(2) Initial landfill gas heat input capacity report: Any owner or operator of a MSW landfill subject to the requirements of WAC 173-408-070(2) must calculate the landfill gas HIC, using the procedures in WAC 173-408-120(2), and submit the calculation to the department. The calculation must be submitted within 90 days of the effective date of this chapter.

(3) Annual reports: The owner or operator of a MSW landfill must prepare an annual report containing the information set forth in subsections (3) through (7) of this section, as applicable.

(a) The annual report must be prepared for the period of January 1st through December 31st of each year and be submitted to the department and local authority by April 1st of the subsequent year.

(b) In each annual report, the following information must be included:

(i) MSW landfill name, owner and operator, address, and facility/site ID (FS ID) number; and

(ii) Most recent topographic map, at a minimum, of the site showing all types of cover (e.g., final, interim, daily) with corresponding percentages over the landfill surface.

(4) Annual waste in place report: Any owner or operator of a MSW landfill subject to the requirements of WAC 173-408-060(2) must include the following information in the annual report required by subsection (3) of this section. The estimated waste in place, in tons, as of December 31st of the previous year.

(5) Annual landfill gas heat input capacity report: Any owner or operator subject to the requirements of WAC 173-408-070(3) must calculate the landfill gas HIC, using the procedures in WAC 173-408-120(2), and include the calculation in the annual report required by subsection (3) of this section.

(6) Surface emissions monitoring report: Any owner or operator who conducts surface emissions monitoring pursuant to WAC 173-408-110(1), and component monitoring pursuant to WAC 173-408-110(2)(c), must include the following information in the annual report required by subsection (3) of this section:

(a) Date(s) of all monitoring;

(b) Location of the monitoring grid coordinates on a topographic map; and

(c) Measured concentration of methane in ppmv, exceedances, and all corrective actions taken.

(7) Gas collection and control system operations: Any owner or operator of a MSW landfill that has a gas collection and control system must include the following in the annual report required by subsection (3) of this section:

(a) Total volume of landfill gas collected (reported in standard cubic feet);

(b) Average composition of the landfill gas collected over the reporting period (reported in percent methane and percent carbon dioxide by volume);

(c) Gas control device type, year of installation, rating, fuel type, and total amount of landfill gas combusted in each control device;

(d) The date that the gas collection and control system was installed and in full operation;

(e) The percent methane destruction efficiency of each gas control device(s);

(f) Type and amount of supplemental fuels burned with the landfill gas in each device;

(g) Total volume of landfill gas shipped off-site, the composition of the landfill gas collected (reported in percent methane and percent carbon dioxide by volume), and the recipient of the gas; and

(h) A copy of the most recent source test for each gas control device.

(8) Closure notification report: The owner or operator of a MSW landfill that ceases to accept waste must submit a closure notification to the department or local authority in accordance with this subsection. Except as provided in (e) of this subsection, the closure notification must be submitted within 30 days of ceasing to accept waste.

(a) The closure notification must include the last day solid waste was accepted, the anticipated closure date of the MSW landfill, and the estimated waste in place.

(b) If a MSW landfill with greater than or equal to 450,000 tons of waste in place submits a closure notification pursuant to this section, the owner or operator of the landfill must submit a 30-year projection of their estimated HIC calculation, according to the procedures in WAC 173-408-980 (Appendix I), as part of this report.

(c) Additional information may be requested as necessary to verify that permanent closure has taken place in accordance with the requirements of any applicable federal, state, or local statutes, regulations, and ordinances in effect at the time of closure.

(d) If a closure report has been submitted, no additional wastes may be placed into the landfill without filing a notification with the department or local authority.

(e) In lieu of submitting the closure notification report within 30 days of ceasing to accept waste, the owner or operator of an inactive municipal solid waste landfill, as defined in WAC 173-408-020, may submit documentation to the department or local authority demonstrating that all of the following occurred prior to the effective date of this chapter.

