TECHNICAL SUPPORT DOCUMENT

FOR

COMAR 26.11.42 – Control of Methane Emissions from Municipal Solid Waste Landfills

December 15, 2022

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INTRODUCTION

This Technical Support Document has been created to support the amendments and new regulatory requirements for the Control of Landfill Gas Emissions from Municipal Solid Waste Landfills.

PURPOSE OF REGULATORY ACTION

The primary purpose of this action is to repeal existing COMAR 26.11.19.20 – Control of Landfill Gas Emissions from Municipal Solid Waste Landfills and adopt new requirements and standards to reduce methane gas emissions from MSW landfills in Maryland under a new chapter COMAR 26.11.42 – Control of Emissions from Municipal Solid Waste Landfills. The new proposed chapter and regulations in this action also incorporate provisions from the federal rules 40 CFR 60, Subparts Cf (Emission Guidelines) and XXX (New Source Performance Standards), and 40 CFR 63, Subpart AAAA (National Emissions Standards for Hazardous Air Pollutants) for Municipal Solid Waste (MSW) landfills.

SUBMISSION to EPA as REVISION to MARYLAND's STATE SIP PLAN

The new regulations will be submitted to the U.S. Environmental Protection Agency (EPA) for approval as part of Maryland's state plan for MSW landfills under the Clean Air Act (CAA) section 111(d). The state plan will be equivalent or more stringent than existing federal regulations (40 CFR 60, Subparts Cf and XXX and 40 CFR 63, Subpart AAAA) for MSW landfills. The state plan will be submitted to EPA to replace the federal implementation plan requirements (40 CFR 62, Subpart OOO - Federal Plan Requirements for Municipal Solid Waste Landfills That Commenced Construction on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014) effective as of June 21, 2021.

BACKGROUND

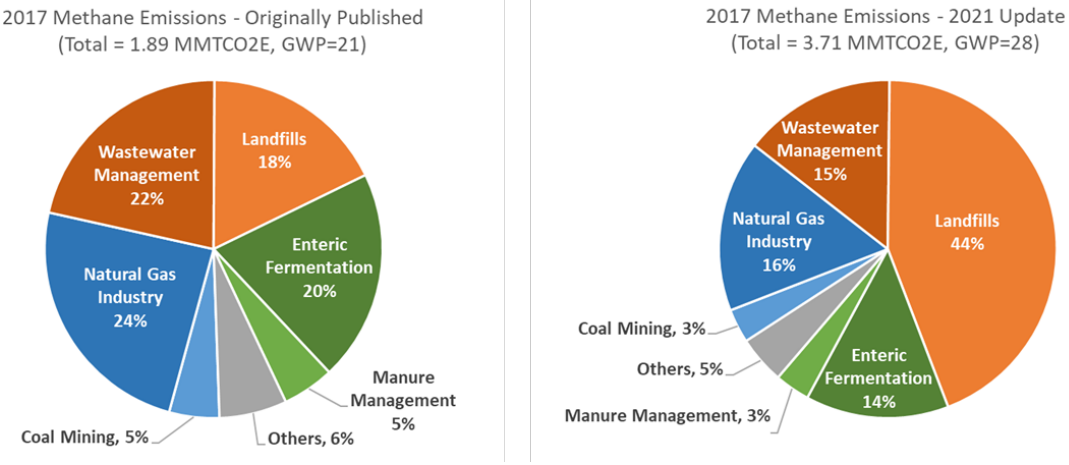
Introduction

A MSW landfill is a parcel of land that accepts garbage or non-hazardous residential and commercial wastes. Landfills that fall under this category exclude those that accept controlled hazardous substances (CHS) as defined in COMAR 26.13.01.03B or are currently regulated under the Comprehensive Environmental Response, Compensation and Liability Act 42 U.S.C, Chapter 103. It also excludes landfills that only accept construction and demolition wastes, inert waste, or non-decomposable wastes.

As the waste decomposes, it produces landfill gas, which is composed of several greenhouse gases (GHGs). The gases produced at landfills include methane — a short-lived but significant

GHG with a global warming potential more than 25 times that of carbon dioxide (CO_2). Landfills are the second largest industrial source of methane emissions in the United States. The Maryland Department of the Environment (MDE or the Department) has concurred with recent research findings which shows that MSW landfills in Maryland are the single largest source for the state's methane emissions. These emissions are approximately four times higher than previously thought[1] (see Figure 1).

Figure 1 – Statewide GHG Emissions by Sector



Addressing climate change and reducing GHG emissions has been a major issue in Maryland for the past decade. This led to the adoption of the Greenhouse Gas Reduction Act (GGRA) in 2009 (amended in 2016) which requires the state to reduce GHG emissions, which has been a major focus of the Maryland Climate Change Commission (MCCC)[2]. The MCCC Mitigation Working Group has developed and adopted mitigation strategies to reduce GHG emissions with specific strategies aimed at reducing methane gas emissions from MSW landfills. Additionally, the Department researched other state regulation requirements for measurement and control strategies to address methane emissions from MSW landfills. The Department is proposing to implement regulatory requirements for owners and operators of new and existing MSW landfills, which include surface emission monitoring, detecting and repairing landfill gas leaks, recordkeeping and reporting requirements, and installing and operating emission control systems based upon the regulatory applicability.

Additional climate change abatement strategies include the Department forming partnerships with state agencies, local jurisdictions, environmental advocacy groups, and the private and public sectors to limit the amount of methane generating waste that enters landfills through waste diversion. These strategies have been effective in reducing methane gas emissions from landfills and helping to meet Maryland's climate goals.

[1] MDE Revises GHG Emission Levels for Landfills. MSW Landfill Stakeholder Meeting and Revised Inventory Notice_June 9 2021.pdf (maryland.gov)
[2] https://mde.maryland.gov/programs/Air/ClimateChange/Pages/index.aspx

Background - Federal Standards

On August 29, 2016, the EPA published final updates to its New Source Performance Standards (NSPS) to reduce landfill gas emissions and its components, including methane from municipal solid waste (MSW) landfills under 40 CFR 60, Subpart XXX (*Standards of Performance for Municipal Solid Waste Landfills*). The NSPS requirements apply to MSW landfills constructed, modified, or reconstructed on or after July 17, 2014. In a separate action, EPA also published emission guidelines (EG) for reducing emissions from existing MSW landfills under 40 CFR 60, Subpart Cf (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills). These emission guidelines and compliance times apply to MSW landfills that commenced construction, modification, or reconstruction on or before July 17, 2014.

Since 2016, the implementation of the state plan requirements under the federal EG rule have been stalled by delays and litigation against the EPA. On May 21, 2021, the EPA published a final rule in which covers 41 states including Maryland, under a Federal Implementation Plan (FIP) documented at Regulations.gov [EPA–HQ–OAR–2019–0338; FRL–10022–82– OAR]. Existing MSW landfills in Maryland are currently subject to the FIP requirements (40 CFR 62, Subpart OOO — *Federal Plan Requirements for Municipal Solid Waste Landfills That Commenced Construction on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014*), until Maryland submits the state plan replacement. The federal regulations include specific monitoring, recordkeeping and reporting requirements for owners and operators of MSW landfills. Also, the federal requirements require owners and operators of landfills meeting certain criteria to install and operate a gas collection and control system.

Background – Maryland

Since 1998, MDE's Air and Radiation Administration (ARA) has regulated landfill gas emissions from MSW landfills under COMAR 26.11.19.20 - *Control of Landfill Gas Emissions from Municipal Solid Waste Landfills*, which was approved as a federal state plan under 111(d). COMAR 26.11.19.20 applies to MSW landfills with a design capacity greater than or equal to 2,750,000 tons and 3,260, 000 cubic yards of waste; landfills constructed, reconstructed, or modified before May 30, 1991; and landfills that received waste on or after November 8, 1987. COMAR 26.11.19.20 includes a threshold for installing a gas collection and control system (GCCS) when the non-methane organic compounds (NMOC) measure greater than or equal to 50 megagrams per year (Mg/yr).

Additionally, MSW landfills are regulated by MDE's Land Management Administration (LMA) under COMAR 26.04.07, which requires MSW landfills to have liners and leachate collection systems that collect leachate and prevent migration of pollutants out of the landfill to adjacent subsurface soil, groundwater, and surface water. While the new regulations will also regulate landfills already subject to requirements under COMAR 26.04.07, MDE's ARA and LMA are coordinating the review and implementation of this action.

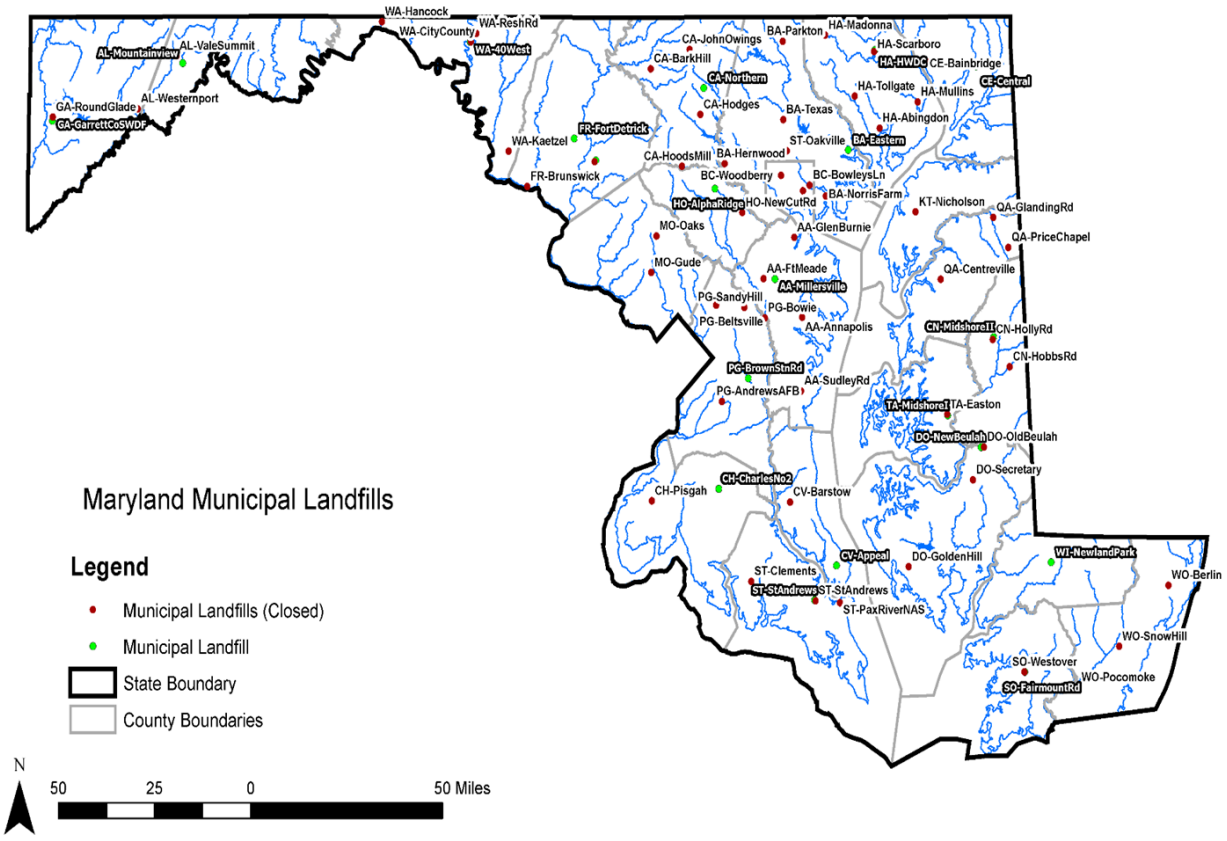
REQUIREMENTS OF THE REGULATION PROPOSAL

Sources Affected and Location

This proposed action requires MSW landfills in Maryland - depending on criteria such as size, age, methane generation rate, etc. to meet certain requirements and standards. According to MDE's 2017 Greenhouse Gas Inventory, there are several MSW landfills with the capability of producing landfill gas which could be subject to the new requirements and standards.

There are both active and closed MSW landfills in the state. An active MSW landfill is a landfill in which solid waste is being placed or has been constructed at least in part and that is planned to accept waste in the future. A closed MSW landfill is a landfill that is no longer accepting solid waste for disposal and has documentation that the closure was conducted in accordance with the applicable statutes, regulations, and local ordinances in effect at the time of closure. The Department estimates 32 MSW landfills will be subject to the proposed regulation, as applicable. Out of those 32 MSW landfills, 11 are closed facilities. A complete list of the 32 MSW landfills subject to the proposed regulation can be found in Appendix A.

Figure 2 – Municipal Solid Waste Landfills in Maryland



Requirements

This proposed action will apply to active and closed MSW landfills that have accepted waste after November 8, 1987 that have a design capacity greater than or equal to 2,750,000 tons and 3,260,000 cubic yards of waste; and, active and closed MSW landfills that have accepted waste after December 31, 1993 that have less than 2,750,000 tons or 3,260,000 cubic yards of waste-in-place but greater than 450,000 tons of waste-in-place. Certain types of landfills, such as those that receive only controlled hazardous substances (CHS) as defined in COMAR 26.13.01.03B, construction and demolition waste (C&D), inert waste, or non-decomposable waste would be exempt. Also exempt are landfills regulated under CERCLA and closed and inactive areas of active MSW landfills that have less than 2,750,000 tons or 3,260,000 cubic yards of waste-in-place but greater than 450,000 tons of waste-in-place, in addition to closed MSW landfills with solar panels or arrays that have commenced installation prior to January 1, 2024.

The new regulations are equivalent or more stringent than 40 CFR 60, Subparts Cf and XXX, 40 CFR 62, Subpart OOO and 40 CFR 63, Subpart AAAA. The new regulations will require MSW landfills to conduct emission monitoring and may require certain MSW landfills to install and operate a GCCS. These measures are intended to reduce methane emissions from MSW landfills.

The new regulations include the following requirements and standards:

- Requirements for MSW Landfills:
    - Active MSW landfills with less than 450,000 tons of waste-in-place will continue to submit annual tonnage reports in accordance with their Refuse Disposal Permit under COMAR 26.04.07.
    - MSW landfills with greater than or equal to 450,000 tons of waste in place are required to submit an initial waste-in-place report and calculate the methane generation rate. Based on the methane generation rate and status of the landfill (active, closed, or inactive), a MSW landfill may be subject to additional requirements, including installation of a GCCS and monitoring provisions.
    - MSW landfills with a calculated methane generation rate greater than 8,548 tons per year are required to install a GCCS.
    - MSW landfills that do not have a GCCS and have a calculated methane generation rate between 732 and 8,548 tons per year are required to perform quarterly surface emissions monitoring for 1 year. Depending on the results, the landfill may be subject to additional requirements, including installation of a GCCS and monitoring provisions.
    - MSW landfills with more than 450,000 tons of waste-in-place that add liquids other than leachate to the waste (to reach a moisture content of at least 40%) to enhance the anaerobic biodegradation of the waste are required to install and operate a GCCS.
    - MSW landfills, regardless of size, are subject to maintenance requirements that include maintaining cover integrity and implementing a program for cover repairs to minimize landfill gas emissions.

    - MSW landfills with an existing GCCS may be required to have a design plan review to determine regulatory adherence and are required to perform surface emissions monitoring.
    - MSW landfills that install a new GCCS are required to submit a design plan according to the new regulation requirements one year after a compliance trigger.
- Requirements for Gas Collection and Control Systems:
    - Owners and operators of MSW landfills installing a new or modified GCCS are required to submit a design plan to the Department in addition to meeting specific operating standards and requirements.
    - The new regulation includes specific requirements for the use of certain types of GCCS, such as enclosed flares, open flares, and gas control devices other than flares.
    - The new regulation includes additional requirements for GCCS, such as a wellhead gauge pressure requirement, well raising, wellhead sampling and requirements for the repair and temporary shutdown.
    - Owners and operators are required to conduct annual performance tests on gas control devices subject to the new regulation using specific test methods.
- Requirements for the Permanent Shutdown and Removal of a GCCS:
    - The new regulation includes a provision that allows the owner or operator of a GCCS installed at a closed landfill or closed area of a landfill to permanently remove the system under certain conditions.
    - Conditions include the GCCS was in operation for at least 15 years; a calculated or measured methane generation rate less than 732 ton/year (based on 3 successive tests); surface methane concentration measurements not exceeding 200 ppmv; and, the submittal of an equipment removal report to the Department.
    - Owners and operators will be required to conduct surface methane concentration measurements over areas of the landfill with capped and removed GCCS for at least 8 consecutive calendar quarters.
- Compliance Standards:
    - The new regulation establishes a surface methane concentration limit of 500 ppmv (other than non-repeatable, momentary readings) as determined by instantaneous surface emissions monitoring and an average methane concentration limit of 25 ppmv as determined by integrated surface emissions monitoring for MSW landfills.
    - Specific wellhead temperature requirements for GCCS interior wellhead in the collection system, which must operate at a landfill gas temperature of no less than 62.8 C (145 F).
    - Exemptions to the surface methane concentration standards for certain areas of the landfill under specific circumstances, such as law enforcement activities requiring excavation.
- Alternative Compliance for MSW Landfills:
    - Owners and operators may request alternatives to compliance measures, monitoring requirements, test methods, and other procedures in the new regulation in writing to the Department.
- Monitoring Requirements and Corrective Actions for MSW Landfills with GCCS:

    - Owners and operators of MSW landfills with a GCCS must follow certain procedures when conducting surface emissions monitoring (both instantaneous and integrated surface monitoring).
    - The regulation includes specific requirements and procedures for monitoring gas control systems such as enclosed flares and other gas control devices.
    - The new regulation contains a component leak standard. Gas control system components that contain landfill gas and are under positive pressure must be monitored on a quarterly basis for leaks. Leaks above 500 ppmv must be tagged and repaired within a specified timeframe. Also, MSW landfills that have landfill gas-to-energy facilities will also have to monitor for leaks on a quarterly basis.
    - Owners and operators of MSW landfills must conduct monthly wellhead monitoring to demonstrate that the gas extraction rate for the gas collection system is sufficient Owners and operators must record the temperature, gauge pressure, and oxygen/nitrogen content of landfill gas emissions and take corrective actions for any positive pressure measurement or elevated temperature.
    - The new regulation specifies that monitoring requirements apply at all times, with certain exceptions (e.g., periods of monitoring system malfunction, repair, or quality control and assurance activities). This is to ensure that the GCCS is operating optimally and to minimize methane gas emissions.
- The new regulations also include recordkeeping and reporting requirements for owners and operators of MSW landfills along with test methods and procedures to ensure compliance with the regulation.
    - For closed MSW landfills that closed on or before December 31, 1993, tonnage/waste-in-place reports can include capacity estimates based on information such as operational information and topography. This information has been accepted by MDE (specifically LMA) to verify annual tonnage and will be accepted under the proposed regulation.
- Solar Panels at MSW Landfills:
    - All solar development projects at MSW landfill sites are subject to review and approval by MDE.
    - All solar development projects submitted to the Department for review and approval will be handled through LMA (Solid Waste Program).
    - Approved solar development plans at MSW landfill sites should include all documentation as required by MDE and satisfactorily address any relevant issues raised during the review process, including siting issues, impact on existing pollution controls, generation capacity, etc.
    - Closed MSW landfills that closed or last accepted waste prior to July 17, 2014, have less than 2,750,000 tons or 3,260,000 cubic yards of MSW, and have solar panels or arrays that commenced installation prior to January 1, 2024 are exempt from the regulations.
    - After January 1, 2024, closed MSW landfills or closed areas of active MSW landfills with less than 2,750,000 tons or 3,260,000 cubic yards of MSW that newly install and operate solar panels or solar arrays will be required to meet certain requirements, such as an approved plan for the installation and operation of solar panels and comply with specific maintenance requirements and may submit an alternative compliance plan to meet the new regulation requirements.

- Large MSW landfills over 2,750,000 tons waste capacity can install and operate solar panels or arrays and will be required to submit an alternative compliance plan for surface emissions monitoring in the solar panel area.

Through this action, the Department will repeal COMAR 26.11.19.20 as MSW landfills will be subject to the updated requirements as specified in the new regulations under COMAR 26.11.42 – Control of Methane Emissions from Municipal Solid Waste Landfills.

EXPECTED EMISSIONS REDUCTIONS

The Department, under ARA's Climate Change Program, has an established GHG Inventory as required under the Greenhouse Gas Emissions Reduction Act. This GHG inventory is updated every 3 years.

Emissions from MSW landfills are characterized and calculated using accepted industry standards along with some measured and reported figures. The methane and carbon dioxide (CO_2) generation rates are modeled using EPA's Landfill Gas Emissions Model tool "Land GEM". Additional figures come from the landfill facility reporting to EPA Part 98 GHG reporting and from annual MDE emission certification reports.

Landfill gas is typically composed of methane, CO_2 and other volatile organic compounds. Landfill gas and potential methane production is unique to each landfill. Temperature, waste components, waste cell size, compaction, liners and covers, and rainfall intensity are all factors in methane production and the design criteria to capture and reduce methane. Scientists report landfill gas generation occurs in four phases, with the composition of the landfill gas changing with each phase. Methane generation begins as soon as trash is placed but maximizes between 5–20 years, then tapers off over the next decade or two.

The Department used the 2020 draft GHG Inventory to calculate a range of anticipated emission reductions that will come from minimizing surface leaks and capturing and converting methane to CO_2. By applying a range of emission reduction factors to the list of affected sources, the Department estimates 25-50% reduction in CO_2 (CO_2 and CO_2 equivalent – using a GWP of 28) emissions from the affected landfills subject to this proposed regulation when fully implemented. The emission calculations and estimated reductions are a guide. Recordkeeping and reporting will supplement and confirm mitigation measures required from the proposed regulation are working. Additional details on the emissions estimates can be found at Appendix B.

The new requirements and standards for MSW landfills are either equivalent or more stringent than current federal requirements for MSW landfills, such as component leak testing, surface emission monitoring, GCCS', and recordkeeping and reporting schedules. Furthermore, the new requirements and standards for MSW landfills are more stringent than those under COMAR 26.11.19.20. This action will result in decreased methane emissions from MSW landfills in the state. The Department will continue to evaluate the emission reductions and benefits of this proposed action once the regulations are implemented.

ECONOMIC IMPACT

Economic Impact on Affected Sources, the Department, other State Agencies, Local Government, other Industries or Trade Groups, the Public

This proposed action will have minimal economic impact on the Department. This action will have minimal or no economic impact on other State agencies.

The majority of MSW landfills are owned and operated by local governments. Factors that could influence costs are landfill size, age, status (*i.e., open, closed, active or inactive*), and the amount of waste-in-place, etc. The proposed action could have a potential impact on local governments as affected sources may incur capital costs from installing and operating new or modified emission control systems to meet requirements. Based on similar regulations promulgated by California and Oregon to reduce methane emissions from landfills, the capital cost associated with modifying an existing GCCS or installing a new GCCS can range from $1-$3 million. This is coupled with associated operating and maintenance costs, with estimates ranging from $150,000 to $400,000/yr. There may be additional costs associated with monitoring (average annual costs around $60,000), recordkeeping, and reporting requirements.

MDE estimates approximately 32 MSW landfills (11 closed and 21 active) meet the applicability requirements for age and waste-in-place, therefore are under consideration of the proposed regulations. MDE established the list of affected sources from the Air and Land Administration records.

The Department estimates that MSW landfills could incur annual expenses ranging from $8,000 to $400,000.

While the Department did not evaluate or consider the cost benefits of any landfill gas-to-energy installations or proposed projects as part of this Technical Support Document, the Department believes that any revenue generated would help offset operating expenses associated with the proposed regulation. Additional details on the estimated cost impacts can be found in Appendix C.

The proposed action will be of benefit to the public and the environment as methane is reduced and minimized. Short-lived climate pollutants (which includes methane) are potent and harmful air pollutants that have a disproportionately large, short-term impact on climate change. Compared to carbon dioxide (CO_2) and other longer-lived climate pollutants that stay in the atmosphere for centuries, short-lived climate pollutants have far more warming impact by weight. Reducing methane emissions will combat the adverse impacts of climate change in Maryland. Maryland is facing a wide variety of consequences from climate change, such as: a climate that is trending warmer and wetter; impacts to Maryland's ecosystems; damage to coastal and inland infrastructure from sea-level rise, storm surge, and heavy rain events; climate-driven stressors in agriculture, fisheries, and forestry; and direct and indirect public health impacts

Economic Impact on Small Businesses

The proposed action has minimal or no economic impact on small businesses.

EQUIVALENT FEDERAL STANDARDS

The new regulations include additional requirements for MSW landfills and is intended to be the equivalent or more stringent than 40 CFR 60, Subparts Cf and XXX, and 40 CFR 63, Subpart AAAA. The new regulations incorporate the new federal requirements (EG, NSPS, and NESHAP) which primarily address NMOC emissions from landfill gas. Also, the new regulations establish standards and requirements to address methane gas emissions from MSW landfills. These measures to mitigate methane gas emissions will ultimately control NMOC emissions from MSW landfills as well.

OTHER STATE STANDARDS

At least two states, California and Oregon have adopted stringent requirements to control the mitigation of landfill gas from landfills.

California's Landfill Methane Regulation (LMR) applies to active, inactive, and closed MSW landfills having 450,000 tons of waste-in-place or greater that received waste after January 1, 1977. Based on the current amount of waste-in-place and upon the owner or operator estimating the landfill's gas heat input capacity (equal to or greater than 3.0 MMBtu/lbs), a landfill is required to install and operate a gas collection and control system to reduce methane emissions. The LMR includes monitoring, recordkeeping, and reporting requirements for affected landfills.

In October 2021, Oregon promulgated the Landfill Gas Emissions Rulemaking to reduce methane emissions from landfills. Oregon's regulation incorporates many of the requirements from California's LMR but regulates a larger set of landfills than the LMR. The regulation is equivalent or more stringent than the federal requirements (NESHAP and NSPS) for landfill gas emissions. The regulation affects all types of landfills in the state having 200,000 tons of waste-in-place or greater that received waste after November 8, 1987. Landfills are required to install and operate a gas collection and control system to reduce methane emissions or conduct surface emission monitoring based on factors such as waste-in-place and the amount of methane the landfill produces (methane generation rate). Like California's LMR, Oregon's regulation includes monitoring, recordkeeping, and reporting requirements for affected landfills.

PROPOSED REGULATIONS

09-13-2022 Rev 10-19-2022 Rev 11-07-2022

Title 26 DEPARTMENT OF THE ENVIRONMENT

Subtitle 11 AIR QUALITY

Chapter 42 Control of Methane Emissions from Municipal Solid Waste Landfills

Authority: Environment Article, §§1-404, 2-103, 2-301—2-303, 10-102, and 10-103, Annotated Code of Maryland

.01 Applicability and Exemptions.

A. This chapter applies to a person who owns or operates a municipal solid waste (MSW) landfill that has accepted waste after November 8, 1987.

B. This chapter does not apply to:

(1) Landfills that are permitted to accept controlled hazardous substances (CHS) as defined in COMAR 26.13.01.03B or are currently regulated under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. Chapter 103;

(2) Landfills that receive only construction and demolition wastes, inert waste, or non-decomposable wastes;

(3) Closed or inactive MSW landfills with:

(a) Less than 450,000 tons of waste-in-place; or

(b) A design capacity of less than 2,750,000 tons (2.5 million megagrams) and 3,260,000 cubic yards (2.5 million cubic meters) that last accepted waste before December 31, 1993; or

(4) Closed or inactive MSW landfills, or closed or inactive areas of an active MSW landfill, that have commenced installation of solar panels or arrays on or before January 1, 2024 and which meet the following requirements:

(a) The landfill, or inactive area of an active landfill, was closed or last accepted waste on or before July 17, 2014;

(b) The landfill, including all active and/or inactive areas combined, has less than 2,750,000 tons (2.5 million megagrams) or 3,260,000 cubic yards (2.5 million cubic meters) of MSW; and

(c) The request to install solar panels or arrays is approved by the Department in writing based on project specifications and impacts to other requirements under this chapter.

C. Title V Operating Permits.

(1) The owner or operator of a MSW landfill which is subject to the provisions of this chapter and that has a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards of MSW shall obtain an operating permit for the landfill in accordance with COMAR 26.11.03.

(2) When a MSW landfill subject to this section is closed, the owner or operator is no longer subject to the requirement to maintain an operating permit under COMAR 26.11.03 for the landfill if the landfill is not otherwise subject to the requirements of COMAR 26.11.03 and if either of the following conditions are met:

(a) The landfill was never subject to the requirement to install and operate a gas collection and control system under Regulation .04 of this chapter; or

(b) The landfill meets the conditions for control system removal specified in Regulation .06A of this chapter.

.02 Incorporation by Reference - Test Methods.

A. In this chapter, the following documents are incorporated by reference.

B. Documents Incorporated.

(1) EPA Method 2 (40 CFR Part 60, Appendix A-1, Section 10.3, as amended).

(2) EPA Method 3A (40 CFR Part 60, Appendix A, as amended).

(3) EPA Method 3C (40 CFR Part 60, Appendix A, as amended).

(4) EPA Method 10 (40 CFR Part 60, Appendix A, as amended).

(5) EPA Method 18 (40 CFR Part 60, Appendix A, as amended).

(6) EPA Method 21 (40 CFR Part 60, Appendix A, as amended).

(7) EPA Method 25 (40 CFR Part 60, Appendix A, as amended).

(8) EPA Method 25C (40 CFR Part 60, Appendix A, as amended).

(9) ASTM D6522-11, "Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers, December 1, 2011.

(10) ASTM D6522-20, "Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers, June 1, 2020.

.03 Definitions.

A. In this chapter, the following terms have the meanings indicated.

B. Terms Defined.

(1) "Active MSW landfill" means a MSW landfill in which solid waste is being placed or a MSW landfill that has been constructed at least in part and that is planned to accept waste in the future.

(2) "Bioreactor" means a landfill or portion of a landfill where any liquid other than leachate (leachate includes landfill gas condensate) is added in a controlled fashion into the waste mass (often in combination with recirculating leachate) to reach a minimum average moisture content of at least 40 percent by weight to accelerate or enhance the anaerobic (without oxygen) biodegradation of the waste.

(3) "Closed MSW landfill" means a MSW landfill that is no longer accepting solid waste for disposal and has documentation that the closure was conducted in accordance with the applicable statutes, regulations, and local ordinances in effect at the time of closure.

(4) "Component" means any equipment that is part of the gas collection and control system and that contains landfill gas including, but not limited to:

(a) Wells;
(b) Pipes;
(c) Flanges;
(d) Fittings;
(e) Flame arrestors;
(f) Knock-out drums;
(g) Sampling ports;
(h) Blowers;
(i) Compressors; and
(j) Connectors.

(5) Component Leak.

(a) "Component leak" means the concentration of methane measured one half an inch or less from a component source that equals or exceeds 500 parts per million by volume (ppmv), other than non-repeatable, momentary readings.

(b) "Component leak" includes measurements from any vault taken within 3 inches above the surface of the vault exposed to the atmosphere.

(6) "Construction and demolition waste" means waste building materials, packing, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures.

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

(8) "Corrective action analysis" means a description of all reasonable interim and long-term measures, if any, that are available, and an explanation of why the selected corrective action(s) is/are the best alternative(s), including, but not limited to consideration of:

(a) Cost effectiveness;
(b) Technical feasibility;
(c) Safety; and
(d) Secondary impacts.

(9) "Destruction efficiency" means a measure of the ability of a gas control device to combust, transform, or otherwise prevent emissions of methane from entering the atmosphere.

(10) "Disposal facility" means all contiguous land and structures, appurtenances, and other improvements used for the disposal of solid waste.

(11) "Enclosed combustor" means an enclosed flare, steam generating boiler, internal combustion engine, or gas turbine.

(12) "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:

(a) Gas turbines;
(b) Internal combustion engines;
(c) Boilers; and
(d) Boiler-to-steam turbine systems.

(13) "Gas collection system" means any system that employs various gas collection wells and connected piping and gas mover equipment, or any system that is a passive collection system.

(14) "Gas collection and control system" means any system consisting of a gas collection system and a gas control system.

(15) "Gas control device" means any device used to dispose of or treat collected landfill gas, including, but not limited to:

(a) Enclosed flares;
(b) Internal combustion engines;
(c) Boilers and boiler-to-steam turbine systems;
(d) Fuel cells; and
(e) Gas turbines.

(16) "Gas control system" means any system that disposes of or treats collected landfill gas by one or more of the following methods:

(a) Combustion;
(b) Gas treatment for subsequent sale; or
(c) Sale for processing offsite, including for transportation fuel and injection into the natural gas pipeline.

(17) "Gas mover equipment" means the equipment (e.g.., fan, blower, compressor) used to transport landfill gas through the header system.

(18) "Inactive area" means a separate area of a MSW landfill in which solid waste is no longer being placed.

(19) "Inactive MSW landfill" means a MSW landfill that is no longer accepting solid waste for disposal and can subsequently document that solid waste is no longer being placed at the landfill.

(20) "Landfill gas" means the gases generated by a MSW landfill through the natural process of decomposing organic material or through the chemical reaction of other substances in the municipal solid waste.

(21) “Landfill surface” means the area of the landfill under which decomposable solid waste has been placed, excluding the working face.

(22) “Leachate recirculation” means the practice of taking the leachate collected from the landfill and reapplying it to the landfill by any of one of a variety of methods, including:

(a) Pre-wetting of the waste;

(b) Direct discharge into the working face;

(c) Spraying;

(d) Infiltration ponds;

(e) Vertical injection wells;

(f) Horizontal gravity distribution systems; and

(g) Pressure distribution systems.

(23) "Municipal solid waste (MSW)" means household waste, commercial solid waste, and industrial solid waste, as defined in 40 CFR §60.751.

(24) Municipal Solid Waste Landfill (MSW Landfill).

(a) "Municipal solid waste landfill" means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land, portions of which may be separated by access roads.

(b) "Municipal solid waste landfill" includes landfills that also receive other types of federal (40 CFR §257.2) Resource Conservation and Recovery Act (RCRA) Subtitle D defined wastes such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste.

(25) Non-Decomposable Solid Waste.

(a) “Non-decomposable solid waste” means materials that do not degrade biologically to form landfill gas.

(b) “Non-decomposable solid waste” includes but is not limited to:

(i) Earth;

(ii) Rock;

(iii) Concrete asphalt paving fragments;

(iv) Uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete);

(v) Brick;

(vi) Glass;

(vii) Ceramics;

(viii) Clay products;

(ix) Inert slag;

(x) Asbestos-containing waste;

(xi) Demolition materials containing minor amounts (less than 10 percent by volume) of wood and metals; and

(xii) Coal combustion byproducts (CCBs) and incinerator ash.

(26) “Non-repeatable momentary readings” means indications of the presence of methane, total organic compounds, or toxic air contaminants, which persist for less than 5 seconds and do not recur when the sampling probe of a portable gas detector is placed in the same location.

(27) “Open flare” means an open combustor without enclosure or shroud.

(28) “Owner or Operator” means a person who owns or operates a MSW landfill.

(29) “Passive gas collection system” means a gas collection system that solely uses positive pressure within the MSW landfill to move gas rather than using gas mover equipment.

(30) “Root cause analysis” means an assessment conducted through a process of investigation to determine the primary cause, and any other contributing causes, of positive pressure at a wellhead.

(31) “Solar array” means multiple solar panels used in conjunction to produce electricity.

(32) Solar Panel.

(a) “Solar panel” means any photovoltaic energy system designed for the generation of electrical power from the collection of sunlight.

(b) “Solar panel” includes without limitation:

(i) Photovoltaic panels;

(ii) Foundations;

(iii) Support structures;

(iv) Braces; and

(v) Related equipment.

(33) “Total waste landfilled” means the same as waste-in-place.

(34) “Treatment system” means a system that filters, de-waters, and compresses landfill gas for sale or subsequent use.

(35) Waste-In-Place.

(a) “Waste-in-place” means the total amount of solid waste placed in the MSW landfill estimated in tons and is also referred to as “total waste landfilled.”

(b) “Waste-in-place” assumes both the refuse density to be 1,300 pounds per cubic yard and the decomposable fraction to be 70 percent by weight.

(36) Well Raising.

(a) "Well raising" means a MSW landfill activity where an existing gas collection well is temporarily disconnected from a vacuum source, and the non-perforated pipe attached to the well is extended vertically to allow the addition of a new layer of solid waste or the final cover; or is extended horizontally to allow the horizontal extension of an existing layer of solid waste or cover material.

(b) "Well raising" includes re-connecting the extended pipe (well extension) to continue collecting gas from that well.

(37) "Working face" means the open area where solid waste is deposited daily and compacted with landfill equipment.

.04 Requirements for Municipal Solid Waste (MSW) Landfills.

A. Active MSW Landfills With Less Than 450,000 Tons of Waste-in-Place.

(1) A person who owns or operates an active MSW landfill having less than 450,000 tons of waste-in-place shall submit to the Department a copy of the annual tonnage report required pursuant to the Refuse Disposal Permit issued under COMAR 26.04.07 which includes all the following information:

(a) Annual waste accepted;

(b) Total waste landfilled or waste-in-place; and

(c) Calculation of remaining airspace.

(2) Once the active MSW landfill reaches a size greater than or equal to 450,000 tons of waste-in-place, the owner or operator shall be subject to requirements of §B of this regulation.

B. MSW Landfills Greater Than or Equal to 450,000 Tons of Waste-in-Place.

(1) Within 90 days of the effective date of this regulation, the owner or operator of a MSW landfill having greater than or equal to 450,000 tons of waste-in-place shall perform the following:

(a) Submit an initial waste-in-place report to the Department; and

(b) Calculate the methane generation rate in accordance with the test methods in Regulation .11D of this chapter and submit a methane generation rate report to the Department.

(2) If the calculated methane generation rate is less than 732 tons per year reported, the owner or operator shall recalculate the methane generation rate annually in accordance with the test methods in Regulation .11D of this chapter.

(a) If the MSW landfill is active, the owner or operator shall submit an annual methane generation rate report to the Department until either of the following conditions is met:

(i) The calculated methane generation rate is greater than or equal to 732 tons per year; or

(ii) The owner or operator submits a closure notification to the Department in accordance with Regulation .10C(1) of this chapter.

(b) If the MSW landfill is closed or inactive, the owner or operator shall submit the following information to the Department:

(i) A final methane generation rate report in accordance with the provisions in Regulation .10C(6) of this chapter; and,

(ii) A closure notification in accordance with the provisions in Regulation .10C(1) of this chapter.

(3) If the calculated methane generation rate is greater than or equal to 732 tons per year but less than 8,548 tons per year, the owner or operator shall either:

(a) Install and operate a gas collection and control system in accordance with the provisions in Regulation .05 and comply with the requirements in Regulations .04 -.11 of this chapter; or

(b) Undertake four consecutive quarterly surface emissions monitoring periods using the instantaneous surface emissions monitoring procedures specified in Regulation .11F of this chapter, in order to demonstrate that there is no measured concentration of methane of 200 parts per million by volume (ppmv) or greater.

(4) An owner or operator of an MSW landfill who chooses to conduct consecutive quarterly surface emissions monitoring pursuant to §B(3)(b) of this regulation shall begin quarterly instantaneous surface emissions monitoring no later than 90 days after the methane generation rate report is required to be submitted under §B(1)(b) of this regulation.

(5) The owner or operator who chooses to conduct consecutive quarterly surface emissions monitoring pursuant to §B(3)(b) of this regulation shall perform one of the following actions based on the monitoring results:

(a) Except as provided in Regulation .09A(1) of this chapter, if there is any measured concentration of methane of 200 ppmv or greater from the surface of an active, inactive, or closed MSW landfill, other than non-repeatable, momentary readings, the owner or operator shall cease the quarterly monitoring, and instead, install a gas collection and control system in accordance with the provisions in Regulation .05, and shall comply with the requirements in Regulations .04 -.11 of this chapter beginning with the next quarterly report submission.

(b) If there is no measured concentration of methane of 200 ppmv or greater from the surface of an active MSW landfill after four consecutive quarterly instantaneous surface emissions monitoring periods, the owner or operator shall comply with all the following requirements:

(i) Recalculate the methane generation rate annually in accordance with the test methods in Regulation .11D of this chapter and submit a methane generation rate report to the Department;

(ii) Continue quarterly instantaneous surface emissions monitoring in accordance with the test methods and procedures specified in Regulation .11F of this chapter; and

(iii) Prepare and submit an annual instantaneous surface emissions monitoring report to the Department in accordance with Regulation .10C(11) of this chapter.

(c) If there is no measured concentration of methane of 200 ppmv or greater from the surface of a closed or inactive MSW landfill, the provisions of this chapter shall no longer apply provided that the owner or operator has completed all of the following requirements:

(i) Satisfied all applicable requirements for the permanent shutdown and removal of a gas collection and control system in Regulation .06 of this chapter;

(ii) Submitted a final waste-in-place report to the Department in accordance with the provisions in Regulation .10C(5) of this chapter;

(iii) Submitted a closure notification to the Department in accordance with the recordkeeping and reporting requirements in Regulation .10C(1) of this chapter; and

(iv) Submitted all instantaneous surface emissions monitoring reports to the Department in accordance with requirements of Regulation .10B(11) of this chapter.