(i) The owner or operator notified the jurisdictional health department of the intent to implement an approved closure plan, in compliance with WAC 173-304-407 (5)(a);

(ii) The owner or operator commenced implementation of an approved closure plan within 30 days of ceasing to accept waste, in compliance with WAC 173-304-407 (5)(b); and

(iii) The owner or operator submitted all facility closure plan sheets and certification of closure, in compliance with WAC 173-304-407 (5)(d).

(9) Equipment removal report: The owner or operator of a MSW landfill must submit a gas collection and control system equipment removal report to the department or local authority within 30 days of well capping or the removal or cessation of operation of the gas collection, treatment, or control system equipment. The report must contain the following information:

(a) A copy of the closure notification report submitted pursuant to subsection (8) of this section;

(b) A copy of the initial source test report, prepared pursuant to WAC 173-408-080 (6)(a), or other documentation demonstrating that the gas collection and control system has been installed and operated for a minimum of 15 years, unless the owner or operator can demonstrate that due to declining methane rates the landfill is unable to operate the gas collection and control system for a 15-year period; and

(c) Eight consecutive quarterly instantaneous or integrated emissions monitoring results, collected pursuant to WAC 173-408-090(2), as needed to verify that landfill surface methane concentration measurements do not exceed the limits in WAC 173-408-100(2).

NEW SECTION

WAC 173-408-180 Civil penalty. (1) Any person who violates any requirement of chapter 70A.540 RCW or this chapter may incur a civil penalty of up to $10,000 per day for each violation, pursuant to RCW 70A.15.3160.

(2) The department will waive penalties under RCW 70A.15.3160, in accordance with this subsection, in the event the owner or operator of the landfill is actively taking corrective actions to control any methane exceedances.

(a) At least 30 calendar days prior to the department's issuance of a civil penalty, the department will send the owner or operator of the landfill a notice of violation, in accordance with RCW 70A.15.3010.

(b) To demonstrate eligibility for waiver of a civil penalty under this subsection, the owner or operator of the landfill must provide the following information to the department within 30 calendar days of issuance of the notice of violation:

(i) A description of all corrective action(s) that have been initiated to control methane exceedances;

(ii) A description of all corrective action(s) that are being planned to control methane exceedances, including an implementation schedule of the actions;

(iii) Any supporting documentation associated with the corrective actions; and

(iv) A written certification meeting the requirements of WAC 173-408-150.

(c) If the owner or operator does not provide the information required by (b) of this subsection within 30 calendar days of issuance of the notice of violation, and has not received a written extension by the department, the department may proceed with issuance of a civil penalty as appropriate.

(d) The department will determine whether the owner or operator is eligible for waiver of a civil penalty on the basis of the information submitted pursuant to (b) of this subsection.

(i) The department may request additional information from the owner or operator before making a final determination. If the owner or operator does not respond to the department's request for additional information within 30 calendar days, the department may proceed with issuance of a civil penalty as appropriate.

(ii) The department will waive issuance of a civil penalty for the violation(s) identified in the notice of violation if the owner or operator demonstrates to the department's satisfaction that the corrective actions that have been initiated, or that are being planned, resolve the violation(s).

(iii) The department may condition its waiver of a civil penalty under this subsection on the owner or operator's continued implementation and/or completion of the identified corrective action(s). If the owner or operator does not comply with any such condition(s), the department may reconsider its prior determination of eligibility for waiver.

(e) If the department waives issuance of a civil penalty under this subsection, the department may subsequently request submission of documentation regarding the implementation status of the identified corrective action(s). If the owner or operator does not respond to the department's subsequent request(s) within 30 calendar days, the department may reconsider its prior determination of eligibility for waiver.

(3) A "local authority," as defined in WAC 173-408-020, may waive penalties under RCW 70A.15.3160, in accordance with subsection (2) of this section, in the event the owner or operator of the landfill is actively taking corrective actions to control any methane exceedances.

NEW SECTION

WAC 173-408-190 Severability. If any provision of this chapter or its application is held invalid, the remainder of the chapter or application of the provision is not affected.

NEW SECTION

WAC 173-408-980 Appendix I.