(6) If the calculated methane generation rate is greater than or equal to 8,548 tons per year, the owner or operator of a MSW landfill shall install and operate a gas control and collection system in accordance with the provisions in Regulation .05 and comply with the requirements in Regulations .04 —.11 of this chapter.

C. Liquids Addition. If the owner or operator of a MSW landfill with more than 450,000 tons of waste-in-place adds any liquid, other than leachate in a controlled fashion, to the waste mass to reach a minimum average moisture content of at least 40 percent by weight to accelerate or enhance the anaerobic biodegradation of the waste, the owner or operator shall install and operate a gas collection and control system that meets the criteria in Regulation .05 of this chapter in accordance with the following:

(1) Install the gas collection and control system for the bioreactor before initiating liquids addition and extend the collection and control system into each new cell or area of the bioreactor prior to initiating liquids addition in that area;

(2) Begin operating the gas collection and control system within 180 days after initiating liquids addition or within 180 days after achieving a moisture content of 40 percent by weight, whichever is later; and

(3) Calculate the bioreactor moisture content in accordance with Regulation .11J of this chapter.

D. Maintenance Requirements. The owner or operator of a MSW landfill shall maintain the cover integrity in accordance with the provisions in COMAR 26.04.07.10D and implement a program for cover repairs as necessary on a quarterly basis.

.05 Requirements for Gas Collection and Control Systems.

A. Design Plan and Installation.

(1) If a gas collection and control system which meets the requirements in §B of this regulation has not been installed, the owner or operator of a MSW landfill shall submit a design plan to the Department within 1 year following the effective date of this regulation or within 1 year of detecting any measured concentration of methane of 200 ppmv or greater in accordance with the provisions in Regulation .04(B)(3) of this chapter.

(2) A design plan shall meet the following requirements:

(a) Be prepared and certified by a professional engineer;

(b) Address the following issues:

(i) Depths of solid waste;

(ii) Solid waste gas generation rates and flow characteristics;

(iii) Cover properties;

(iv) Gas system expandability;

(v) Leachate and condensate management;

(vi) Accessibility;

(vii) Compatibility with filling operations;

(viii) Integration with closure end use;

(ix) Air intrusion control;

(x) Corrosion resistance;

(xi) Fill settlement;

(xii) Resistance to the solid waste decomposition heat; and

(xiii) The ability to isolate individual components or sections for repair or troubleshooting without shutting down entire collection system.

(c) Provide for the control of the collected gas using a gas collection and control system meeting the requirements of §B(1), §B(2), §B(3), or §B(4) of this regulation or an alternative method approved in accordance with the provisions in Regulation .08 of this chapter;

(d) Demonstrate that the gas collection and control system is designed to handle the maximum expected gas generation flow rate from the entire area of the MSW landfill that warrants control over the intended use period of the gas control system equipment;

(e) Include any proposed alternatives to the requirements, justification for the need for any proposed alternatives, test methods, procedures, compliance measures, monitoring, and recordkeeping or reporting requirements in accordance with the provisions in Regulation .08 of this chapter;

(f) Include a description of potential mitigation measures to be used to prevent the release of methane or other pollutants into the atmosphere during the installation or preparation of wells, piping, or other equipment, during repairs or the temporary shutdown of gas collection system components, or when solid waste is to be excavated and moved;

(g) For active MSW landfills, identify areas of the landfill that are closed or inactive;

(h) Design the gas collection and control system to handle the expected gas generation flow rate from the entire area of the landfill and to collect gas at an extraction rate to comply with the surface methane concentration standards in Regulation .07A, component leak standards in Regulation .09B(3), and which is sufficient to meet all operational and performance standards in this chapter;

(i) Identify any areas of the MSW landfill that contains only asbestos-containing or non-decomposable solid waste that may be excluded from gas collection provided that the owner or operator submits documentation to the Department containing the nature of the waste, date of deposition, and location and amount of asbestos-containing or non-decomposable solid waste deposited in the area;

(j) Design the gas collection and control system to maintain a negative pressure at all wellheads in the collection system without causing air infiltration, including any wellheads connected to the system as a result of expansion or excess surface emissions;

(k) Ascertain the density of wells, horizontal collectors, surface collectors, or other gas extraction devices necessary to achieve compliance with §B of this regulation; and

(l) Include any procedures for detecting and suppressing any internal landfill fires or thermal waste oxidation events that might occur within the waste, and for mitigating any damage that may have occurred to pollution control devices such as the liner, leachate collection system, cap, or gas collection system elements as a result of the event.

(3) The maximum expected gas generation flow rate in §A(2)(d) of this regulation shall be calculated using the test method in Regulation .11B or an alternative test method approved in accordance with Regulation .08 of this chapter.

(4) The owner or operator of a MSW landfill that is required or chooses to install and operate a gas collection and control system, shall do so within 30 months after approval of the design plan.

(5) If an owner or operator is modifying an existing gas collection and control system to meet the requirements of this regulation, the owner or operator shall submit an amended design plan to the Department that includes the information in §A(2) of this regulation and any necessary updates or addenda in accordance with Regulation .10C(9) of this chapter.

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

B. Standards and Requirements for Gas Collection and Control Systems.

(1) General Requirements. The owner or operator of a MSW landfill that is subject to the provisions of this regulation shall satisfy the following standards and requirements when operating a gas collection and control system:

(a) Route the collected gas to a gas control device(s) and operate the gas collection and control system continuously, except as provided in §D and §F of this regulation.

(b) Operate the gas collection and control system to comply with the requirements in §A(2)(h) of this regulation;

(c) Design and operate the gas collection and control system to draw all the gas toward the gas control device or devices.

(d) Design and operate the gas collection system to minimize off-site and on-site migration of subsurface gas in compliance with COMAR 26.04.07.03B(9), COMAR 26.04.07.08B(15), and COMAR 26.04.07.10I.

(e) In the event the gas collection or control system is inoperable, the gas mover system shall be shut down and all valves in the gas collection and control system contributing to venting of the gas to the atmosphere shall be closed within 1 hour of the gas collection or control system not operating.

(f) Efforts to repair the gas collection or control system shall be initiated and completed in a manner such that downtime is kept to a minimum, and the gas collection and control system is returned to operation as expeditiously as practicable.

(g) For a MSW landfill with a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards of MSW:

(i) Install all passive gas collection systems with liners on the bottom and all sides in all areas in which gas is to be collected; and

(ii) Install all liners in accordance with 40 CFR §258.40, as amended.

(h) Any nonproductive area of the MSW landfill as identified in §A(2)(i) may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of methane emissions from the landfill and:

(i) The amount, location, and age of the material or waste shall be documented and provided to Department;

(ii) If data on actual amounts and age of the material or waste is not available, the owner or operator shall estimate based on known information and provide all documentation used to make the estimates;

(iii) A separate methane emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the methane emissions estimate for the entire landfill, and all calculations, data and documentation used to perform the calculations shall be submitted to the Department; and

(iv) The methane emissions from each section proposed for exclusion shall be calculated using the test methods provided in Regulation .11D of this chapter.

(i) reserved

(j) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to:

(i) Convey projected amounts of gases;

(ii) Withstand installation, static, and settlement forces; and

(iii) Withstand planned overburden or traffic loads.

(k) The gas collection system shall extend as necessary to comply with emission and migration standards.

(l) Gas collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss which may impair performance across the intended extent of control.

(m) Perforations shall be situated with regard to the need to prevent excessive air infiltration.

(n) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill.

(i) Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill.

(ii) Collection devices shall be designed so as not to allow indirect short circuiting of air into the soil cover, into the MSW, or into the collection system, or gas into the air.

(iii) Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block the perforations.

(o) Gas collection devices may be connected to the collection header pipes below or above the landfill surface.

(i) The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings, and at least one sampling port.

(ii) The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.

(p) Landfill gas shall be conveyed through the gas collection system header pipe(s) to a gas control device.

(q) The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:

(i) For existing gas collection systems, the flow data shall be used to project the maximum flow rate;

(ii) If no flow data exists, the procedures in §B(l)(q)(iii) of this regulation shall be used; and

(iii) For new gas collection systems, the maximum flow rate shall be determined in accordance with Regulation .11B of this chapter.

(2) Requirements for Enclosed Flares.

(a) An owner or operator of a MSW landfill that routes landfill gas to an enclosed flare shall achieve a methane destruction efficiency of at least 99 percent by weight and meet the following specifications:

(i) The device shall be equipped with automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors; and

(ii) The device shall have a sufficient flow of propane, natural gas, or another fuel source approved by the Department to the pilot light to prevent unburned collected methane from being emitted to the atmosphere during restart and startup.

(b) The owner or operator of a MSW landfill shall install, calibrate, operate and maintain the flare system in accordance with the manufacturer's specifications and if applicable, within the parameter ranges established in the landfill's permit to construct issued by the Department.

(c) An owner or operator that used an enclosed flare shall install, calibrate, and maintain a gas flow rate measuring device that either records the flow to the control device at least every 15 minutes or secures the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration.

(3) Requirements for Open Flares.

(a) The owner or operator of a MSW landfill that routes landfill gas to an open flare shall operate the equipment according to the requirements included in 40 CFR §60.18, as amended.

(b) The owner or operator of a MSW landfill using an open flare shall install, calibrate, maintain, and operate the following equipment according to the manufacturer's specifications:

(i) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame; and

(ii) A device that records flow to the flare and bypass of the flare (if applicable).

(c) An owner or operator that uses an open flare shall install, calibrate, and maintain a gas flow rate measuring device that either records the flow to the control device at least every 15 minutes or secures the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration.

(d) An owner or operator that is subject to §B(3)(b) of this regulation shall perform a visual inspection of the seal or closure mechanism at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(e) The operation of an open flare on or after January 1, 2025 is prohibited unless the owner or operator demonstrates that one of the following conditions apply and receives the Department's prior written approval:

(i) The methane generation rate is less than 732 tons per year in accordance with the test methods in Regulation .11D of this chapter and is insufficient to support the continuous operation of an enclosed flare or other gas control device;

(ii) The owner or operator is seeking to 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;

(iii) The owner or operator has landfill gas emissions that are unable to be controlled using enclosed flare gas control devices in the gas control system; or

(iv) The owner or operator otherwise has received written approval from the Department to operate an open flare in accordance with Regulation .08 of this chapter.

(f) An owner or operator seeking to operate an open flare in accordance with one of the provisions of §B(3)(e) shall submit a written request to the Department which includes the following information:

(i) Proof that the landfill gas emissions being controlled using an open flare does not exceed 732 tons per year of methane; and

(ii) An analysis verifying there is no feasible alternative control device configuration that would use the landfill gas emissions without use of an open flare.

(4) Requirements for Gas Control Devices other than Flares. An owner or operator of a MSW landfill may operate a gas control device other than a flare if it complies with one of the following requirements:

(a) The device is a boiler or process heater with a design heat input capacity equal to or greater than 44 megawatts per hour (150 MMBtu/hr), provided that the landfill gas stream is introduced into the flame zone;

(b) The collected gas is routed to an energy recovery device, or series of devices, that shall meet all the following requirements:

(i) Achieves a methane destruction efficiency of at least 99 percent by weight;

(ii) For lean burn internal combustion engines, reduces the outlet methane concentration to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen; and

(iii) The gas control device operates within the parameter ranges established during the initial or most recent performance test that demonstrates compliance with the methane destruction efficiency standard in §B(4)(b)(i) of this regulation or within engineering or manufacturer's established parameter ranges until a performance test is performed as specified in §B(7) of this regulation; or

(c) The collected gas is routed to a treatment system that processes the collected gas for subsequent sale or beneficial use provided that:

(i) The venting of treated landfill gas to the ambient air is not allowed; and

(ii) If, for any reason, the treated landfill gas cannot be routed for subsequent sale or beneficial use, then the treated landfill gas shall be controlled in accordance with the requirements of §B(2), §B(3), or §B(4)(a) and (b) of this regulation.

(5) The owner or operator subject to the requirements of §B(4)(c) in this regulation shall prepare a site-specific treatment monitoring plan, submitted with the gas collection and control design plan, to include all of the following:

(a) Monitoring records of parameters that are identified in the treatment system monitoring plan and that ensure the treatment system is operating properly for each intended end use of the treated landfill gas;

(b) At a minimum, records shall include records of filtration, de-watering, and compression parameters that ensure the treatment system is operating properly for each intended end use of the treated landfill gas;

(c) Monitoring methods, frequencies, and operating ranges for each monitored operating parameter based on manufacturer's recommendations or engineering analysis for each intended end use of the treated landfill gas;

(d) Documentation of the monitoring methods and ranges, along with justification for their use;

(e) Processes and methods used to collect the necessary data; and

(f) A description of the procedures and methods that are used for quality assurance, maintenance, and repair of all continuous monitoring systems.

(6) The owner or operator subject to the provisions in §B(4)(c) of this regulation shall demonstrate compliance by using a device that records flow to the treatment system and bypass of the treatment system, if applicable, that shall be calibrated, maintained, and operated according to the manufacturer's specifications.

(a) The owner or operator shall maintain and operate all monitoring systems associated with the treatment system in accordance with the site-specific treatment system monitoring plan prepared in accordance with the provisions of §B(5) of this regulation.

(b) The owner or operator shall comply with the following requirements:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the treatment system at least every 15 minutes;

(ii) Install liners or equivalent non-permeable materials as required under 40 CFR §258.40, as amended, on the bottom and all sides in all areas in which gas is to be collected; and,

(iii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration and perform a visual inspection of the seal or closure mechanism at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(7) Performance Test Requirements.

(a) The owner or operator shall conduct annual performance tests for any gas control device(s) subject to the requirements of §B(2), (3) & (4) of this regulation using the test methods identified in Regulation .11C of this chapter.

(b) An initial performance test shall be conducted within 180 days of start-up of the gas collection and control system.

(c) Following an initial performance test, the owner or operator shall conduct a complete annual performance test no later than 45 days following the 1-year anniversary date of the initial performance test.

(d) The owner or operator of an existing gas control device shall demonstrate compliance with this regulation no later than 180 days following the effective date of this regulation in accordance with the test methods and procedures specified in Regulation .11C of this regulation.

(e) The owner or operator shall conduct performance tests under conditions specified by the Department based on representative performance of the affected source for the period being tested.

(f) Representative conditions shall exclude periods of startup and shutdown unless specified by the Department.

(g) The owner or operator may not conduct performance tests during periods of malfunction.

(h) The owner or operator shall record the process information that is necessary to document operating conditions during the test and include in such record an explanation to support that such conditions represent normal operation.

(i) The owner or operator shall make available records necessary to determine the conditions of performance tests available upon request by the Department.

(j) If a gas control device remains in compliance after three consecutive performance tests, the owner or operator may conduct the performance test every 3 years.

(k) Once a gas control device is placed on the 3-year performance test schedule, if a subsequent performance test shows the gas collection and control system is out of compliance with the requirements of this regulation, the performance testing frequency shall return to annual.

(l) The performance test is not required for boilers and process heaters with design heat input capacities equal to or greater than 44 megawatts per hour (150 MMBtu/hr) that burn landfill gas for compliance with the requirements in §B(4) of this regulation.

C. Wellhead Gauge Pressure Requirement. Each landfill gas collection and control system wellhead shall be operated under negative pressure without causing air filtration, except as provided in §§D and F of this regulation, or under any of the following conditions:

(1) Use of a Geomembrane or Synthetic Cover. The owner or operator shall develop acceptable pressure limits for the wellheads and include them in the design plan;

(2) A Decommissioned Well. A well may experience a static positive pressure after shutdown to accommodate for declining flows; or

(3) A Fire or Increased Well Temperature.

(a) The owner or operator shall record all instances when positive pressure occurs, in efforts to avoid a fire.

(b) These records shall be submitted as part of the semi-annual report to the Department in accordance with the requirements of Regulation .10C(3) of this chapter.

D. Well Raising. The requirements of §B(1)(a)—(b) and §E of this regulation do not apply to individual wells involved in well raising provided the following conditions are met:

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

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

E. Wellhead Sampling. The owner or operator that is required to comply with §B of this regulation for an active gas collection system shall install a sampling port and measuring devices, or an access port for measuring devices, at each wellhead and comply with the following, using measuring devices that meet the requirements of Regulation .11H of this chapter:

(1) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in Regulation .09C of this chapter;

(2) Monitor temperature of the landfill gas on a monthly basis as provided in Regulation .09C in this chapter; and

(3) Measure the gauge pressure in the gas collection header on a monthly basis as provided in Regulation .09B(8) of this chapter.

F. Repairs and Temporary Shutdown of Gas Collection System Components. The requirements of §B(1)(a) and (b) do not apply to individual landfill gas collection system components that are temporarily shut down in order to repair the components, due to an emergency, catastrophic events such as earthquakes, to connect new landfill gas collection system components to the existing system, to extinguish landfill fires, or to perform construction activities in accordance with Regulation .07C of this chapter, provided the following requirements are met:

(1) Any new gas collection system components required to maintain compliance with this regulation shall be included in the most recent design plan in accordance with §A of this regulation;

(2) Methane emissions are minimized during shutdown in accordance with §A(2)(f) of this regulation; and

(3) The owner or operator submits a notification to the Department after any temporary shutdown due to an emergency, catastrophic event, or landfill fire(s) in accordance with Regulation .10C(13) of this chapter.

.06 Requirements for the Permanent Shutdown and Removal of a Gas Collection and Control System.

A. A gas collection and control system installed at a closed MSW landfill or closed area of a MSW landfill may be capped and permanently removed provided the following requirements are met:

(1) The gas collection and control system was in operation for at least 15 years, unless the owner or operator can demonstrate to the Department that due to declining methane rates the MSW landfill will be unable to operate the gas collection and control system for a 15-year period;

(2) The calculated or measured methane generation rate at the MSW landfill is less than 732 tons per year on three successive test dates, provided that:

(a) For measured methane generation rates, the test dates shall be no less than 90 days apart, and no more than 180 days apart; or

(b) The calculated methane generation rate shall be calculated in accordance with the provisions of Regulation .11D of this chapter;

(3) Surface methane concentration measurements do not exceed 200 ppmv;

(4) The concentrations of methane gas at the MSW landfill do not exceed 25 percent of the lower explosive limit in facility structures (excluding gas collection and control system components) or the lower explosive limit at the property boundary; and

(5) The owner or operator submits an equipment removal report to the Department in accordance with the provisions of Regulation .10(2) of this chapter.

B. The owner or operator of a MSW landfill that has capped or removed a gas collection and control system subject to §A of this regulation shall conduct surface methane concentration measurements over the portion of the landfill with the capped or removed gas collection and control system in accordance with the procedures in Regulation .11F of this chapter for at least eight consecutive calendar quarters after the gas collection and control system is capped or removed. The measurements shall comply with the following requirements:

(1) The walking grid in Regulation .11F(1)(d) of this chapter may be reduced to 100-foot spacing so long as the walking grid is offset by 25-feet each quarter so that by the end of 1 year of monitoring, the entire surface area has been monitored every 25 feet;

(2) If there is no measured concentration of methane of 200 ppmv or greater from the surface of the closed MSW landfill in any of these measurement events, the owner or operator shall submit a final gas collection and control system closure notification to the Department in accordance with the provisions in Regulation .10C(1) of this chapter; and

(3) If there is any measured concentration of methane of 200 ppmv or greater in any of these measurement events, other than nonrepeatable, momentary readings, as determined by instantaneous surface emissions monitoring from the surface of the closed MSW landfill, the owner or operator shall comply with the provisions in Regulations .04 — .11 of this chapter.

.07 Compliance Standards.

A. Surface Methane Concentration Standards. Except as provided in Regulations .05D and F, Regulation .09A of this chapter, and §C of this regulation, beginning January 1, 2024, or upon commencing operation of a newly installed gas collection and control system or modification of an existing gas collection and control system in accordance with Regulation .05A of this chapter, whichever is later, no location on the MSW landfill surface shall equal or exceed either of the following methane concentration limits:

(1) Excluding non-repeatable, momentary readings, a methane concentration limit of 500 ppmv as determined by instantaneous surface emissions monitoring in accordance with Regulation .11F(1) and (2) of this chapter; and

(2) An average methane concentration limit of 25 ppmv as determined by integrated surface emissions monitoring in accordance with Regulation .11F(1) and (3) of this chapter.

B. Wellhead Temperature Requirement.

(1) Each interior wellhead of a landfill gas collection and control system shall be operated with a landfill gas temperature of less than 62.8°C (145°F), unless a higher operating temperature is approved in writing by the Department.

(2) The Department shall approve an alternate temperature only where a MSW landfill owner or operator submits to the Department a request which uses supporting data to adequately demonstrate that the higher operating temperature value at a particular well will not:

(a) cause a fire; and

(b) significantly inhibit anaerobic decomposition by killing methanogens.

C. Construction Activities. The requirements of §A of this regulation do not apply to the working face of the landfill or to areas of the landfill surface where the landfill cover material has been removed and refuse has been exposed for the following activities:

(1) The purpose of installing, expanding, replacing, or repairing components of the landfill gas, leachate, or gas condensate collection and removal system; or

(2) For law enforcement activities requiring excavation.

.08 Alternative Compliance Standards.

A. The owner or operator may request alternatives to the compliance measures, monitoring requirements, test methods and procedures of Regulations .05, .09 and .11 of this chapter. Any alternative compliance options requested by the owner or operator shall be submitted in writing to the Department for approval and may include, but are not limited to, the following:

(1) Semi-continuous (batch) operation of the gas collection and control system due to insufficient landfill gas flow rates;

(2) Alternative wind speed requirements for landfills consistently having winds in excess of the limits specified in this regulation;

(3) Alternative walking patterns to address potential safety and other issues, such as steep or slippery slopes, monitoring instrument obstructions, and physical obstructions;

(4) Exclusion of construction areas and other dangerous areas from landfill surface inspection; and

(5) Exclusion of paved roads that do not have any cracks, potholes, or other penetrations from landfill surface inspection.

B. The owner or operator of a MSW landfill seeking an alternative compliance option in accordance with the provisions of this regulation shall provide information satisfactory to the Department and EPA demonstrating that:

(1) The off-site migration of landfill gas is being, and will be, effectively controlled; and

(2) The proposed alternative compliance option provides an equivalent level of methane emission control, as compared with the methane controls that would have been required under Regulations .05, .09 and .11 of this chapter.

C. The Department and EPA may approve any alternative compliance option as long as the proposed alternative effectively controls the off-site migration of landfill gas and provides an equivalent level of methane emission control.

.09 Monitoring Requirements and Corrective Actions.

A. Surface Emissions Monitoring Requirements. The owner or operator of a MSW landfill shall conduct instantaneous and integrated surface emissions monitoring of the landfill surface on a quarterly basis in accordance with the procedures specified in Regulation .11F of this chapter. All the following requirements shall apply to surface monitoring:

(1) Instantaneous Surface Emissions Monitoring. Any reading equal to or exceeding a limit specified in Regulation .04B(3)(b), .06B(3), or .07A(1) of this chapter shall be recorded as an exceedance and the following actions shall be taken:

(a) The owner or operator of an MSW landfill shall:

(i) Record the date, location, and value of each test, including re-tests, with the location of the grids, the gas collection system, and the tests clearly mark and identify on a topographic map of the MSW landfill which is drawn to scale; and

(ii) Retain and submit to the Department in accordance with the provisions of Regulation .10 of this chapter, a copy of the documentation required under §A(1)(a)(i).

(b) The owner or operator shall take corrective action such as, but not limited to, cover maintenance, cover repair, or well vacuum adjustments;

(c) The owner or operator shall re-monitor the location within 10 calendar days of the measured exceedance and comply with all the following requirements:

(i) If after the initial monitoring of the location a second exceedance is detected, additional corrective action shall be taken, and the location shall be re-monitored again no later than 10 calendar days after detecting the second exceedance;

(ii) If after the re-monitoring in A(1)(c)(i) a third exceedance is detected, the owner or owner or operator shall install a new or replacement well or collection device and demonstrate compliance no later than 120 calendar days after detecting the third exceedance;

(iii) If after the re-monitoring in A(1)(c)(i) a location has demonstrated no subsequent exceedance, that location shall be re-monitored 1 month from the initial exceedance;

(iv) If the 1-month re-monitoring in A(1)(c)(iii) shows a concentration less than 500 ppmv methane (for compliance with Regulation.07A(1) of this chapter), or less than 200 ppmv methane (for compliance with Regulations .04B(3)(b) or .06B(3) of this chapter), no further monitoring of that location is required until the next quarterly monitoring period;

(v) If the 1-month re-monitoring in A(1)(c)(iii) shows an exceedance, the owner or operator shall install a new or replacement well or collection device no later than 120 days after detecting the third exceedance;

(vi) For any location where the monitored methane concentration had a third exceedance within a quarterly period, and there is no gas collection and control system, the owner or operator shall design and install a system following Regulations .05 - .11; and

(vii) An alternative remedy to the exceedance, such as upgrading the blower, header pipes or control device, and a corresponding timeline for installation may be submitted for approval to the Department in accordance with requirements of Regulation .08 of this chapter.

(d) The owner or operator of a closed or inactive MSW landfill, or of any closed or inactive areas on an active MSW landfill, that has no monitored exceedances of the limit specified in Regulation .07A(1) of this chapter after four consecutive quarterly instantaneous surface monitoring periods may shift to annual instantaneous surface monitoring; and

(e) Any exceedances of the limit specified in Regulation .07A(1) of this chapter as detected during any compliance inspections or annual instantaneous surface monitoring that cannot be remediated within 10 calendar days will result in a return to quarterly instantaneous surface monitoring of the MSW landfill.

(2) Integrated Surface Emissions Monitoring: Any reading exceeding the limit specified in Regulation .07A(2) of this chapter shall be recorded as an exceedance and the following actions shall be taken:

(a) The owner or operator shall:

(i) Record the date, location, and the average surface concentration measured as methane for each test, including re-tests, with the location of the grids, the gas collection system, and each test clearly marked and identified on a topographic map of the MSW landfill which is drawn to scale; and

(ii) Retain, and submit to the Department in accordance with the provisions of Regulation .10 of this chapter, a copy of the documentation required under §A(2)(a)(i) of this regulation.

(b) Within 10 calendar days of a measured exceedance, the owner or operator shall take corrective action such as, but not limited to:

(i) Cover maintenance or repair; or,

(ii) Well vacuum adjustments.

(c) The owner or operator who takes corrective action as required under §A(2)(b) of this regulation shall re-monitor the grid and comply with the requirements under §A(1)(c) when an exceedance of Regulation .07A(2) is recorded for the grid.

(d) Any closed or inactive MSW landfill, or any closed or inactive areas on an active MSW landfill that has no monitored exceedances of the limit specified in Regulation .07A(2) of this chapter after four consecutive quarterly integrated surface emissions monitoring periods may shift to annual integrated surface emissions monitoring; and,

(e) An owner or operator of a MSW landfill that has shifted to annual integrated surface monitoring under §A(2)(d) of this regulation shall return to quarterly integrated surface emissions monitoring upon the occurrence of any exceedances of the limits specified in Regulation .07A(2) of this chapter detected during the annual integrated surface emissions monitoring or during any compliance inspection.

B. Gas Control System Equipment Monitoring. The owner or operator shall monitor the gas control system using the following procedures:

(1) For enclosed combustors (including enclosed flares), the following equipment shall be installed, calibrated, maintained, and operated according to the manufacturer's specifications:

(a) A temperature monitoring device equipped with a continuous recorder which has an accuracy of plus or minus (±) 1 percent of the temperature being measured expressed in degrees Celsius or Fahrenheit; and

(b) A device which records the gas flow to the control device(s) and bypass of the control device. The owner or operator shall:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the control device at least every 15 minutes;

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration; and

(iii) Perform a visual inspection of the seal or closure mechanism at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(c) A temperature monitoring device is not required for boilers and process heaters with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater.

(2) For open flares, the following equipment shall be installed, calibrated, maintained, and operated according to the manufacturer's specifications:

(a) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame; and

(b) A device which records the gas flow to the flare and bypass if applicable. The owner or operator shall:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the control device at least every 15 minutes;

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration; and

(iii) Perform a visual inspection of the seal or closure mechanism at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(3) For a gas control device other than an enclosed flare, the owner or operator shall demonstrate compliance by providing and complying with the following information and instructions:

(a) A description of the operation of the gas control device;

(b) Operating parameters that would indicate proper performance;

(c) Appropriate monitoring procedures; and

(d) The manufacturer's instructions and specifications.

(4) The owner or operator subject to §B(3) of this regulation shall maintain, operate, and monitor the device in accordance with written manufacturer instructions and specifications.

(5) The owner or operator subject to §B(3) may submit alternative compliance procedures to the Department for approval in accordance with the provisions in Regulation .08 of this chapter.

(6) Notwithstanding §B(3) and (4) of this regulation, the Department may specify additional monitoring procedures for a gas control device other than an enclosed flare, and the owner or operator shall comply with any such requirement.

(7) Components containing landfill gas and under positive pressure shall be monitored quarterly for leaks.

(a) Any component leak of 500 ppmv or greater shall be tagged and repaired within 10 calendar days.

(b) Any component leak of 250 ppmv or greater shall be recorded in accordance with the provisions in Regulation .10B(1)(s) of this chapter.

(c) Quarterly component leak testing at a MSW landfill having a landfill gas-to-energy facility shall be conducted prior to scheduled maintenance or planned outage periods.

(8) The owner or operator shall measure gauge pressure in the gas collection header applied to each individual well on a monthly basis.

(a) If a positive pressure exists, other than as provided in Regulation .05C of this chapter, action shall be initiated to correct the positive pressure within 5 days.

(b) Any attempted corrective action shall not cause exceedances of other operational or performance standards.

(9) For a gas treatment system, the following equipment shall be installed, calibrated, maintained, and operated according to the manufacturer's specifications:

(a) A device which records the gas flow to the treatment system and bypass if applicable.

(b) The owner or operator shall:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the treatment system at least every 15 minutes;

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration; and

(iii) Perform a visual inspection of the seal or closure mechanism at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

C. Wellhead Monitoring. The owner or operator shall monitor each individual wellhead monthly to determine and record the gauge pressure, temperature, and nitrogen and oxygen content of gas emissions. The monitoring shall comply with all the following requirements:

(1) If there is any positive pressure reading other than as provided in Regulation .05D and E, the owner or operator shall take the following actions and shall not cause exceedances of other operational or performance standards from any attempted corrective measure:

(a) Initiate corrective action within 5 calendar days of the positive pressure measurement;

(b) If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement of positive pressure, the owner or operator shall conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after positive pressure was first measured and submit reports in accordance with the reporting requirements of Regulation .10B and .10C(3) of this chapter;

(c) If corrective actions cannot be fully implemented within 60 days following the positive pressure measurement for which the root cause analysis was required, the owner or operator shall also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the positive pressure measurement and submit reports in accordance with the requirements of Regulation .10B, .10C(3) and .10C(4); and

(d) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator shall submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Department for approval in accordance with the requirements of Regulation .10C(10) and .10C(14) of this chapter.

(2) If a well exceeds the operating parameter for temperature, action shall be initiated to correct the exceedance within 5 days.

(3) The owner or operator shall not cause exceedances of other operational or performance standards from any attempted corrective measure and shall comply with all the following requirements:

(a) If a landfill gas temperature less than 62.8ºC (145ºF), or as established in Regulation .07B, cannot be achieved within 15 days of the first measurement of landfill gas temperature greater than 62.8ºC (145ºF), the owner or operator shall conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after a landfill gas temperature greater than 62.8ºC (145ºF) was first measured;

(b) If corrective actions cannot be fully implemented within 60 days following the temperature measurement for which the root cause analysis was required, the owner or operator shall also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the measurement of landfill gas temperature greater than 62.8ºC (145ºF) and submit records in accordance with the provisions of Regulation .10B and .10C(3);

(c) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator shall submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Department for approval, in accordance with the provisions of Regulation .10C(10) and .10C(14) of this chapter and §C(1)(c) of this regulation;

(d) If a landfill gas temperature measured at either the wellhead or at any point in the well is greater than or equal to 76.7ºC (170ºF) and the carbon monoxide concentration measured, according to the procedures in Regulation .11H of this chapter, is greater than or equal to 1,000 ppmv the corrective action(s) for the wellhead temperature standard 62.8ºC (145ºF) shall be completed within 15 days; and

(e) If a higher operating temperature has not been approved by the Department, the enhanced monitoring specified in Regulation .11I of this chapter is required at each well with a measurement of landfill gas temperature greater than 62.8ºC (145ºF).

(4) The owner or operator subject to the requirements in §C(3)(b) of this regulation shall submit the items listed in Regulation .10C(3)(c) to the Department as part of the next semi-annual report.

(5) The owner or operator subject to the requirements in §C(3)(a)-(c) of this regulation shall keep records in accordance with the provisions of Regulation .10B of this chapter.

(6) The owner or operator shall monitor each wellhead and record all nitrogen levels at or above 20 percent and all oxygen levels at or above 5 percent according to Regulation .10B(1)(e) and .10C(3) following the procedures of Regulation .11H of this chapter.

D. Requirements for Monitoring Systems – Malfunction, Repair and Other Activities.

(1) The monitoring requirements in the regulation apply at all times except for periods of monitoring system malfunctions, repairs associated with monitoring system malfunctions, and required monitoring system quality assurance or quality control activities.

(2) Any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data shall be considered a monitoring system malfunction.

(3) For purposes of this regulation, monitoring system failures that are caused in part by poor maintenance or careless operation are not malfunctions.

(4) Monitoring system repairs completed in response to monitoring system malfunctions to return the monitoring system to operation shall be completed as expeditiously as possible.

.10 Recordkeeping and Reporting Requirements.

A. The owner or operator of a MSW landfill that meets the applicability or designated facility requirements in 40 CFR §60.31f, 40 CFR §60.760, or 40 CFR §63.1935 shall comply with the electronic reporting requirements of 40 CFR §60.38f(j), 40 CFR §60.767(i), or CFR §63.1981(i), as applicable.

A-1. Whenever a provision in this chapter requires submission or reporting of test results, reports, or other information to the Department, unless otherwise specified, the information shall be submitted to:

Program Manager
Air Quality Compliance Program
Maryland Department of the Environment
1800 Washington Boulevard, Suite 715
Baltimore, Maryland 21230
410-537-4225
Or electronically to: MDEAIR.OTHERCOMPLIANCE@maryland.gov

B. Recordkeeping Requirements.

(1) An owner or operator of a MSW landfill shall maintain the following records for at least 5 years:

(a) All gas collection system downtime exceeding 5 days, including dates of downtime, individual well shutdown and disconnection times, the reason for the downtime, and any corrective actions conducted in response to the downtime;

(b) All gas control system downtime in excess of 1 hour, the reason for the downtime, and the length of time the gas control system was shut down, and any corrective actions conducted in response to the downtime;

(c) All instantaneous surface readings of 100 ppmv methane or greater and all exceedances of the limits in Regulation .04B(3)(b) and Regulation .07, including:

(i) The location of the leak (or affected grid);
(ii) The leak concentration of methane (in ppmv);
(iii) The date and time of measurement;
(iv) The action(s) taken to repair the leak and the date(s) of repair;
(v) Any required re-monitoring and the re-monitored concentration of methane (in ppmv);
(vi) Wind speed during surface sampling; and,
(vii) The installation date and location of each well installed as part of a gas collection system expansion.

(d) Any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken;

(e) Each wellhead temperature monitoring value of 62.8ºC (145ºF) or above, each wellhead nitrogen level at or above 20 percent, and each wellhead oxygen level at or above 5 percent;

(f) The monthly solid waste acceptance rate for active MSW landfills or MSW landfills that have accepted waste within the last 5 years;

(g) The current amount of waste-in-place including waste composition;

(h) The nature, location, amount, and date of deposition of non-decomposable waste for any landfill areas excluded from the collection system;

(i) Results of any performance tests conducted in accordance with the provisions in Regulation .05B(7) of this chapter;

(j) A description of mitigation measures taken to prevent the release of methane or other emissions into the atmosphere, including:

(i) When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment;
(ii) During repairs or the temporary shutdown of gas collection system components; or,
(iii) When solid waste was excavated and moved.

(k) Records of any construction activities in accordance with Regulation .07C of this chapter. Records shall contain the following information:

(i) A description of the actions being taken, the areas of the 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;

(ii) Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components; and,

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

(l) For any root cause analysis for which corrective actions are required, the following information:

(i) Records of the root cause analysis conducted;
(ii) The corrective action analysis;
(iii) The date for corrective action(s) already completed following the positive pressure reading or high temperature reading;
(iv) For action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates; and,
(v) A copy of any comments or final approval on the corrective action analysis or schedule from the Department.

(m) Records of the gas control system equipment operating parameters specified to be monitored under Regulation .09B of this chapter as well as records for periods of operation during which the parameter boundaries established during the most recent performance test are exceeded. The records shall include the following information:

(i) For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28ºC (50° F) below the average combustion temperature during the most recent performance test at which compliance with Regulations .05B(2) and (3) of this chapter was determined;

(ii) For a boiler or process heater with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater to comply with Regulation .05B(3) of this chapter, 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, local, or tribal regulatory requirements;

(iii) For open flares, continuous records of the flame or flare pilot flame monitoring, and up-to-date, readily accessible records of all periods of operation in which the flame or flare pilot flame is absent; and,

(iv) For the system, the indication of flow to the control system and the indication of bypass flow or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines.

(n) All gas collection and control system exceedances of the operational standards, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance;

(o) For the owner or operator of a MSW landfill who converts waste-in-place from volume to mass, records of the annual recalculation of site-specific density, design capacity, and the supporting documentation;

(p) For the owner or operator of a MSW landfill demonstrating that site-specific surface methane emissions are below 200 ppmv by conducting surface emissions monitoring in accordance with Regulation .04B(3)(b) of this chapter, records of all surface emissions monitoring and information related to monitoring instrument calibrations conducted according to sections 8 and 10 of Method 21 of Appendix A of 40 CFR Part 60, including all of the following items:

(i) Calibration records, including the date of calibration and initials of operator performing the calibration, calibration gas cylinder identification, certification date, and certified concentration, the instrument scale used, description of any corrective action taken if the meter readout could not be adjusted to correspond to the calibration gas value, and, if an owner or operator makes their own calibration gas, a description of the procedure(s) used;

(ii) Digital photographs of the instrument setup, including the wind barrier. The photographs shall be accurately time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day;

(iii) Timestamp of each surface scan reading which shall be detailed to the nearest second, based on when the sample collection begins and log for the length of time each sample was taken using a stopwatch (e.g., the time the probe was held over the area);

(iv) Location of each surface scan reading. The owner or operator shall determine the coordinates using an instrument with an accuracy of at least 4 meters and the coordinates shall be in decimal degrees with at least five decimal places and the coordinates will become the location identification label;

(v) Monitored methane concentration (ppmv) of each reading;

(vi) Background methane concentration (ppmv) after each instrument calibration test;

(vii) For readings taken at each surface penetration, the unique identification location label matching the label specified in Regulation .10B(1)(p)(iv) of this chapter; and,

(viii) Records of the operating hours of the gas collection system for each destruction device.

(q) For the owner or operator reporting leachate or other liquids addition under Regulation .10C(16) of this chapter, records of any engineering calculations or company records used to estimate the quantities of leachate or liquids added, the surface areas for which the leachate or liquids were applied, and the estimates of annual waste acceptance or total waste in place in the areas where leachate or liquids were applied;

(r) The date of initial placement of waste in newly constructed MSW landfill cells;

(s) Documentation of any component leaks of methane equal to or greater than 250 ppmv detected in accordance with the provisions in Regulation .09B(7) of this chapter and all repairs performed in response to any component leaks equal to or greater than 500 ppmv; and,

(t) The maximum design capacity of the MSW landfill.

(2) The owner or operator of a MSW landfill shall maintain the following records for the life of each gas control device, as measured during the initial performance test or compliance determination:

(a) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures and requirements specified in Regulation .05A(1) of this chapter;

(b) The expected gas generation flow rate as calculated in accordance with Regulation .11B of this chapter;

(c) The percent reduction of methane achieved by the control device determined in accordance with Regulation .11C of this chapter;

(d) 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;

(e) Where the owner or operator subject to the provisions of this regulation is demonstrating compliance with Regulation .05B of this chapter through use of an enclosed combustion device other than a boiler or process heater with a design heat input capacity equal to or greater than 44 megawatts per hour (150 million British thermal units per hour):

(i) The average temperature measured at least every 15 minutes and averaged over the same time period of the performance test; and

(ii) The percent reduction of methane determined as specified in Regulation .11C of this chapter achieved by the control device;

(f) For an open flare:

(i) The flare type (i.e., steam-assisted, air-assisted, or non-assisted);

(ii) 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 CFR §60.18, as amended; and

(iii) 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;

(g) The most recent map showing each existing and planned gas collector in the system;

(h) Bypass records, including records of the flow of landfill gas to, and bypass of, the treatment system, as used to demonstrate compliance with Regulation .05B

(i)Site-specific treatment monitoring plan meeting the requirements of Regulation .05B(5) of this chapter.