1.0 Calculate Heat Input Capacity

Equation 1

$$Heat\ Input\ Capacity\ \left(\frac{MMBtu}{hr}\right) = Methane\ Gas\ Generation\ (scfm) \times \frac{60\ minutes}{1\ hour} \times Collection\ Efficient \times GHV_{Methane} \times \frac{1MMBtu}{1{,}000{,}000Btu}$$

Where:

Collection Efficiency	=	The landfill gas collection efficiency in percent (%), which is 75 percent.
GHV (Gross Heating Value)	=	Gross heating value of methane, which is 1,012[1] in units of British thermal units per standard cubic feet, or Btu/scf.

[1] Landfill Methane Outreach Program (LMOP) Interactive Conversion Tool

2.0 Methane Gas Generation

CH_4 Generation is calculated using the following equation:

Equation 2

$$CH_4\ Generation\ (Mg) = \left\{ ANDOC_{year-start} \times [1 - e^{-k}] - ANDOC_{deposited-last\ year} \times \left[\frac{1}{k} \times \left(e^{-k \times \left(1 - \frac{M}{12}\right)} - e^{-k} \right) - \frac{M}{12} \times e^{-k} \right] + ANDOC_{deposited-same\ year} \times \left[1 - \left(\frac{1}{k} \times \left(1 - e^{-k \times \left(1 - \frac{M}{12}\right)} + \frac{M}{12} \right) \right) \right] \right\} \times FCH_4$$

Where:

CH_4 Generation	=	CH_4 generated in the inventory year (Mg of CH_4).
FCH_4	=	Fraction of decomposing carbon converted into CH_4 (Default = 0.5).[2]
$ANDOC_{year\text{-}start}$	=	ANDOC in place at the beginning of the inventory year.
$ANDOC_{deposited\text{-}last\ year}$	=	ANDOC deposited during the previous inventory year.
$ANDOC_{deposited\text{-}same\ year}$	=	ANDOC deposited during the inventory year.

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

3.0 To Convert Methane Generated from Mg of CH_4 to SCFM

Equation 3

$$CH_4\ Gas\ Generated\ (scfm) = \frac{CH_4\ Generation\ (Mg)}{(year)} \times \frac{1\ (year)}{525{,}600\ (minutes)} \times \frac{1{,}000{,}000\ (g)}{1\ (Mg)} \times \frac{1\ (mole\ CH_4)}{16.0426\ (g\ CH_4)} \times \frac{0.83662\ (scf)}{1\ (mole\ landfill\ gas)}$$

4.0 Define ANDOC%

Equation 4

$$ANDOC\% = \sum WIPFRAC_j \times TDOC_j \times DANF_j$$

Where:

$WIPFRAC_i$	=	Fraction of the i^{th} component in the waste in place.
$TDOC_i$	=	Total Degradable Organic Carbon fraction of the i^{th} waste component (Mg of that component/Mg of Total waste in place).

$DANF_i$ = Decomposable Anaerobic Fraction of the i^{th} waste component, that fraction capable of decomposition in anaerobic conditions (Mg of decomposable carbon for that component/Mg $TDOC_i$ for that component).

5.0 Define ANDOC

Equation 5

$$ANDOC = WIP\ (tons) \times \frac{0.9072\ (Mg)}{(ton)} \times\ ANDOC\%$$

Where:

ANDOC = Anaerobically Degradable Organic Carbon, carbon that is capable of decomposition in an anaerobic environment (Mg of carbon).

WIP = Waste in place estimate of all the landfilled waste (wet weight) as reported to Ecology's Solid Waste Management Program (tons).

6.0 Calculate $ANDOC_{year\text{-}end}$

Equation 6

$$\begin{aligned} ANDOC_{year-end} &= ANDOC_{year-start} \times e^{-k} \\ &+ ANDOC_{deposited-last\ year} \\ &\times \left[\frac{1}{k} \times \left(e^{-k\times\left(1-\frac{M}{12}\right)} - e^{-k}\right) - \frac{M}{12} \times e^{-k}\right] \\ &+ ANDOC_{desposited-same\ year} \times \left[\frac{1}{k} \times \left(1 - e^{-k\times\left(1-\frac{M}{12}\right)} + \frac{M}{12}\right)\right] \end{aligned}$$

Where:

$ANDOC_{year\text{-}end}$ = ANDOC remaining undecomposed at the end of the inventory year.