(j) The most recent, readily accessible plot map showing all existing and planned collectors in the system and providing a unique identification location label for each collector.

(3) Bioreactor Moisture Content Calculations.

(a) A MSW landfill owner or operator conducting calculations to determine the moisture content of a bioreactor shall document the calculations and the basis of any assumptions made to make such calculations.

(b) The owner or operator shall keep records of the calculations for a minimum of 5 years or until liquids addition ceases.

(4) Retention of Records and Reports.

(a) The owner or operator shall keep records of subsequent tests or monitoring in §B(2) of this regulation for a minimum of 5 years and records of the control device vendor specifications until removal.

(b) The owner or operator shall maintain copies of the records and reports required by this regulation and provide them to the Department upon request.

C. Reporting Requirements.

(1) Closure Notification.

(a) The owner or operator of a MSW landfill which has ceased accepting waste shall submit a closure notification to the Department no later than 30 days after waste acceptance cessation.

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

(c) The Department may request additional information as necessary to verify that permanent closure has taken place in accordance with the requirements of any applicable federal, State, or local regulations and ordinances in effect at the time of closure.

(2) Equipment Removal Report.

(a) A gas collection and control system equipment removal report shall be submitted to the Department 30 days prior to well capping, removal, or cessation of operation of the gas collection, treatment, or control system equipment.

(b) The report shall contain the following information:

(i) A copy of the closure notification submitted to the Department in accordance with §C(1) of this regulation;

(ii) A copy of the initial performance test report 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 MSW landfill is unable to operate the gas collection and control system for a 15-year period; and

(iii) Surface emissions monitoring results needed to verify that landfill surface methane concentration measurements do not exceed the limits specified in Regulation .07A of this chapter.

(3) Semi-annual Report. A MSW landfill owner or operator subject to the requirements of this chapter shall submit a semi-annual report to the Department by the end of the month following the 6-month period beginning January 1, 2024 through June 30, 2024, and each subsequent 6 months thereafter. The semi-annual report shall include the MSW landfill name, owner and operator, and address; and the following information:

(a) All instantaneous surface readings of 100 ppmv or greater;

(b) All exceedances of the limits in Regulation .04B(3)(b), Regulation .07A, and Regulation .09B(7) of this chapter including:

(i) The location of the leak (or affected grid);

(ii) Leak concentration in ppmv;

(iii) Date and time of measurement;

(iv) The action taken to repair the leak;

(v) Date of repair;

(vi) Any required re-monitoring and the re-monitored concentration in ppmv;

(vii) Wind speed during surface sampling;

(viii) The concentration recorded at each location for which an exceedance was recorded in the previous month; and,

(ix) The installation date and location of each well installed as part of a gas collection system expansion.

(c) For any corrective action analysis for which corrective actions are required in Regulation .09C(1)--(3) of this chapter and that take more than 60 days to correct the exceedance:

(i) The root cause analysis conducted, including a description of the recommended corrective action(s);

(ii) The date for corrective action(s) already completed following the positive pressure or elevated temperature reading; and

(iii) For action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates.

(d) All known, prevented, or suspected subsurface landfill fire(s) along with potential causes and any efforts conducted to avoid or put out the fire(s), including any positive pressure readings that may have contributed to the known, prevented, or suspected fire;

(e) The number of times that applicable parameters monitored under Regulation .05B or Regulation .07 were exceeded and when the gas collection and control system was not operating in compliance with the provisions of Regulation .05B(1) including periods of startup, shutdown, and malfunction. For each instance, report the date, time, and duration of each exceedance;

(f) Where the owner or operator subject to the requirements of this regulation is demonstrating compliance with the operational standard for temperature in Regulation .09C(2) and (3) of this chapter, the owner or operator shall provide a statement of the wellhead operational standard for temperature and oxygen level the landfill is complying with for the period covered by the report. The report shall indicate:

(i) The number of times each of those parameters monitored under Regulation .09C of this chapter were exceeded, reporting for each instance the date, time, and duration of each exceedance; and

(ii) The number of times the parameters for the site-specific treatment system in Regulation .05B(5) were exceeded.

(g) Description and duration of all periods when the gas stream was diverted from the control device or treatment system through a bypass line or there was an indication of bypass flow resulting from an inspection required by Regulation .05B(3)(d) of this chapter;

(h) Description and duration of all periods when the control device or treatment system was not operating and length of time the control device or treatment system was not operating;

(i) All periods when the collection system was not operating;

(j) The date of installation and the location of each well or collection system expansion;

(k) Each owner or operator required to conduct enhanced monitoring in accordance with the provisions of Regulation .11I of this chapter for temperatures exceeding 62.8ºC (145ºF) shall include the results of all monitoring activities conducted during the period;

(l) For enclosed combustors, except for boilers and process heaters with design heat input capacity of 44 megawatts per hour (150 million British thermal units per hour) or greater, all three-hour periods of operation during which the average temperature was more than 28ºC (82ºF) below the average combustion temperature during the most recent performance test; and

(m) For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone.

(4) Annual Report.

(a) The owner or operator subject to the requirements of this chapter shall submit to the Department an annual report for the period of January 1 through December 31 of each year.

(b) Unless otherwise stated, the annual report shall be submitted to the Department no later than March 15 of the following year.

(c) The annual report shall consist of the semi-annual reports and contain the following additional annual reporting requirements:

(i) MSW landfill name, owner and operator, and address;

(ii) Total volume of landfill gas collected for the entire reporting period (reported in standard cubic yards);

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

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

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

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

(vii) The type and amount of supplemental fuels burned with the landfill gas in each device;

(viii) The 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;

(ix) The most recent topographic map of the site showing the areas with final cover and a geomembrane and the areas with final cover without a geomembrane with corresponding percentages over the landfill surface;

(x) The information required in §B(1)(a)—(e), §B(1)(g), and §B(1)(j)—(l) of this regulation; and

(xi) Instrument specifications for all instruments used for monitoring compliance with this chapter.

(5) Waste-in-Place Report. The owner or operator subject to the requirements of Regulation .04B shall prepare a Waste-in-Place report for the period of January 1 through December 31 of each year and submit the following information to the Department by March 15 of the following year:

(a) MSW landfill name, owner and operator, and address;

(b) The MSW landfill's status (active, closed, or inactive);

(c) The total estimated waste-in-place, in tons, as of December 31 of each year;

(d) A description of the known and assumed waste composition in the landfill; and

(e) The most recent topographic map of the site showing the areas with final cover and a geomembrane and the areas with final cover without a geomembrane with a calculation of the corresponding percentage geomembrane coverage over the landfill surface.

(6) Methane Generation Rate Report. The owner or operator subject to the requirements of Regulation .04B shall calculate the methane generation rate using the calculation procedures specified in Regulation .11D of this chapter and submit the results, along with a summary of efforts being implemented at the MSW landfill to reduce landfill gas emissions to the Department:

(a) By March 15, 2024 for MSW landfills with greater than 450,000 tons waste-in-place;

(b) Within 90 days of reaching 450,000 tons of waste-in-place;

(c) By March 15 of each subsequent year while waste-in-place is greater than 450,000 tons and the methane generation rate is less than 732 tons per year.

(d) Include in the report the methane generation calculation, along with relevant parameters, ; and

(e) Include in the report the results of a visual inspection of the landfill cover and any actions done to fix leaks and minimize methane releases.

(7) Performance Test Report.

(a) For a control system designed and operated to meet the requirements of this chapter, the owner or operator shall submit a Performance Test Report to the Department that establishes the reduction efficiency or parts per million by volume no later than 180 days after the initial startup of the approved control system using EPA Method 25 or 25C, 40 CFR Part 60, Appendix A.

(b) The owner or operator shall submit any additional performance test reports to the Department within 30 days after the date of completing each performance test, including any associated fuel analyses.

(c) The performance test report shall include the following information:

(i) A diagram of the collection system showing collection system positioning including all wells, horizontal collectors, surface collectors, or other gas extraction devices, all areas excluded from collection, and the proposed sites for the future collection system expansion;

(ii) The data upon which the sufficient density of wells, horizontal collectors, surface collectors, or other gas extraction devices and the gas mover equipment sizing are based;

(iii) The documentation of the presence of asbestos or non-decomposable material for each area from which collection wells have been excluded based on the presence of asbestos or non-decomposable material;

(iv) The sum of the gas generation flow rates for all areas from which collection wells have been excluded based on nonproductivity and the calculations of gas generation flow rate for each excluded area;

(v) The process for increasing gas mover equipment capacity with increased gas generation flow rate, if the present gas mover equipment is inadequate to move the maximum flow rate expected over the life of the landfill; and

(vi) The process for controlling off-site migration.

(d) The control device shall be operated within the parameter ranges established during the initial or most recent performance test, or manufacturer written specifications.

(e) The operating parameters shall be monitored in accordance with the procedures specified in Regulation .09B of this chapter.

(8) Gas Collection and Control System Design Plans. The collection and control system design plan shall be prepared by a professional engineer and shall meet the following requirements:

(a) The gas collection and control system as described in the design plan shall meet the design requirements and deadlines in Regulation .05A of this chapter;

(b) In the event that the design plan is required to be modified to obtain approval, the owner or operator shall take any steps necessary to conform any prior actions to the approved design plan; and,

(c) If the owner or operator chooses to demonstrate compliance with the emission control requirements of this chapter using a treatment system as defined in this chapter, then the owner or operator shall prepare and submit to the Department a site-specific treatment system monitoring plan as specified in Regulation .05B(5) of this chapter.

(9) Amended Design Plans. The owner or operator who has previously been required to submit a design plan under Regulation .05Aof this chapter shall submit an amended design plan to the Department at least 90 days in advance of any of the following events:

(a) Expanding operations to an area not covered by the previously approved design plan; or

(b) Installing, repairing, or expanding the gas collection system in a way that is not consistent with the design plan previously approved by the Department.

(10) Corrective Action and Corresponding Timeline Reports.

(a) For corrective action that is required in accordance with the provisions in Regulation .09C of this chapter and is expected to take longer than 120 days after the initial exceedance to complete, the MSW landfill owner or operator shall submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Department for approval as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature monitoring value of 55ºC (131ºF).

(b) For corrective action that is required according to Regulation .09C and is not completed within 60 days after the initial exceedance, the MSW landfill owner or operator shall submit a notification to the Department as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature exceedance.

(11) Instantaneous Surface Emissions Monitoring Report.

(a) A MSW landfill owner or operator conducting surface emission monitoring in accordance with the provisions in Regulation .04B(3)(b) and (4) of this chapter shall submit an instantaneous surface emissions monitoring report to the Department within 30 days after the fourth consecutive quarter of monitoring if no exceedances are detected, or 30 days after a measured concentration of methane of 200 ppmv or greater, whichever is first.

(b) The instantaneous surface emissions monitoring report shall include:

(i) All results of the surface emissions monitoring, clearly identifying the location, date and time (to nearest second), average wind speeds including wind gusts, reading (in parts per million) of concentrations of methane above 100 ppmv, other than non-repeatable, momentary readings, and any corrective actions taken;

(ii) For location, the owner or operator shall determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters and the coordinates in decimal degrees with at least five decimal places; and

(iii) The results of the most recent methane generation rate calculation.

(12) 24-Hour High Temperature Report. Where an owner or operator seeks to demonstrate compliance with the operational standard for temperature in Regulation .09C(2)-(3) of this chapter and the landfill gas temperature measured at either the wellhead or at any point in the well is greater than or equal to 76.7ºC (170ºF), and the carbon monoxide concentration measured is greater than or equal to 1,000 ppmv, the owner or operator shall report the date, time, well identifier, temperature and carbon monoxide reading to the Department within 24 hours of the measurement unless a higher operating temperature value has been approved by the Department for the well.

(13) Repairs and Temporary Shutdown Notification.

(a) The owner or operator of an MSW landfill that intends to temporarily shut down a gas collection and control system in accordance with Regulation .05F of this chapter shall submit a notification of the shutdown to the Department at least 30 days in advance that includes a justification for the shutdown, the system component(s) that will require shutdown, and the approximate timeline for the shutdown.

(b) If a shutdown occurs due to catastrophic or other unplanned events as listed in Regulation .05F of this chapter, the notification shall be submitted to the Department within 10 days after the shutdown.

(14) Root Cause Analysis Report.

(a) If a person who owns or operates a MSW landfill cannot fully implement a corrective action required according to Regulation .09C within 120 days after the initial exceedance, the owner or operator shall submit the root cause analysis and additional analysis and reporting in accordance with §C(10) of this regulation as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature monitoring value of 55ºC (131ºF).

(b) The root cause analysis shall include a thorough investigation of the landfill gas collection and control system to determine the primary cause, and any other contributing causes, of positive pressure or high temperature at a wellhead. (c) The report shall include each factor investigated, methods used, and alternative causes that were analyzed.

(15) Bioreactor Moisture Content Report. If a MSW landfill owner or operator calculates moisture content to establish the date the bioreactor is required to begin operating the collection and control system, the owner or operator shall submit not later than 90 days after the bioreactor achieves 40-percent moisture content a bioreactor moisture content report to the Department that includes all of the following information:

(a) Results of the calculation;

(b)The date the bioreactor achieved 40-percent moisture content by weight: and

(c) The date the owner or operator will begin collection and control system operation.

(16) Liquids Addition Report.

(a) An owner or operator subject to the provisions in Regulation .05C of this chapter that has employed leachate recirculation or added liquids based on a research, development, and demonstration permit for landfill operations (issued through Resource Conservation and Recovery Act, subtitle D, part 258) within the last 10 years shall submit to Department, annually, the following information:

(i) Volume of leachate recirculated (gallons per year) and the reported basis of those estimates (records or engineering estimates);

(ii) Total volume of all other liquids added (gallons per year) and the reported basis of those estimates (records or engineering estimates);

(iii) Surface area (acres) over which the leachate is recirculated (or otherwise applied);

(iv) Surface area (acres) over which any other liquids are applied;

(v) The total waste disposed (megagrams) in the areas with recirculated leachate, added liquids, or both, based on on-site records to the extent data are available, or engineering estimates and the reported basis of those estimates; and

(vi) The annual waste acceptance rates (megagrams per year) in the areas with recirculated leachate, added liquids, or both, based on on-site records to the extent data are available, or engineering estimates.

(b) The initial report shall include the information listed in §C(16)(a) of this regulation for the initial annual reporting period as well as for each of the previous 10 years, to the extent historical data is in possession or control of the owner or operator.

(c) The initial report shall be submitted to the Department no later than 12 months after the date of commenced construction, modification, or reconstruction.

(d) Subsequent annual reports shall include the information listed in §C(16)(a) of this regulation for the 365-day period following the 365-day period included in the previous annual report.

(e) All subsequent annual reports shall be submitted to the Department no later than 365 days after the date the previous report was submitted.

(f) Landfills may cease annual reporting of the information listed in §C(16)(a) of this regulation once they have submitted the closure notification in §C(1) of this regulation to the Department.

(17) Design Capacity Report.

(a) An amended design capacity report shall be submitted to the Department within 90 days of an increase in the maximum design capacity of the landfill to meet or exceed 2,750,000 tons and 3,260,000 cubic yards.

(b) An increase in design capacity may result from an increase in the permitted volume of the MSW landfill and/or an increase in the density.

.11 Test Methods and Procedures. The owner or operator of a MSW landfill shall use the following test methods and procedures to demonstrate compliance with the provisions of this chapter.

A. Hydrocarbon Detector Specification. Any instrument used for the measurement of methane shall be a gas detector or other equivalent instrument approved by the Department that meets the calibration, specifications, and performance criteria of EPA Reference Method 21, Determination of Volatile Organic Compound Leaks, 40 CFR Part 60, Appendix A, as amended except for the following modifications and adjustments:

(1) "Methane" shall replace all references to volatile organic compounds (VOC);

(2) The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air;

(3) To meet the performance evaluation requirements in section 8.1 of Method 21 of 40 CFR Part 60, Appendix A the instrument evaluation procedures of section 8.1 of Method 21 of 40 CFR. Part 60, Appendix A shall be used; and

(4) The calibration procedures provided in sections 8 and 10 of Method 21 of 40 CFR Part 60, Appendix A shall be followed immediately before commencing a surface monitoring survey.

B. Determination of Expected Gas Generation Flow Rate. The expected gas generation flow rate shall be determined in accordance with 40 CFR §63.1960(a)(1), as amended.

C. Determination of Control Device Destruction Efficiency. The following methods of analysis shall be used to determine the efficiency of the control device in reducing methane:

(1) Enclosed Combustors. One of the following test methods shall be used to determine the efficiency of the control device in reducing methane by at least 99 percent, or in reducing the outlet methane concentration for lean burn engines to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen:

(a) U.S. EPA Reference Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography;

(b) U.S. EPA Reference Method 25, Determination of Total Gaseous Nonmethane Organic Emissions as Carbon;

(c) U.S. EPA Reference Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer; or

(d) U.S. EPA Reference Method 25C, Determination of Nonmethane Organic Compounds in Landfill Gases.

(2) The following equation shall be used to calculate destruction efficiency:

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

D. Determination of Methane Generation Rate. The following methods and procedures shall be used to determine the methane generation rate, as applicable:

(1) MSW Landfills without Carbon Adsorption or Passive Venting Systems.

(a) The methane generation rate shall be calculated using the procedures specified in 40 CFR §98.343(a)(1) or 40 CFR §98.463(a)(1), as amended.

(b) The Department may request additional information as may be necessary to verify the methane generation rate from the landfill and site-specific data may be substituted when available.

(2) MSW Landfills with Carbon Adsorption Systems.

(a) The methane generation rate shall be determined by measuring 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 the methane concentration (percent by volume) using a hydrocarbon detector meeting the requirements of Regulation .11A of this chapter.

(b) The total landfill gas flow rate shall be multiplied by the methane concentration to determine the methane generation rate.

(3) MSW Landfills with Passive Venting Systems. The methane generation rate shall be determined using the following methods and shall be the higher of those determined values:

(a) The test methods in Regulation .11D(1)(a); and

(b) The measured actual landfill gas flow rates (in units of scfm) using a flow measuring device such as a standard pitot tube and methane concentration (percent by volume) using a hydrocarbon detector meeting the requirements of Regulation .11A from each venting pipe that is within the waste mass.

(i) Each gas flow rate shall be multiplied by its corresponding methane concentration to obtain the individual methane flow rate.

(ii) The individual methane flow rates shall be added together to determine the methane generation rate.

(4) The methane generation rate shall include waste received during the previous calendar year, from January 1 through December 31.

E. Open Flares. Open flares shall meet the requirements of 40 CFR §60.18, as amended.

F. Surface Emissions Monitoring. The owner or operator shall measure the landfill surface concentration of methane using a hydrocarbon detector meeting the requirements of Regulation .11A of this chapter. The landfill surface shall be inspected using the following procedures:

(1) General Procedures for Instantaneous and Integrated Monitoring.

(a) The entire MSW landfill surface or monitoring area shall be divided into individually identified 50,000 square foot grids and include the entire perimeter of the collection area.

(b) The grids shall be used for both instantaneous and integrated surface emissions monitoring.

(c) Surface emissions monitoring shall be performed in accordance with section 8.3.1 of EPA Method 21 of Appendix A of 40 CFR. Part 60 by holding the inlet probe of the hydrocarbon detector within 2 inches of the landfill surface while traversing the grid.

(d) The walking pattern shall be no more than a 25-foot spacing interval and shall traverse each monitoring grid.

(i) If the owner or operator has no exceedances of the limits specified in Regulation .07A of this chapter after any four consecutive quarterly monitoring periods, the walking pattern spacing may be increased to 100-foot intervals.

(ii) The owner or operator shall return to a 25-foot spacing interval upon any exceedances of the limits specified in Regulation .07A of this chapter that cannot be remediated within 10 calendar days or upon any exceedances detected during a compliance inspection.

(iii) If an owner or operator of a MSW landfill can demonstrate that in the past 3 years before the effective date of this regulation that there were no measured exceedances of the limit specified in Regulation .07A(1) of this chapter by annual or quarterly monitoring, the owner or operator may increase the walking pattern spacing to 100-foot intervals.

(e) Average wind speed shall be determined on a 5-minute average using an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event.

(f) The owner or operator shall use a wind barrier, similar to a funnel, when onsite average wind speed exceeds 4 miles per hour or 2 meters per second or gust exceeding 10 miles per hour.

(g) The wind barrier shall surround the surface emission monitoring monitor, and shall be placed on the ground, to ensure wind turbulence is blocked.

(h) Surface emissions monitoring shall not be conducted if average wind speed exceeds 25 miles per hour.

(i) Surface emissions monitoring shall be performed during typical meteorological conditions.

(2) Instantaneous Surface Emissions Monitoring Procedures.

(a) The owner or operator of a MSW landfill shall record any instantaneous surface readings of methane 100 ppmv or greater and shall document if the reading is a confirmed reading or whether it is a non-repeatable, momentary reading.

(b) Surface areas of the MSW landfill that equal or exceed a methane concentration limit of 500 ppmv, or 200 ppmv if this is to determine compliance with the requirements in Regulation .04B(3)(b), shall be marked and remediated in accordance with Regulation .09A(1) of this chapter.

(c) Surface areas of the MSW landfill that equal or exceed a methane concentration limit of 250 ppmv (for compliance with Regulation .09B(7) of this chapter), or 100 ppmv (for compliance with Regulation .04B(3)(b) of this chapter), shall be monitored in a 5-foot grid around the location to determine the extents of the methane leak.

(d) The wind speed shall be recorded during the sampling period.

(e) The landfill surface areas with cover penetrations, distressed vegetation, cracks, or seeps shall also be inspected visually and with a hydrocarbon detector meeting the requirements in §A of this regulation.

(f) If a MSW landfill is not subject to quarterly monitoring but is otherwise required to monitor in accordance with the provisions in 40 CFR Part 63 Subpart AAAA, 40 CFR 60 Subpart WWW or XXX, the MSW landfill owner or operator may reduce monitoring to annually at a specific penetration location if no methane is detected with the hydrocarbon detector at that specific penetration location for four consecutive quarters, but the penetration location shall return to quarterly monitoring if any subsequent methane concentration is detected during annual monitoring.

(g) The location of each monitored exceedance shall be marked and the location and concentration recorded.

(i) The location shall be recorded using an instrument with an accuracy of at least 4 meters.

(ii) The coordinates shall be in decimal degrees with at least five decimal places.

(3) Integrated Surface Emissions Monitoring Procedures.

(a) Integrated surface readings shall be recorded and then averaged for each grid.

(b) Individual monitoring grids that exceed an average methane concentration of 25 ppmv shall be identified and remediated in accordance with Regulation .09A(2) of this chapter.

(c) The wind speed shall be recorded during the sampling period.

G. Gas Collection and Control System Leak Inspection Procedures. Leaks shall be measured using a hydrocarbon detector meeting the requirements of Regulation .11A of this chapter.

H. Wellhead Monitoring.

(1) An owner or operator of a MSW landfill shall determine wellhead nitrogen levels using EPA Reference Method 3C, Determination of Volatile Organic Compound Leaks, 40 CFR Part 60, Appendix A, as amended, unless an alternative test method is approved by the Department.

(2) Unless an alternative test method is established and approved by the Department, an owner or operator of an MSW landfill shall determine wellhead oxygen levels by an oxygen meter using EPA Reference Method 3A or 3C, 40 CFR Part 60, Appendix A, or ASTM D6522-20, (if sample location is prior to combustion) except that:

(a) The span shall be set between 10 and 12 percent oxygen;

(b) A data recorder is not required;

(c) Only two calibration gases are required, a zero and span;

(d) A calibration error check is not required; and

(e) The allowable sample bias, zero drift, and calibration drift are ±10 percent.

(3) The owner and operator of a MSW landfill may use a portable gas composition analyzer to monitor wellhead oxygen levels provided that the analyzer is calibrated and the analyzer meets all quality assurance and quality control requirements for 40 CFR Part 60, Appendix A-1, Method 3A or ASTM D6522-11.

(4) Determination of Gauge Pressure.

(a) Wellhead gauge pressure shall be determined using a hand-held manometer, magnehelic gauge, or other pressure measuring device approved by the Department.

(b) The device shall be calibrated and operated in accordance with the manufacturer's specifications.

(5) An owner or operator of a MSW landfill shall calibrate the wellhead temperature measuring devices annually using the procedure in 40 CFR Part 60, Appendix A-1, Method 2, Section 10.3, except that a minimum of two temperature points, bracket within 10 percent of all landfill absolute temperature measurements or two fixed points of ice bath and boiling water, corrected for barometric pressure, are used.

I. Enhanced Monitoring. The owner or operator of a MSW landfill shall initiate enhanced monitoring at each well with a measurement of landfill gas temperature greater than 62.8 ºC (145 ºF) as follows:

(1) Visual observations for subsurface oxidation events (smoke, smoldering ash, damage to well) within the radius of influence of the well;

(2) Monitor oxygen or nitrogen concentration as provided in Regulation .09C of this chapter;

(3) Monitor temperature of the landfill gas at the wellhead as provided in Regulation .09C of this chapter;

(4) Monitor temperature of the landfill gas every 10 vertical feet of the well as provided in Regulation .09C of this chapter;

(5) Monitor the methane concentration with a methane meter using EPA Method 3C of Appendix A-6 to 40 CFR Part 60, EPA Method 18 of Appendix A-6 to 40 CFR. part 60, or a portable gas composition analyzer to monitor the methane levels provided that the analyzer is calibrated and the analyzer meets all quality assurance and quality control requirements for EPA Method 3C or EPA Method 18;

(6) Monitor carbon monoxide concentrations, as follows:

(a) Collect the sample from the wellhead sampling port in a passivated canister or multi-layer foil gas sampling bag (such as the Cali-5-Bond Bag) and analyze that sample using EPA Method 10, 40 CFR Part 60, Appendix A-4, or an equivalent method with a detection limit of at least 100 ppmv of carbon monoxide in high concentrations of methane; and

(b) Collect and analyze the sample from the wellhead using EPA Method 10, 40 CFR Part 60, Appendix A-4 to measure carbon monoxide concentrations.

(7) The enhanced monitoring shall begin 7 days after the first measurement of landfill gas temperature greater than 62.8ºC (145ºF);

(8) The enhanced monitoring shall be conducted on a weekly basis.

(a) If four consecutive weekly carbon monoxide readings are under 100 ppmv, then enhanced monitoring may be decreased to a monthly basis.

(b) If monthly carbon monoxide readings exceed 100 ppmv, the MSW landfill shall return to weekly monitoring.

(9) The enhanced monitoring can be stopped once a higher operating value is approved, at which time the monitoring provisions issued with the higher operating value shall be followed, or once the measurement of landfill gas temperature at the wellhead is less than or equal to 62.8ºC (145ºF);

(10) For each wellhead with a measurement of landfill gas temperature greater than or equal to 73.9ºC (165ºF), annually monitor temperature of the landfill gas every 10 vertical feet of the well; and

(11) The owner or operator may use a removable thermometer or use temporary or permanent thermocouples installed in the well to monitor the temperature of the landfill gas.

J. Bioreactor Moisture Content.

(1) The bioreactor moisture content calculation shall consider the following:

(a) Waste mass;

(b) Moisture content of the incoming waste;

(c) Mass of water added to the waste including leachate recirculation and other liquids addition and precipitation;

(d) Mass of water removed through leachate or other water losses; and

(e) Moisture level sampling or mass balances.

(2) The owner or operator of a MSW landfill subject to the requirements in Regulation .04C of this chapter shall document the calculations and the basis of any assumptions and keep the record of the calculations until liquids addition ceases.

K. Alternative Test Methods. Alternative test methods may be used upon written approval by the Department and EPA.

Title 26 DEPARTMENT OF THE ENVIRONMENT

Subtitle 11 AIR QUALITY

Chapter 19 Volatile Organic Compounds from Specific Processes

Authority: Environment Article, §§1-101, 1-404, 2-101, 2-103, 2-301, 2-303, 10-102, and 10-103, Annotated Code of Maryland

Repeal

[.20 Control of Landfill Gas Emissions from Municipal Solid Waste Landfills.]

[A. Definitions. The following terms have the meanings indicated. Any other term that is used in this regulation or in a referenced portion of the federal requirements and not defined in this regulation is as defined in the Clean Air Act and 40 CFR Part 60, Subparts A, B, and WWW.

B. Terms Defined.

(1) "Active collection system" means a gas collection system for a municipal solid waste landfill that uses gas mover equipment.

(2) "Commercial solid waste" means all types of solid waste generated by stores, offices, restaurants, warehouses, and other similar nonmanufacturing activities, excluding residential and industrial wastes.

(3) "Landfill gas" means the gases generated by a municipal solid waste landfill through the natural process of decomposing organic material or through the chemical reaction of other substances in the municipal solid waste.

(4) "Lateral expansion" means a horizontal expansion of the waste boundaries of an existing MSW landfill. "Lateral expansion" is not a modification unless it results in an increase in the design capacity of the landfill.

(5) "Municipal solid waste (MSW)" means household waste, commercial waste, and industrial waste as defined in 40 CFR.

(6) Municipal Solid Waste Landfill (MSW Landfill).

(a) "Municipal solid waste landfill (MSW landfill)" means an entire disposal facility in a contiguous geographical space where municipal solid waste is placed in or on land, portions of which may be separated by access roads.

(b) "Municipal solid waste landfill (MSW landfill)" includes landfills that also receive other types of RCRA Subtitle D wastes such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste.

(7) "Non-methane organic compounds (NMOC)" means the total organic compound content of landfill gas, excluding methane measured in accordance with the procedures in 40 CFR §60.754.

C. Applicability and Exemptions.

(1) Except for the reporting requirements in §D(1) and (2) of this regulation, this regulation applies to a person who owns or operates an MSW landfill:

(a) That has a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards of MSW;

(b) That was constructed before May 30, 1991;

(c) That received MSW on or after November 8, 1987; and

(d) For which reconstruction or modification began before May 30, 1991.

(2) A person who owns or operates an MSW landfill is not subject to this regulation but is subject to the federal New Source Performance Standards for MSW landfills at 40 CFR Part 60, Subpart WWW, if the landfill:

(a) Was constructed or received its initial MSW on or after May 30, 1991; or

(b) Was reconstructed or modified to increase the design capacity on or after May 30, 1991.

(3) Physical or operational changes to an existing MSW landfill solely to comply with the requirements of this chapter are not considered a modification or reconstruction and would not subject an existing MSW landfill to the requirements of 40 CFR Part 60, Subpart WWW.

(4) Except as provided in §C(2) of this regulation, a person who owns or operates an MSW landfill that is initially subject to this regulation and later receives a permit for reconstruction or modification will become subject to the federal New Source Performance Standards for MSW landfills at 40 CFR Part 60, Subpart WWW.

(5) For the purpose of this chapter, the applicability threshold in this regulation is an MSW landfill that has a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards of MSW.

D. General Requirements.

(1) A person who owns or operates an MSW landfill shall prepare and submit a design capacity report to the Department not later than November 1, 1997. The report shall contain the following information:

(a) A map or a plot of the landfill providing the size and the location of the landfill and the area in which MSW is or will be landfilled;

(b) The date the MSW landfill began accepting MSW;

(c) The date the MSW landfill ceased or is estimated to cease accepting MSW;

(d) The maximum design capacity of the MSW landfill in tons or cubic yards; and

(e) The amount of MSW accepted in tons or cubic yards for each operating year.

(2) Notwithstanding the permit to construct requirements in COMAR 26.11.02, a person who increases the maximum design capacity of an existing MSW landfill after November 1, 1997, shall amend and resubmit the design capacity report required in §D(1) of this regulation within 90 days of the issuance of any permit that authorizes the increase or any other change that increases the maximum design capacity of the landfill.

(3) A person who owns or operates an MSW landfill subject to this regulation that has a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards shall:

(a) Estimate the annual NMOC emission rate calculated using the formula and procedures as described in 40 CFR §60.754(a) or (b); and

(b) Submit an initial NMOC emission rate report to the Department by November 1, 1997.

(4) The NMOC emission rate report under §D(3) of this regulation shall include all the data, calculations, sample reports, and measurements used to estimate the annual emissions.

(5) A person who owns or operates an MSW landfill that has a design capacity less than 2,750,000 tons or 3,260,000 cubic yards, and resubmits the initial design capacity report required in §D(1) of this regulation showing that the design capacity is equal to or greater than 2,750,000 tons and 3,260,000 cubic yards, shall submit an NMOC emission rate report by November 1 of the year following the year in which the design capacity report was resubmitted.

(6) Following the initial submittal or resubmittal of an emission rate report, a person subject to this regulation shall prepare and submit an updated NMOC emission rate report by November 1 of each year thereafter. A less frequent emission rate report may be approved by the Department if:

(a) Revised emission estimates are submitted at least every 5 years;

(b) The 5-year emission estimates include the current amount of solid waste in place and the estimated waste acceptance rate for each year of the 5 years for which an NMOC emission rate is estimated;

(c) A revised emissions estimate is submitted if the actual waste acceptance rate exceeds the estimated waste acceptance rate in any year reported in the 5-year estimate; and

(d) The emissions estimates are demonstrated to remain below 55 tons per year for the 5-year period.

(7) A person who is subject to the NMOC reporting requirements and also to the emissions certification requirements in COMAR 26.11.01.05-1, may, upon approval by the Department, submit a combined report.

(8) If the NMOC emission rate determined in §D(3) or (5) of this regulation is 55 tons or more per year, the MSW landfill owner shall comply with §G of this regulation except as follows:

(a) The owner or operator may elect to recalculate the NMOC emission rate based on a site-specific NMOC concentration according to the procedures provided in 40 CFR §60.754(a)(3);

(b) The revised NMOC emission rate based on the site-specific NMOC concentration shall be submitted to the Department by December 31 of the year in which the first NMOC emission rate report was submitted showing that the NMOC emission rate exceeded 55 tons per year;

(c) If the NMOC emission rate based on the site-specific NMOC concentration is less than 55 tons per year, the owner or operator shall continue the emission rate reporting using the site-specific NMOC concentration according to the schedule in §D(6) of this regulation;

(d) If the NMOC emission rate based on the site-specific NMOC concentration is 55 tons or more per year, the owner or operator shall comply with §G of this regulation or may recalculate the NMOC emission rate based on the site-specific methane generation according to the procedures provided in 40 CFR §60.754(a)(4);

(e) The revised NMOC emission rate based on site-specific methane generation shall be submitted to the Department by November 1 of the year following the year in which the first NMOC emission rate report was submitted showing that the NMOC emission rate exceeded 55 tons per year;

(f) If the NMOC emission rate based on the site-specific methane generation rate is less than 55 tons per year, the owner or operator shall resume the emission rate reporting using the site-specific methane generation rate according to the schedule in §D(6) of this regulation;

(g) If the NMOC emission rate based on the site-specific methane generation rate is 55 tons or more per year, the owner or operator shall comply with §G of this regulation.

(9) The NMOC emission rate reporting requirements in §D(3) of this regulation do not apply after the installation of the required collection and control system in compliance with §E of this regulation, during the time when the collection and control system is in operation and in compliance with 40 CFR §§60.753 and 60.755.

E. Compliance Plans.

(1) A person who owns or operates an MSW landfill that has a calculated NMOC emission rate that is 55 tons or more per year shall submit to the Department a plan for compliance by June 1 of the year following the year in which an NMOC emission rate was first calculated to be 55 tons or more per year. The plan for compliance shall contain all of the elements contained in 40 CFR §60.752(b)(2). In addition, the plan shall contain the following schedule:

(a) The release of purchase orders or contracts within 5 months from the date the plan for compliance is required;

(b) Beginning of construction of the gas collection and control system within 8 months after the plan for compliance is required; and

(c) Completion of construction of the gas collection and control system within 16 months from the date the plan for compliance is required.

(2) The plan for compliance required in §E(1) of this regulation shall include the following compliance dates for start-up of the gas collection and control system and performance of a compliance test:

(a) For areas that are closed or at final grade, a landfill gas collection and control system shall be installed and the initial MSW landfill has been in place for a period of 2 years, whichever date is later;

(b) For active areas, a landfill gas collection and control system shall be installed and compliance achieved by December 1 of the year following the year the plan for compliance was required to be submitted or after the initial MSW landfill has been in place for a period of 5 years, whichever date is later;

(c) Upon written request to the Department, an extended schedule, not to exceed 30 months from the date the NMOC emission rate was first calculated to be 55 tons or more per year, may be granted for installing the landfill gas collection and control system;

(d) The schedule to achieve compliance shall be met regardless of whether the owner or operator of the MSW landfill determines emissions based on site-specific NMOC and methane generation rates as provided in §D(8) of this regulation.

(3) In its determination for an extension, the Department will consider:

(a) The past and future rate at which MSW has been or will be accepted;

(b) The expected life of the area;

(c) Costs of control;

(d) Physical constraints for installing controls; and

(e) Other information regarding the safety and technical aspects of control.

(4) Any extension granted by the Department pursuant to §E(2)(c) of this regulation shall be submitted to EPA for approval as a revision to the Department's plan for control of landfill gas emissions from MSW landfills.

F. Closure Report and Equipment Removal.

(1) A person who owns or operates an MSW landfill subject to §G of this regulation shall submit a closure report to the Department within 30 days of MSW acceptance cessation. The Department may request additional information, as necessary, to verify that permanent closure has taken place in accordance with the requirements in 40 CFR §258.60.

(2) After the notice of closure has been submitted to the Department, additional MSW may not be placed in the MSW landfill.

(3) A person who owns or operates an MSW landfill who installs the required gas collection and control system and complies with §G of this regulation for at least 15 years may continue to operate the control system or, if the control system is to be taken out of service, an equipment removal request shall be submitted to the Department for approval 30 days before the removal or cessation of operation of the control equipment.

(4) The equipment removal request shall contain all of the information in 40 CFR §60.757(e)(1) and (2), including:

(a) A copy of the closure report submitted in accordance with §F(1) of this regulation;

(b) A copy of the initial performance test report demonstrating that the 15-year minimum control period has expired; and

(c) Dated copies of three successive NMOC emission rate calculations, performed in accordance with 40 CFR §60.754(b), demonstrating that the annual uncontrolled NMOC emissions from the MSW landfill are currently below and will remain below 25 tons per year.

G. Compliance and Operating Conditions.

(1) Compliance Conditions. A person who owns or operates an MSW landfill that has a calculated NMOC emission rate of 55 tons per year or more shall comply with the landfill gas collection and control requirements in 40 CFR §§60.752(b)(2) and 60.755.

(2) Specifications for Active Collection Systems. A person who complies with §G(1) of this regulation by using an active collection system shall comply with the specifications included in 40 CFR §60.759.

(3) Operating Conditions. A person who is required to install a gas collection and control system in compliance with §G(1) of this regulation shall operate the equipment according to the requirements included in 40 CFR §60.753.

H. Testing, Monitoring, Reporting, and Record-Keeping Requirements.

(1) Performance Testing. A person who is required to install a gas collection and control system in compliance with §G(1) of this regulation shall demonstrate adequate control efficiency by complying with the conditions in 40 CFR §§60.754(d) and 60.8.

(2) Monitoring Requirements. A person who is required to install a gas collection and control system in compliance with §G(1) of this regulation shall:

(a) Monitor the equipment in accordance with the provisions in 40 CFR §60.756(a)—(e);

(b) Monitor the methane surface emissions in accordance with the provisions in 40 CFR §60.756(f); and

(c) Commence the methane surface monitoring required in §H(2)(b) of this regulation by the beginning of the calendar quarter following the quarter during which the system required in §G(1) of this regulation is installed.

(3) Reporting Requirements.

(a) A person who complies with §G(1) of this regulation by using an active collection system shall comply with the reporting provisions in 40 CFR §§60.757 and 60.758.

(b) A person who complies with §G(1) of this regulation shall comply with the initial performance test reporting requirements in 40 CFR §60.757(g).

(4) Record-Keeping Requirements. A person who is required to install a gas collection and control system in compliance with §G(1) of this regulation shall comply with the record-keeping requirements in 40 CFR §60.758.]

APPENDICES

Appendix A – Affected Sources and Estimated Emissions Reductions

There are both active and closed landfills in the state. MDE estimates approximately 32 MSW landfills (11 closed and 21 active) meet the applicability requirements in the proposed regulation based on the age of accepted waste and the amount of waste-in-place (greater than 450,000 tons). MDE established the list of anticipated affected sources from records compiled by the Air and Radiation Administration (ARA) and Land and Materials Administration (LMA).