$ANDOC_{year\text{-}start}$ = ANDOC in place at the beginning of the inventory year.

$ANDOC_{deposited\text{-}last\ year}$ = ANDOC deposited during the previous inventory year.

$ANDOC_{deposited\text{-}same\ year}$ = ANDOC deposited during the inventory year.

M = Assumed delay before newly deposited waste begins to undergo anaerobic decomposition (Months, Default = 6).

k = Assumed rate constant for anaerobic decomposition; k = ln2/ half-life (years); half-life is the number of years required for half of the original mass of carbon to degrade.

Table 1 lists the accepted constant values for the anaerobic decomposition rate ("k").

Table 1: K Values

K for Average Rainfall (Inches/Year)			
Inches Rain	<20	20-40	>40
K Value	0.02	0.038	0.057

NEW SECTION

WAC 173-408-990 Appendix II. OTM-51 – UAS Application of Method 21 for Surface Emission Monitoring of Landfills.

1.0 Background on OTM-51

This method provides procedures for use of unmanned aerial systems (UAS) to perform surface emissions monitoring for MSW landfills. This method was submitted by Sniffer Robotics, LLC to EPA's Office of Air Quality Planning and Standards Measurement Technology group and was included into the Other Test Method (OTM) category on EPA's Air Emission Measurement Center website on 12/15/2022.

OTM-51 is approved for use at MSW landfills for several federal regulations and is approved for use under this chapter, subject to the caveats and additional information specified in section 11.0 of this appendix.

The following application of OTM-51 is only approved for the purpose of compliance with the surface emission monitoring requirements of this chapter, and does not supersede any approved methods, requirements, or regulations regarding the use of OTM-51 for other federal, state, and local laws or regulations.

2.0 Scope and Application

Scope: This method is an alternative test method for determining compliance with the surface methane operational standard for landfills in lieu of procedures set forth pursuant to WAC 173-408-120 (1)(a).

Analytes

Analyte	CAS Number
Methane (CH_4)	74-82-8

3.0 Summary of Method

This alternative test method seeks to replicate, to the greatest extent possible, EPA Method 21, but automates surface emission monitoring by utilizing a methane detection payload on an "unmanned aerial system (UAS)," as defined in WAC 173-408-020, coupled with a ground level to UAS sampling system. The methane detector payload includes a hose and custom nozzle design that, when carried by the UAS, places the nozzle inlet within 5-10 cm of the ground. The UAS transmits the geolocated methane readings to the operator via a wireless communication system. The UAS is used to sample large areas for "increased meter readings," as defined in WAC 173-408-020, each of which are then inspected using EPA Reference Method 21.

4.0 Equipment and Supplies

(a) The methane detection payload shall have the following specifications:

(i) The methane detection payload shall collect and respond to methane in the air samples; standoff or remote detection technologies are not applicable. Detector types that may meet this requirement include, but are not limited to, flame ionization, nondispersive infrared absorption (NDIR) and tunable diode laser absorption spectroscopy (TDLAS).

(ii) The methane detection payload shall be capable of measuring methane in the range from zero through the increased meter reading up to and above the exceedance limit of 500 ppm specified in this chapter.

(iii) The scale of the methane detection payload shall be readable to ±2.5 percent of the increased meter reading level of 200 ppm methane.

(iv) The methane detection payload shall be equipped with a pump that provides the detector a constant sample flow rate. The nominal sample flow rate, as measured at the sample probe nozzle, shall be at least 0.5 l/min when the probe is fitted with the full impedance stack of tubing, filters, and nozzle.