List of 32 Anticipated Affected Sources

County	MSW Landfill under Proposed Regulation	Active/Open or Closed
1. Allegany	Mountainview Municipal Landfill	Active
2. Anne Arundel	Fort G. Meade Municipal Landfill	Closed
3. Anne Arundel	Millersville Municipal Landfill	Active
4. Baltimore City	Eastern Municipal Landfill	Active
5. Baltimore City	Quarantine Road Municipal Landfill	Active
6. Calvert	Appeal Municipal Landfill	Active
7. Caroline	Hobbs Rd	Closed
8. Caroline	Midshore II Regional Municipal LF	Active
9. Carroll	Hoods Mill	Closed
10. Carroll	Northern Municipal Landfill	Active
11. Cecil	Cecil County Central Landfill - Hog Hill	Active
12. Charles	Charles County Municipal LF #2	Active
13. Charles	Pisgah	Closed
14. Dorchester	Beulah HE #1 & HE #2 (Old Beulah)	Active and Closed
15. Frederick	Fort Detrick Municipal Landfill	Active
16. Frederick	Reich's Ford A & B Municipal Landfill	Active and Closed
17. Garrett	Garrett County SWD&RF	Active
18. Garrett	Round Glade	Closed
19. Harford	Harford W.D. Center Municipal Landfill	Active
20. Howard	Alpha Ridge	Active
21. Montgomery	Oaks Landfill	Closed
22. Prince Georges	Andrews Air Force Base	Closed
23. Prince Georges	Brown Station Landfill (A & B & C)	Active and Closed
24. Prince Georges	CDP/Sandy Hill	Closed
25. Somerset	Somerset Co Municipal LF or Fairmount Rd	Active
26. St Mary's	Pax River NAS	Closed
27. St Mary's	Saint Andrews 1 & 2 Municipal LF	Active and Closed
28. Talbot	Midshore I Regional Landfill	Closed
29. Washington	Forty West	Active
30. Washington	Resh Road 1 & 2 Municipal LF	Closed
31. Wicomico	Newland Park Municipal LF - Wicomico County Landfill	Active
32. Worcester	Central Municipal LF- Worcester Co Sanitary Landfill Cell 1 - 4	Active and Closed

Anticipated Requirements based on current figures:

- Under the proposed regulations an estimated 5 closed landfills would be required to submit a one-time waste and methane generation report.
- Under the proposed regulations an estimated 5 closed and 8 active landfills would have to perform SEMs and reporting to determine if enough landfill gas can be generated for a GCCS.
- Under the proposed regulations an estimated 9 landfills would go from a voluntarily operating a GCCS to a requiring the operation of a GCCS along with conducting annual SEMs.
- There are 5 landfills subject to the federal GCCS requirements already.

The Department's Estimated Emission Reductions

The Department, under ARA's Climate Change Program, has an established Greenhouse Gas (GHG) Inventory as required under the Greenhouse Gas Emissions Reduction Act. This GHG inventory is updated every 3 years. Emissions from MSW landfills are characterized and calculated using accepted industry standards along with some measured and reported figures. The methane (CH_4) and carbon dioxide (CO_2) generation rates are modeled using EPA's Landfill Gas Emissions Model tool "Land GEM". Additional figures come from the landfill facility reporting to EPA Part 98 GHG reporting and from annual MDE emission certification reports.

MDE recently released the MD GHG Emissions Inventory for 2020

- The state achieved a 30% reduction from 2006 levels
- New goals
  - 60% reduction by 2031
  - Net-zero by 2045

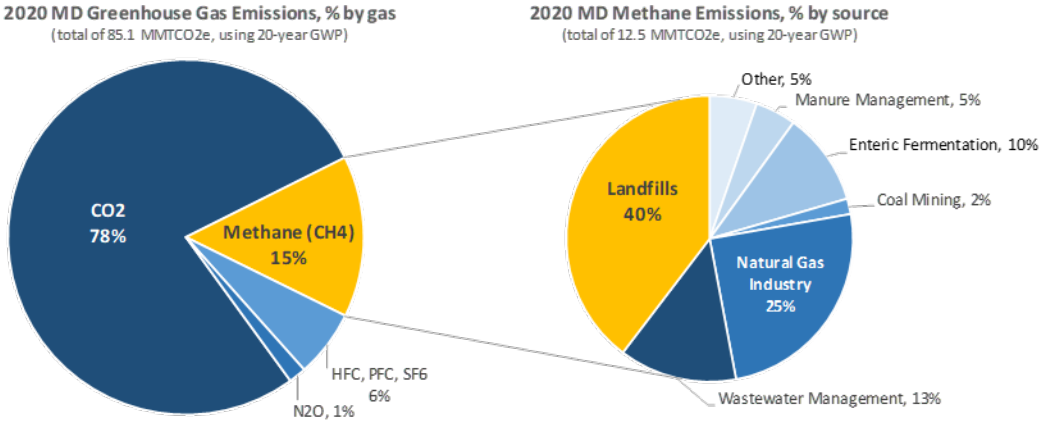
Methane makes up 15% of the state's GHG emissions

- Using the 20-year GWP
- Methane = 84 times the warming impact of CO_2

Landfills make up 40% of the state's methane emissions

- The largest methane emission source in the inventory

Landfill gas is typically composed of methane, CO_2, and other volatile organic compounds. Landfill gas and potential methane production is unique to each landfill. Variables such as temperature, waste components, waste cell size, compaction, liners and covers, and rainfall intensity are all factors in methane production and the design criteria to capture and reduce methane. Scientists report landfill gas generation occurs in four phases, with the composition of the landfill gas changing with each phase. Methane generation begins as soon as trash is placed in a landfill but maximizes between 5 – 20 years, then tapers off over the next decade or two.



The Department used the 2020 draft GHG Inventory to calculate a range of anticipated emission reductions that will come from minimizing surface leaks and capturing and converting methane to CO_2. By applying a range of emission reduction factors to the list of affected sources, the Department estimates 25 - 50% reduction in CO_2e (CO_2 and CO_2 equivalent) emissions from the affected landfills subject to this proposed regulation when fully implemented. The emission calculations and estimated reductions are a guide. Recordkeeping and reporting will supplement and confirm mitigation measures required from the proposed regulation are working.

The Department's Estimated Range of Emission Reductions

As a guide, the Department estimated a range of anticipated maximum and minimum emission reductions once the proposed regulation is fully implemented.

Methodology for establishing the 32 estimated affected sources:

- Filtered the draft 2020 GHG Inventory[1] for the list of landfills
- Removed closed landfills prior to 1994
- Added 3 closed landfills from LMA list that meet regulation size and age requirements
- Combined some landfills have double names as they have sections that are closed and active

Baseline for emissions estimated from the GHG Inventory which uses the EPA tool, Land GEM, for modeling emissions from the MSW landfills:

- Reported WIP is used to calculate CO_2 and CH_4 generation rates
- Flow data is entered from the MDE annual emission certification reports (ECR)

[1] https://mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx

- The above data is used to determine a facility percent efficiency calculated by MDE
- Emissions are estimated based on capture/treatment and fugitive emissions
- The GWP potential of 28[2] was used to convert CH_4 to CO_2e (equivalent)

While MDE's Air Quality Planning Program (specifically the Regulations Development Division) compiled data, the Climate Change Program updated the methane conversion factor as required by the Climate Solutions Now Act of 2022[3], to report MD's GHG inventory with emissions with a GWP considered over a 20-year time horizon. That GWP potential is 84 used to convert CH_4 to CO_2e (equivalent). Emissions are also presented using a GWP over a 100-yr time horizon, consistent with conventional national and international inventory protocols. The 20-yr GWP emissions are to be used in evaluating progress towards Maryland's GHG reduction goal. MDE uses short tons, and the conversion of short tons to metric tons is by multiplying the number of short tons by 0.9071847.

To establish the emission reduction range, MDE applied different reduction factors based on possible mitigation measures - improving the existing GCCS, adding a GCCS, and cover improvements that could be recognized through SEMs.

- Maximum scenario assumed the best facility collection rate of 90%, flare efficiency of 99%, and fugitive reductions from SEMs of 40%
- Minimum scenario assumed the least number of improvements as gas collection rate of 65%, flare efficiency of 99%, and fugitive reductions from SEMs of 10%
- The calculated range is 25 - 50% of overall CO_2e reduction from the set of affected facilities when mitigation measures have been established.
- The conversion from GWP of 25 verses GWP of 84 does not affect the estimated reductions.

See the summary table in Appendix B.

[2] Maryland Base Year 2020 GHG Inventory uses the Global Warming Potential (GWP) values from the IPCC's Fifth Assessment Report (AR5)

[3] https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/sb0528?ys=2022RS

Calculations for estimated emission reductions from proposed reglation

MDE Septmeber 2022

The site % eff is the difference between reported ECR flow data vs LandGEM based on solid waste estimates

Facility Name	2020 GHG Inventory Year Closed	2020 GHG Inventory TOTAL Landfill Capacity (Million tons)	2020 GHG Inventory Average Acceptance / Yearly Disposal (tons/yr)	2020 GHG Inventory CO2 Generation (short tons) LandGEM 3.0	2020 GHG Inventory CH4 Generation (short tons/yr) LandGEM 3.0	2020 GHG Inventory CH4 Collection Efficiency (%)	2020 GHG Inventory Total GHG Emissions (tons)	Max. Assumed reduction from controlled landfill GCCS = 90% CO2e tons	Max. Assumed reduction from uncontrolled landfill >3MMBTU/hr = GCCS 90% CO2e tons	Max. Assumed reduction by improved SEMs = 20% CO2e tons	Max. Assumed reduction by adding SEMs= 40% CO2e tons	Max. Assumed Total site tons CO2e	Min. Assumed reduction from landfill GCCS = 65% CO2e tons	Min. Assumed reduction by adding SEMs = 10% CO2e tons	Min. Assumed Total site tons CO2e
CLOSED					***SMALLER THAN 732 tons/yr conversion to 3 MMBTU/hr***										
Pax River NAS	1994	NEED DATA	NEED DATA	NEED DATA	NEED DATA	NEED DATA	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Hobbs Rd	1996	NEED DATA	NEED DATA	NEED DATA	NEED DATA	NEED DATA	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Andrews Air Force Base	1995	NEED DATA	NEED DATA	NEED DATA	NEED DATA	NEED DATA	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Hoods Mill	1994	0.5	35,000	1,009.0	367.8	0%	10,277.6	0.0	0.0	0.0	0.0	10,277.6		0.0	10,277.6
Round Glade	1994	0.8	20,000	1,436.0	523.3	0%	14,623.2	0.0	0.0	0.0	0.0	14,623.2		0.0	14,623.2
CLOSED					***Larger THAN 732 tons/yr conversion to 3 MMBTU/hr***										
Fort G. Meade Municipal Landfill	1996	0.7	11,000	2,146.0	782.1	0%	21,854.9				7,883.6	13,971.4		1,970.9	19,884.0
Resh Road 1 & 2 Municipal LF	2000	2.6	150,000	2,147.0	782.4	0%	21,863.5				7,886.6	13,976.9		1,971.6	19,891.8
Pisgah	1994	1.5	75,000	3,163.0	1,153.0	0%	32,218.6		23,034.3			9,184.3		2,905.6	29,313.0
CDP/Sandy Hill	2000	7.5	280,000	14,630.0	6,773.8	95%	44,557.4			1,809.4		42,748.0		904.7	43,652.7
Midshore I Regional Landfill	2010	3.5	52,000	8,021.0	2,923.0	51%	48,992.2	25,706.6				23,285.6	9,485.73	0.0	39,506.5
Oaks Landfill	1998	5.0	360,000	11,020.0	6,553.7	75%	69,300.2	24,055.3				45,244.9		4,128.8	65,171.4
							263,687.5					**173,311.8**			**242,320.1**
												34%			**8%**
ACTIVE					***SMALLER THAN 732 tons/yr conversion to 3 MMBTU/hr***										
Appeal Municiapl Landfill	2037	2.8	20,000	1,520.0	554.1	0%	15,483.3	0.0	0.0	0.0	0.0	15,483.3		0.0	15,483.3
Fort Detrick Municipal Landfill	2054	1.0	12,000	170.7	62.2	0%	1,738.9	0.0	0.0	0.0	0.0	1,738.9		0.0	1,738.9
ACTIVE					***Larger THAN 732 tons/yr conversion to 3 MMBTU/hr***										
Alpha Ridge	2122	10.0	255,000	6,899.0	2,515.0	38%	49,033.7	29,000.8				20,033.0	15,044.09		33,989.6
Beulah HE #1 (Old Beulah)	1995	0.8	35,000	984.2	358.7	0%	10,023.4		0.0			10,023.4		903.9	9,119.5
Beulah HE #2	2025	4.1	58,000	6,332.0	2,308.0	27%	50,481.7	32,096.7				18,385.0	19,288.78		31,192.9
Brown Station Landfill A	1993	7.1	275,000	11,590.0	4,223.0	85%	38,074.1	4,430.5				33,643.6		1,638.9	36,435.2
Brown Station Landfill B	2025	16.0	340,000	40,570.0	14,790.0	85%	141,222.2	23,415.1				117,807.1		5,739.7	135,482.5
Cecil County Central Landfill - Hog Hill	2046	4.5	106,000	13,070.0	4,763.0	53%	77,501.3	39,557.7				37,943.6	13,126.02		64,375.2
Central Worcester Co Sanitary Landfill Cells 2 & 3	2007	NEED DATA	NEED DATA	4.6	1.7	87%	14.9				0.0	14.9		0.6	14.3
Central Worcester County Sanitary Landfill Cell 1& 4	2028	4.8	70,000	4,414.0	1,609.0	87%	44,960.8	32,144.2				12,816.6		4,054.7	40,906.1
Charles County Municipal LF #2	2040	4.4	82,000	8,971.0	3,270.0	98%	18,953.8	0.0				18,953.8		131.0	18,822.7
Eastern Municipal Landfill	2033	22.8	25,000	18,110.0	9,498.0	67%	118,351.0	50,640.1				67,710.9	0.0	0.0	118,351.0
Forty West	2047	20.3	130,000	20,040.0	7,306.0	0%	204,151.2		145,957.4			58,193.8	105,413.71		98,737.5
Garrett County SWD&RF - Del Signiore	2028	1.5	38,000	2,599.0	947.3	0%	26,471.0				9,548.8	16,922.2		2,387.2	24,083.8
Harford W.D. Center Municipal Landfill	2135	3.0	74,000	5,627.0	2,051.0	36%	40,713.0	24,375.2				16,337.8	12,993.43		27,719.6
Midshore II Regional Municipal LF	2048	3.8	82,000	6,460.0	2,354.0	NEED DATA	65,780.8		47,027.6			18,753.2	33,964.39		31,816.4
Millersville Municipal Landfill	2060	14.3	358,000	24,330.0	8,868.0	54%	140,823.3	70,182.4				70,640.9	20,970.55		119,852.8
Mountainview Municipal Landfill	2025	4.3	113,398	12,070.0	4,401.0	43%	81,426.5	46,373.4				35,053.1	21,950.59		59,475.9
Newland Park Municipal LF - Wicomico Co Lanc	2031	7.2	125,000	14,170.0	5,163.0	55%	80,685.0	39,552.5				41,132.5	10,901.10		69,783.9
Northern Municpal Landfill	2053	3.5	82,000	3,994.0	1,456.0	19%	34,552.2	22,954.6				11,597.6	14,874.71		19,677.5
Quarantine Road Municipal Landfill	2019	18.3	523,000	22,150.0	8,071.0	31%	170,077.6	105,778.8				64,298.8	60,989.79		109,087.8
Reich's Ford Site B-Cell 3 Municpal Landfill	2045	4.2	100,000	1,016.0	401.0	NEED DATA	11,121.2					11,121.2		1,010.5	10,110.7
Reich's Ford A & B Municpal Landfill	1997	2.1	69,000	8,568.0	3,123.0	77%	34,756.7	9,879.6				24,877.1		1,840.0	32,916.7
Saint Andrews 1 & 2 Municipal LF	2004	1.6	34,000	2,965.0	1,081.0	0%	30,206.2		21,595.9			8,610.3	15,597.07		14,609.1
Somerset Co Municipal LF -Fairmount Rd	2023	1.6	28,000	2,255.0	821.9	0%	22,966.9	16,419.7	16,419.7			6,547.2	11,858.68		11,108.2
							1,509,570.6					**738,639.5**			**1,134,891.2**
												51%			**25%**

Appendix C - Cost Impact Analysis

The majority of MSW landfills are owned and operated by local governments. Factors that could influence costs are landfill size, age, status (*i.e., open, closed, active or inactive*), and the amount of waste-in-place. The proposed action could have a potential impact on local governments as affected sources may incur capital costs from installing and operating new or modified landfill gas collection and control systems (GCCS) to meet requirements. Based on similar regulations promulgated by other states to reduce methane emissions from landfills, the capital cost associated with modifying an existing GCCS or installing a new GCCS can range from $1-$3 million[1]. This is coupled with estimated operating and maintenance costs ranging from $150,000 to $400,000/yr.[2]. There may be additional costs associated with monitoring (average annual costs around $60,000)[3] and recordkeeping and reporting requirements.

The following cost impact information was used for MDE's analysis.

I. Estimated Compliance Costs

Proposed Regulation Requirement	Lump Sum Cost, 2021
Annual Waste-In-Place (WIP) Report	$4,000
Calculate/Report Methane Generation Rate Annually	$4,000
Annual Gas Collection and Control System report	$4,000
Surface Emissions Monitoring	$59,792[a] /year
Upgrade Gas Collection and Control System	$1M - $2M[b,c]
Install New Gas Collection and Control System	$1M-$3M[b,c]
Operating and Maintenance	$150,000-$400,000/year

a = value obtained by updating CARB 2009 costs to year 2021. CARB 2009 costs obtained from California Environmental Protection Agency, Air Resources Board, May 2009, Staff Report: Initial Statement of Reasons for the Proposed Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills. https://ww3.arb.ca.gov/regact/2009/landfills09/landfills09.htm Costs updated to 2021 using: https://www.bls.gov/data/inflation_calculator.htm
b = based on data provided by the Oregon fiscal advisory committee members https://www.oregon.gov/deq/EQCdocs/100121_I_LandfillMethane.pdf
c = based on information from EPA's Landfill Methane Outreach Program's LFG cost-Web tool: https://www.epa.gov/lmop/lfgcost-web-landfill-gas-energy-cost-model

For comparison, EPA has published the following compliance costs in the Landfill Methane Outreach Program's (LMOP) document titled "LFG Energy Project Development Handbook" dated June 2017. Located at https://www.epa.gov/system/files/documents/2021-07/pdh_full.pdf (see page 1-4)

[1] Lump Sum Basis. 2021 Staff Report, State of Oregon Department of Environmental Quality, Landfill Methane Rule
[2] Annual Basis. 2021 Staff Report, State of Oregon Department of Environmental Quality, Landfill Methane Rule
[3] Annual Basis. 2021 Staff Report, State of Oregon Department of Environmental Quality, Landfill Methane Rule

LMOP	Cost - 2020 Dollars[a]
Install New Gas Collection and Control System for 40 Acres Landfill	$1.313M ($32,800 per acre)
Operations and Maintenance	$221,000 ($5,500/acre per year)

[a] = Based on LFG cost-Web — Landfill Gas Energy Cost Model | US EPA

"Total GCCS costs vary widely, based on a number of site-specific factors. For example, if the landfill is deep, costs tend to be higher because well depths will need to be increased. Costs increase with the number of wells installed, and costs will vary based on the type of flare used.
...If an LFG energy project generates electricity, often a landfill will use a portion of the electricity generated to operate the GCCS and sell the rest to the grid to offset these operational costs. Flaring costs are incorporated into these estimated capital and O&M costs, because excess gas may need to be flared at any time even if an energy generation system is installed."

II. Maryland Landfills Estimated Compliance Costs

MDE estimates approximately 32 MSW landfills (11 closed and 21 active) meet the applicability requirements in the proposed regulations based on age of accepted waste and the amount of waste-in-place (WIP). MDE established the list of anticipated affected sources from records compiled by the Air and Radiation Administration (ARA) and Land and Materials Administration (LMA).

The Department estimates that 5 closed landfills will have to submit a one-time WIP report in addition to calculating and reporting the methane generation rate.

The Department estimates that 5 closed landfills could calculate and report a methane generation rate over 732 tons/yr. and thus be required to perform one year of quarterly SEMs. Based on the results of quarterly SEMs, this could possibly trigger the requirement to install and operate a GCCS.

There is one closed landfill that falls under the category of a Title V facility and is required to meet the current federal requirements for MSW landfills under 40 CFR 60, Subpart Cf (Emission Guidelines and Compliance Times for MSW Landfills (EG)) and 40 CFR 62, Subpart OOO (Federal Plan Requirements for MSW Landfills). This facility reports annual waste, operates a GCCS and is required to perform SEMs.

The Department estimates 15 active landfills that are larger with a design capacity equal to or greater than 2,750,000 tons and 3,260,000 cubic yards. These landfills are subject to either 40 CFR 60, Subpart XXX (New Source Performance Standards for MSW Landfills (NSPS)) or 40 CFR 60, Subpart Cf and 40 CFR 62, Subpart OOO. Of the 15 landfills, 4 landfills are required to operate a GCCS, 8 landfills have a voluntary installed and operate a GCCS system and 3 landfills currently do not have a GCCS.