(v) The methane detection payload shall have a known instrument-only response time. Instrument-only response time shall be measured for the methane detection instrument prior to being placed into service but does not have to be repeated at subsequent intervals. Instrument-only response time shall be measured by measuring the T90 response time for a minimum of five unique tube lengths less than 10m, fitting a linear regression to the measured T90 response times and recording the y-intercept as the instrument only response time if the r^2 of the linear regression is greater than 0.95.

(b) The ground level sampling system shall have the following specifications:

(i) The ground level sampling system shall be equipped with a single nozzle with inside diameter such that the air speed into the nozzle (per the nominal sample flow rate defined in section 4.0(a)(iv) of this appendix) is at least 0.3 m/s.

(ii) The ground level sampling system shall include a hose of sufficient length to drag the nozzle on the ground such that the nozzle is in fluid communication with the methane detection payload.

(iii) Before putting the ground level sampling system into service, determine the "nozzle offset distance," as defined in WAC 173-408-020. If the tube length of the ground sampling density changes or the planned AGL for the ground level sampling system changes, repeat measurements to determine the nozzle offset distance.

(c) The UAS shall have the following specifications:

(i) The UAS shall carry the methane detection payload and the ground level sampling system and use an automated, real-time measurement and control system to fly at a constant AGL of ±1 meter.

(ii) The UAS shall include a data acquisition system to record both timestamped drone position (GPS coordinates with an accuracy of no worse than ±2 meters) and methane concentration. The data shall be logged at a frequency of at least the instrument-only response time per section 4.0(a)(v) of this appendix.

(iii) The UAS shall have a gimbaled camera that is remotely viewable and controllable by a remote operator in near real-time. The camera and display shall have high enough resolution for the operator to discern indicators of elevated concentrations of landfill gas, including distressed vegetation, cracks or seeps in the cover and cover penetrations from the defined flight AGL. Pictures taken shall be georeferenced via metadata or similar to the GPS accuracy of ±2 meters.

(iv) The UAS shall be in communication with an operator display that shows the methane concentration, as measured by the methane detection payload.

(v) If automated flight plans are used to control the path of the UAS, the UAS shall be controllable by the remote operator to deviate from said flight plans to inspect areas where visual observations indicate potential elevated concentrations of landfill gas, such as distressed vegetation, cracks, or seeps in the cover and cover penetrations.

(vi) The UAS shall be equipped with a method to control the forward speed to the value determined to meet the limit under section 7.0 of this appendix.

5.0 Reagents and Standards

(a) Two gas mixtures are required for methane detection payload calibration and performance evaluation:

(i) Zero gas. Air, less than 10 parts per million by volume (ppmv) methane.

(ii) Methane calibration gas. Obtain a known standard in air at a concentration approximately equal to the 500 ppm above background operational limit specified in the regulation.

(b) Cylinder gases: If cylinder calibration gas mixtures are used, they must be analyzed and certified by the manufacturer to be within two percent accuracy, and a shelf life must be specified. Cylinder standards must be either reanalyzed or replaced at the end of the specified shelf life.

6.0 Sample Collection, Preservation, Storage, and Transport

(a) Methane detection payload performance evaluation: Assemble and start up the methane detection payload according to the manufacturer's instructions for recommended warm-up period and preliminary adjustments.

(b) Calibration precision: The calibration precision test shall be completed prior to placing the methane detection payload into service and at subsequent three-month intervals or at the next use, whichever is first.

(i) Make a total of three measurements of both the zero and the methane calibration gas by alternately introducing them where the measurement is collected via the ground level sampling system with all filters, the full tube length, and nozzle present. The introduction of the gas must be done such to not change the flow rate of the system or to pressurize the measurement cell. Record the meter readings.

(ii) Calculate the average algebraic difference between the meter readings and the known value. Divide this average difference by the known calibration value and multiply by 100 to express the resulting calibration precision as a percentage.

(iii) The calibration precision shall be equal to or less than 10.0 percent of the calibration gas value.

(c) Response time: The response time test shall be completed prior to placing the methane detection payload and ground level sampling system into service and at subsequent three-month intervals or at the next use, whichever is first. If a modification to the sample pumping system or flow configuration is made that would change the response time, a new test is required before further use.

(i) Introduce zero gas into the nozzle of the ground level sampling system. When the meter reading has stabilized, switch quickly to the specified calibration gas. After switching, measure the time required to attain 90 percent of the final stable reading. Perform this test sequence three times and record the results. Calculate the average response time.

(ii) The response time shall be equal to or less than 30 seconds. The instrument pump, ground level sampling system with all filters, tubing, and nozzle lengths, which will be used during testing shall all be in place during the response time determination.

(d) Nozzle offset distance: The nozzle offset distance shall be measured prior to placing the methane detection payload into service by recording the time between the UAS passing a known point in space

and the nozzle passing the same point in space at a known, consistent speed, hose length and AGL. The horizontal offset distance is the measured temporal offset of the UAS to the nozzle, multiplied by the known, consistent speed.

(e) Offset calculation: Derive the temporal offset from UAS GPS measurement to receipt of quantified methane measurement for each combination of AGL and methane detection payload configuration by adding the response time to the nozzle offset distance divided by speed. Record this time offset for input to the data acquisition system and offset the reported location of all methane measurements along the actual traversed path by this offset (i.e., if the offset is "X" seconds, the location of the measurement shall be reported as the location of the UAS "X" seconds in the past).

(f) Flow rate: The flow rate test shall be completed prior to placing the methane detection payload and ground level sampling system into service and at subsequent three-month intervals or at the next use, whichever is first. If a modification to the sample pumping system or flow configuration is made that would change the flow rate, a new test is required before further use. Measure the flow rate at the distal end of the collection nozzle with a flow meter readable to at least 0.1 l/min per the flow meter manufacturer's specification. Record the flow rate; the flow rate shall be greater than 0.5 l/min.

(g) Instrument calibration: Calibrate the methane detection payload according to section 10.0 of this appendix.

7.0 Surface Emissions Monitoring via UAS and Follow-up Ground-based Surveys

(a) Set the UAS terrain following system to fly at the constant AGL for the ground level sampling system characterized in section 4.0(b)(ii) of this appendix. Ensure the remote operator can control the gimbaled camera on the UAS and that the resolution is adequate to make visual observations that indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover and cover penetrations.

(b) Take off and fly the UAS (at the predefined constant AGL) at a speed such that the instrument-only response time multiplied by the forward flight speed does not exceed four meters along a pattern that traverses the landfill at 25-ft intervals. The aggregation of all the surface sampling traverses shall include the perimeter of the collection area, and all locations where visual observations from the gimbaled camera or aerial imagery taken within 120 days indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover.

(i) Surface sampling traverses in accordance with this test method shall only occur during average barometric pressure conditions to the extent possible.

(ii) Surface sampling traverses in accordance with this test method must be terminated when the average wind speed exceeds five miles per hour, or the instantaneous wind speed exceeds 10 miles per hour. Surface testing can continue when the average wind speed is five miles per hour or less. The department or local authority may approve alternatives to this wind speed surface testing termination for MSW landfills consistently having measured winds in excess of these specified limits.

(iii) Surface sampling traverses in accordance with this test method must be conducted only when there has been no measurable precipitation in the preceding 72 hours. The department or local authori-

ty may approve alternatives to this procedure for MSW landfills that cannot meet the requirements of this subsection.

(c) During flight, take georeferenced pictures from the UAS gimbaled camera of features that indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover and cover penetrations. Inspect these locations per section 7.0(d) of this appendix.

(d) Increased meter readings: If an increased meter reading is observed or recorded by the UAS data acquisition system, refer to Section 8.3.1 of Method 21 to survey the area of the GPS coordinate of the increased meter reading and the area within a radius of at least 15 meters. While inspecting the increased meter readings and traversing the landfill between said increased meter readings, make visual observations to identify areas that indicate elevated concentrations of landfill gas, such as distressed vegetation, cracks or seeps in the cover and cover penetrations and inspect said areas as increased meter readings.

(e) Cover penetrations: In addition to conducting ground-based surveys where increased meter readings were detected, refer to Section 8.3.1 of Method 21 to survey applicable cover penetrations or openings within the landfill area.

(f) Monitoring route: All measurement points compliant with the specifications of this alternative method shall be plotted on a map that encompasses and includes the perimeter of waste. Any points that deviate from this test method including, but not limited to, manual deviations to the AGL that exceed ±1 meter, GPS accuracy worse than ±2 meters, presumed or measured flow rate less than 0.5 l/min, ground sampling density worse than 25-ft intervals, etc. shall not be plotted. Any location on the map greater than 15m from a measurement point shall be noted and justified (e.g., noted as an active area, noted hazards that prevent inspection detail, etc.).

(g) Remonitoring: Refer to EPA Reference Method 21 for remonitoring of previously identified exceedances.

8.0 Exceedances

(a) The owner or operator of a MSW landfill must notify the department or local authority within two working days after all corrective actions and remonitoring taken to address exceedances detected using this method. The notification must include a description of the corrective actions taken. The owner or operator of a MSW landfill may request alternative compliance measures to replace the requirements of this subsection pursuant to WAC 173-408-130.

(b) The owner or operator must record the date, location, and value of each exceedance, along with retest dates and results. The location of each exceedance must be clearly marked and identified on a topographic map, at a minimum, of the MSW landfill, drawn to scale with the location of both the grids and the gas collection system clearly identified.

(c) Corrective action must be taken by the owner or operator such as, but not limited to, cover maintenance or repair, and well vacuum adjustments, and the location must be remonitored within 10 calendar days of a measured exceedance.

(i) If the remonitoring of the location shows a second exceedance, additional corrective action must be taken, and the location must be remonitored again within 10 calendar days of the second exceedance.

(ii) If the remonitoring required by section 8.0(c)(i) of this appendix shows a third exceedance, the owner or operator must install a new or replacement well, or an alternative active methane control approved by the department or local authority, as needed to achieve compliance no later than 120 calendar days after detecting the third exceedance.

9.0 Quality Control

Section	Quality Control Measure	Effect
6.0 (Calibration Precision)	Instrument calibration precision check	Ensure precision and accuracy, respectively, of instrument response to standard.
10.0	Instrument calibration	

10.0 Calibration and Standardization

(a) Calibrate the methane detection payload as follows: After the appropriate warm-up period and any internal zero calibration procedure, introduce the calibration gas at the inlet of the ground level sampling system to include all filter, tubing, and the nozzle. Per the manufacturer's guidelines ensure the instrument readout corresponds to the calibration gas value within 10.0 percent.

Note: If the meter readout cannot be calibrated to the proper value and/or a malfunction of the methane detection payload is indicated, corrective actions are necessary before use.

11.0 ALT-150 Compliance Letter

The use of OTM-51 for purposes of compliance with this chapter is subject to the following limitations/caveats, as specified in the EPA's ALT-150 letter (dated 12/15/2022):

(a) Entities other than Sniffer Robotics, LLC must submit data comparing OTM-51 and EPA Reference Method 21 to the department or local authority before this alternative test method may be used in lieu of SEM test procedures specified by WAC 173-408-120 (1)(a).

(b) Increased meter readings must be documented as prescribed by OTM-51. When an exceedance of the operational standard is identified, the location of the monitored exceedance must be marked, and the location and concentration recorded as specified in section 8.0 of this appendix. When an increased meter reading is not identified as an exceedance of the operational standard, there must be at a minimum a traditional surface monitoring pattern either in a spiral or serpentine pattern with three-meter intervals that covers a 30-meter radius from the increased meter readings to confirm no exceedance of the operational standard.

(c) Affected landfills using OTM-51 must notify the department or local authority before use of this alternative method and notification must include a copy of this appendix.

(d) Landfills must include a copy of this appendix and method with each report presenting SEM results using OTM-51.

(e) Once an owner or operator of a landfill chooses to use OTM-51, the landfill must continue to use the alternative method in meeting the requirements of this chapter until the owner or operator receives approval from the department or local authority to return to the existing Method 21 or use of a new EPA-test method.