The Department estimates 6 active landfills that are considered medium size per the proposed regulations. These landfills have a smaller design capacity and are not subject to any federal requirements (NSPS or EG) for MSW landfills. Of these 6 landfills, 1 landfill has voluntary installed and operates a GCCS and 5 landfills currently do not have a GCCS. These 5 landfills will be required to submit a one-time WIP report in addition to calculating and reporting the

methane generation rate. Based on the reported methane generation rate, these 5 landfills could be required to perform quarterly SEMs or install and operate a GCCS.

Table C1: Itemized estimated compliance costs for Maryland landfills based on permit type/size

Blue expenses are a result of the regulation, gray expenses already incurred.

Department Estimation	Reporting WIP (annual)	Reporting MGR (annual)	Reporting GCCS (annual)	SEM (annual)	Upgrade GCCS (initial)	Install new GCCS (initial)	O&M GCCS (annual)
5 Small/ medium closed[a]	$4,000	$4,000					
5 Medium closed[b]	$4,000	$4,000	Possible $4,000	$59,792		Possible $1M-$3	Possible $150,000-$400,000
1 Large closed EPA GCCS[c]	$4,000	$4,000	$4,000	$59,792			$150,000-$400,000
5 Medium active no GCCS	$4,000	$4,000	Possible $4,000	$59,792		Possible $1M-$3	Possible $150,000-$400,000
1 Medium active voluntary GCCS	$4,000	$4,000	$4,000	$59,792	Possible $1M-$2		$150,000-$400,000
3 Large active no GCCS	$4,000	$4,000	$4,000	$59,792		Possible $1M-$3	$150,000-$400,000
8 Large active voluntary GCCS	$4,000	$4,000	$4,000	$59,792	Possible $1M-$2		$150,000-$400,000
4 Large active EPA GCCS	$4,000	$4,000	$4,000	$59,792			$150,000-$400,000

a = One-time report WIP and MGR – not annual, no other regulatory requirements
b = One-time WIP and MGR report – not annual, one-year quarterly SEMs. Could trigger need for GCCS if SEMs threshold are exceeded
c = One-time WIP and MGR report – not annual, quarterly SEMs required, voluntary system design review to determine if upgrades are required, O&M to continue

Proposed Regulation - MSW Landfill Cost Impact Range

Small/Medium Sized MSW Landfills ~ One-time $8,000
Medium Sized MSW Landfills ~ One-time $72,000 – Annual cost $272,000 with one-time cost $1-$3Million
Large Sized MSW Landfills ~ Annual cost $260,000 with one-time cost $1-$3Million

III. Estimated Compliance Cost Benefits

MDE estimates there are approximately 9 landfills in Maryland with landfill-gas-to-energy (LFGTE) projects. The following landfills are: Sandy Hill, Midshore I, Oaks, Alpha Ridge, Brown Station, Eastern, Millersville, Newland Park Wicomico, & Quarantine Road.

However, the cost benefits of landfill-gas-to-energy projects at landfills were not considered as part of this evaluation. However, under the EPA Landfill Methane Outreach Program (LMOP) those cost benefits are examined.

The website to the EPA LMOP can be found here: https://www.epa.gov/lmop/benefits-landfill-gas-energy-projects

EPA notes the following potential economic and environmental benefits of LFGTE projects at landfills:

> *LFG energy projects generate revenue from the sale of the LFG, electricity, or renewable natural gas (RNG) created from LFG. LFG use can also create jobs associated with the design, construction, and operation of energy recovery systems. LFG energy projects involve engineers, construction firms, equipment vendors and utilities or end users of the power produced. Much of the project costs are spent locally for drilling, piping, construction, and operational personnel, helping communities to realize economic benefits from increased employment and local sales. Local businesses can realize cost savings associated with using LFG as a replacement for more expensive fossil fuels. Some companies could save millions of dollars over the life of their LFG energy projects.*
>
> *By linking communities with innovative ways to deal with their LFG, LMOP helps communities enjoy increased environmental protection, better waste management and responsible community planning* - 09/16/2022.

Table C2: Estimated Regional Economic Impacts and Job Creation from LFGTE Project Construction[a]

Estimated Regional (State-wide) Economic Benefits (Economic and job creation benefits are estimates only and are not guaranteed)	Typical 3-MW Engine Project	Typical 1,000 scfm Direct-use Project 5-mile pipeline	Typical 2,800 scfm RNG Project 2-mile pipeline
Direct Effects			
Project expenditures for the purchase of generators, piping, and gas compression, treatment skid and auxiliary equipment	$2.15 million	$1.54 million	$4.35 million
Jobs created	6.0	9.1	15.7
Indirect Effects			
Economic output, resulting from ripple effects	$4.80 to $5.48 million	$3.11 to $3.68 million	$9.66 to $10.94 million
Jobs created, including economic ripple effects	20.3 - 26.1	19.3 - 23.7	43.8 - 55.5

MW: megawatt

scfm: standard cubic feet per minute
RNG: renewable natural gas

[a] Estimates based on LMOP's LFGcost-Web, Version 3.5

Incentives

Landfills that have installed and are operating a GCCS may be eligible to defray costs through the Maryland Renewable Portfolio Standard (RPS) Program, which offers incentives and grants.

The link to incentives and grants offered through the Maryland RPS Program can be found here: https://www.psc.state.md.us/electricity/maryland-renewable-energy-portfolio-standard-program-frequently-asked-questions/

There are currently no grant or incentive programs available through MDE to reduce costs for affected landfills. However, the Maryland Energy Administration (MEA) occasionally receives proposals for initiatives and proposals for energy projects through its OPEN Energy Program (OPEN Energy). Information about OPEN Energy can be found on MEA's website at the following link: https://energy.maryland.gov/Pages/OpenEnergyGrantProgram.aspx

OPEN Energy may provide opportunities for landfills to pursue grants for energy projects that advances the agency's goals while benefiting stakeholders. One example of an energy project is Midshore I Landfill located in Easton, which is installing a biogas generator to produce energy.

More information regarding this energy project can be found at the following link: https://www.prnewswire.com/news-releases/qnergy-announces-the-installation-of-its-first-biogas-landfill-methane-conversion-generator-with-maryland-environmental-service-301625991.html

Federal Incentives – EPA Grants

Federal grant programs through the EPA may also provide opportunities for landfills. One example of a recent project can be found at the following link: https://wasteadvantagemag.com/epa-awards-food-lifeline-200000-for-project-to-reduce-methane-food-waste-in-south-seattle/

> *Oct. 14, 2022 – "Environmental Protection Agency has awarded Food Lifeline of Seattle approximately $200,000 to assist in the development of a community-owned anaerobic digester in the South Park neighborhood of Seattle. Food Lifeline will partner with Duwamish Valley Sustainability Association, Black Star Farmers, and Sustainable Seattle, to develop new anaerobic digester capacity for the South City Biodigester Collaboration project. This project is designed to be a demonstration of the potential for a larger scale biofuel system and serve as an example of a closed loop "circular economy." It is also intended to help provide Black, Indigenous, and People of Color and low-income communities autonomy over their waste-to-energy cycle, reduce greenhouse gas emissions, and introduce immigrant, first-generation, and BIPOC youth in the Duwamish Valley to STEM career pathways…"*

Climate and Social Cost Benefits

The proposed action will be beneficial to the public and the environment as methane is reduced and minimized. Short-lived climate pollutants (which includes methane) are potent and harmful air pollutants that have a disproportionately large, short-term impact on climate change. Compared to carbon dioxide (CO_2) and other longer-lived climate pollutants that stay in the atmosphere for centuries, short-lived climate pollutants have far more warming impact by weight. Reducing methane emissions will combat the adverse impacts of climate change in Maryland. Maryland is facing a wide variety of consequences from climate change, such as a climate that is trending warmer and wetter; impacts to Maryland's ecosystems; damage to coastal and inland infrastructure from sea-level rise, storm surge, and heavy rain events; climate-driven stressors in agriculture, fisheries, and forestry; and direct and indirect public health impacts.

The proposed regulations will have a positive effect on public health and the environment. Short-lived climate pollutants (SLCPs) are harmful air pollutants and potent climate forcers with a much shorter lifespan in the atmosphere than carbon dioxide. Reducing methane emissions methane from landfills will combat the adverse impacts of climate change in Maryland.

MDE has applied a social cost benefit of reducing GHG from MSW landfills by using information from the Federal Interagency Working Group (IWG), which was published in 2021.

Approximately 360,000 to 725,000 metric tons of CO_2e could be reduced from annual emissions at affected landfills by 2030, using the MDE calculated emissions reductions, converting methane to CO_2e at the 100-year GWP of 28, for this proposal. This equates to a range of $22,320,000 to $44,950,000 using $62/metric ton at 3% discount rate.

(Note: **1 metric ton = 1,000 kilograms = 2,205 pounds**. Also called a "tonne," it's what's typically used when discussing carbon emissions. You can convert short tons to metric tons **by multiplying the number of short tons by 0.9071847**.)

MDE used the following document for these calculations:

"Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990", Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, February 2021. Link: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

> *"The Interagency Working Group (IWG) on the Social Cost of Greenhouse Gases is committed to ensuring that the estimates agencies use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions continue to reflect the best available science and methodologies. This Technical Support Document (TSD) presents interim estimates of the social cost of carbon, methane, and nitrous oxide developed under Executive Order 13990. These interim values are the same as those developed by the IWG in 2013 and 2016…"*
>
> *From pg. 2 – "A robust and scientifically founded assessment of the positive and negative impacts that an action can be expected to have on society provides important insights in the policy-making process. The estimates of the social cost of carbon (SC-CO_2), social cost of methane (SC-CH_4), and social cost of nitrous oxide (SCN_2O) presented here allow agencies to*

understand the social benefits of reducing emissions of each of these greenhouse gases, or the social costs of increasing such emissions, in the policy making process. Collectively, these values are referenced as the "social cost of greenhouse gases" (SC-GHG) in this document. The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, should reflect the societal value of reducing emissions of the gas in question by one metric ton. The marginal estimate of social costs will differ by the type of greenhouse gas (such as carbon dioxide, methane, and nitrous oxide) and by the year in which the emissions change occurs. The SC-GHGs are the theoretically appropriate values to use in conducting benefit-cost analyses of policies that affect GHG emissions…"

From pg. 4 – "This TSD presents the IWG's interim findings and provides interim estimates of the SC-CO_2, SC-CH_4, and SC-N_2O that should be used by agencies until a comprehensive review and update is developed in line with the requirements in E.O. 13990. The TSD maintains the same methodological approach as has been used for global USG SC-GHG estimation to date. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. At this time, the IWG has determined that it is appropriate for agencies to revert to the same set of four values drawn from the SC-GHG distributions based on three discount rates (2.5 percent, 3 percent, and 5 percent) as were used in regulatory analyses between 2010 and 2016 and subject to public comment. However, as described below, based on the IWG's initial review, new data and evidence strongly suggests that the discount rate regarded as appropriate for intergenerational analysis is lower…"

The Executive summary of the federal document summarizes the social cost benefits in the following tables:

Table ES-1: Social Cost of CO_2, 2020 – 2050 (in 2020 dollars per metric ton of CO_2)[3]

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

Table ES-2: Social Cost of CH_4, 2020 – 2050 (in 2020 dollars per metric ton of CH_4)

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	670	1500	2000	3900
2025	800	1700	2200	4500
2030	940	2000	2500	5200
2035	1100	2200	2800	6000
2040	1300	2500	3100	6700
2045	1500	2800	3500	7500
2050	1700	3100	3800	8200

[3] The values reported in this TSD are identical to those reported in the 2016 TSD adjusted for inflation to 2020 dollars using the annual GDP Implicit Price Deflator values in the U.S. Bureau of Economic Analysis' (BEA) NIPA Table 1.1.9: 113.626 (2020)/ 92.486 (2007) = 1.228575 (U.S. BEA 2021). Values are the average across models and socioeconomic emissions scenarios for each of three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. Values of SC-CO2 are rounded to the nearest dollar; SCCH4 and SC-N2O are rounded to two significant figures. The annual unrounded estimates are available on OMB's website for use in regulatory and other analyses: Source: https://www.whitehouse.gov/omb/information-regulatoryaffairs/regulatory-matters/#scghgs

VI. Industry Quoted Compliance Costs

Additional references that discuss the cost impact to install and operate a landfill GCCS are listed below:

1. MDE has quoted a portion of an article published in MSW Management magazine Title "Day to Day" by Daniel P. Duffy dated Feb. 7, 2019. Source: https://www.mswmanagement.com/landfills/article/13036124/day-to-day

"Landfill Gas System Capital and Operating Costs (Feb 2019)
A fully complete landfill gas management system consists of collection wells and wellheads, header pipes and fittings, branch pipelines and fittings, condensate drip legs, and at least one blower assembly and flare system for safe destruction of the extracted gas (usually one flare per 100 acres of landfill). Instead of a flare, more advanced systems at larger landfills can utilize waste to energy systems that use the heat from combusted LFG to run a turbine or use as a fuel for a reciprocating engine to generate electricity for the local grid. The pricing of each component is unique, but can be roughly prorated on a per acre basis:

- *Gas probes typically cost from $5,000 to $10,000 each and are typically installed at a rate of one per 10 acres, giving a cost per acre between $500 and $1,000.*
- *Gas extraction wells and associated fittings cost between $8,000 and $12,000 each, depending on their depth. At a rate of one per acre, the costs per acre would be between $8,000 and $12,000.*
- *Assuming about a 200-foot average spacing interval, header pipelines are installed at a rate of 200 feet per acre. Costing $100 to $150 to install, their cost per acre varies from $20,000 to $30,000.*
- *A gas collection blower and flare assembly connected to the extraction well field by the header pipes will cost from $40,000 to $60,000 each. At an installation rate of one per 100 acres, per acre cost would be between $400 and $600.*

The total cost per acre of the landfill gas management system would be between $30,000 and $54,000.

The annual costs of landfill gas system maintenance can also be prorated on a per acre basis. Annual maintenance averages $50 to $100 per well, with an average of one gas well per acre. Maintenance of the header pipelines and other appurtenances averages $2.00 to $2.50 per linear foot. At an average of 200 linear feet of header pipeline per acre, the cost of maintaining the pipelines varies from $400 to $500 per acre. Total annual gas system costs per acre will be $450 to $600. Over a 30-year post-closure care period, leachate system management costs will vary from $13,500 to $18,000 per acre."

2. MDE has quoted a portion of the comments received from Environmental Integrity Project (EIP) made on December 21, 2021, titled "Maryland Landfill Methane Regulation: Compliance Cost Estimates" (after MDE held a stakeholder meeting on June 23, 2021)

EIP Dec 2021 Evaluation	Cost - 2021 Dollars[a]
Install new Gas Collection and Control System for 40 acres landfill	$60,000 – $800,000
System Operations and Maintenance	$11,000 - $137,000[b]

a = EIP's Maryland-specific estimates were derived using California's and EPA's methodology, including the use of EPA's LFGcost-Web tool.
b = These are the annual monitoring costs based on California's methodology. The monitoring cost for the first year is higher using California's methodology because it is assumed that landfill operators will be purchasing monitoring equipment for the first time. See California Economic Impact Analysis at 5–6, Worksheet 3. This will not necessarily be the case, since many landfill

operators hire engineering firms to conduct monitoring. Applying the California methodology to Maryland's landfills, the first-year monitoring costs present a range of $54,000 to $154,000.

Another resource for cost impacts to the MSW landfill industry can be found under the rulemaking for the federal EPA NSPS and EG for MSW Landfills at regulations.gov docket document EPA-HQ-OAR-2014-0451-0086. This is the regulatory impact analysis (RIA) for the federal adoption of 40 CFR 60 Subpart, XXX and 40 CFR 60, Subpart Cf. The document is titled "Regulatory Impact Analysis for the Proposed Revisions to the Emission Guidelines for Existing Sources and Supplemental Proposed New Source Performance Standards in the Municipal Solid Waste Landfills Sector" EPA-452/R-15-008, August 2015.

IV. MDE's Compliance Costs

This proposed action will have a minimal economic impact on the Department for the compliance determination of design plans and reports.

ARA expects to add a registration process for those facilities without a permit to operate (PTO).

Appendix D – Solar Installations at MSW Landfills

This appendix was created to explain how the proposed regulations will affect MSW landfills with solar panels installed or under consideration, and to provide references for the solar panel approval process. This document is not intended to cover the options and benefits of solar panels.

There are MSW landfills in Maryland that have installed, or are preparing to install, solar panels to provide renewable energy. The Department recognizes the investments made by the MSW landfills in Maryland and supports renewable energy projects. The Department has helped to implement solar projects in the state, and will continue to work with private industry, local governments, other state agencies, and other clean energy stakeholders to facilitate the development of new initiatives and to promote their environmental and economic benefits.

The proposed MSW landfill regulations allow for exemptions or alternative compliance options to address MSW landfills that have invested in solar panels. These exemptions are based on the size of the landfill. The proposed regulations provide an exemption for some closed landfills with less than 2.75 million tons of waste-in-place that have commenced installation of solar panels by January 1, 2024. This allows Maryland to address small and medium size landfills separate from larger landfills that are required to meet the federal state plan requirements under the Clean Air Act. Through this proposed action, the Department does not intend that existing solar panel installations need to be removed or reinstalled to satisfy regulation requirements.

- The proposed regulations exempt closed MSW landfills or inactive areas of active MSW landfills that have less than 2,750,000 tons or 3,260,000 cubic yards of waste-in-place but greater than 450,000 tons of waste-in-place with solar panels or arrays that have commenced installation prior to January 1, 2024. For specific language, please refer to COMAR 26.11.42.01.B(4) in the proposed regulation. The Air and Radiation Administration (ARA) at MDE will review and approve the exemption request based on project specifications and impacts to other requirements under the new chapter.
- Closed MSW landfills or inactive areas of active MSW landfills with greater than 2,750,000 tons or 3,260,000 cubic yards of waste-in-place or capacity for waste with solar panels or arrays that have commenced installation prior to January 1, 2024 will require an alternative compliance plan for surface emissions monitoring to be approved by the Department. For specific language, please refer to COMAR 26.11.42.08 in the proposed regulation.
- All future solar panel installations will require an alternative compliance plan for surface emissions monitoring to be approved by the Department. For specific language, please refer to COMAR 26.11.42.08 in the proposed regulation.

The Solid Waste Management Program, which is part of the Land and Materials Administration (LMA) at MDE reviews and approves solar panel installations at all MSW landfills in Maryland. Also, landfills considering solar panel projects may be required to file a Notice of Intent for construction activities with the Water and Science Administration (WSA) at MDE.

The website for the Solid Waste Management Program at MDE includes the following facts sheets which detail information about solar panel installation and generation at landfills in Maryland:

Solid Waste Management Program Website:
https://mde.maryland.gov/programs/land/SolidWaste/Pages/index.aspx

"Solar Panel Installation at Closed and Capped Landfills" Guidance Document:
https://mde.maryland.gov/programs/land/SolidWaste/Documents/Solar%20On%20LFs%20Fact%20Sheets/2019-12-Factsheet-SolarPanels.pdf

"Solar Power Generation at Landfills" Fact Sheet:
https://mde.maryland.gov/programs/land/SolidWaste/Documents/Solar%20On%20LFs%20Fact%20Sheets/Solar%20at%20LFs%20FS%201-15-2020%20(1).pdf

Currently, the Solid Waste Management Program reports that eight landfills that have solar panels installed onsite while five more landfills are in the planning/proposal stages. There are solar panels installed at closed rubble landfills, however those landfills are not regulated under this proposal. It should also be noted that some of the solar panels are installed at closed MSW landfills that do not meet the requirements for last accepted waste dates under this proposal.

Under the proposed regulation, the following MSW landfills have either installed solar panels, or are expected to commence operation by January 1, 2024. The landfills that are considered affected sources under the proposed regulation are as follows:

- Brown Station Landfill in Prince George's County – Approved plan – Solid Waste
- Garrett County Landfill in Garrett County - Installed
- Fort Detrick Landfill in Frederick County - Installed
- Forty West Landfill in Washington County - Installed
- Hoods Mills Landfill in Carroll County - Installed
- Oaks Landfill in Montgomery County – Approved plan – Solid Waste
- Resh Road Landfill in Washington County – Installed
- Reich's Ford Landfill in Frederick County – Installed
- Pisgah Landfill in Charles County – Approved plan – Solid Waste

MDE supports projects that promote renewable energy generation, such as solar, wind, and hydroelectric energy. **The 2030 Greenhouse Gas Reduction Act Plan (GGRA Plan)** lays out the Department's approach to Maryland's Greenhouse Gas reduction goals. The Plan calls for a goal of 50% reductions by 2030, as recommended by the Maryland Commission on Climate Change (MCCC). Details regarding the GGRA Plan, including excerpts on solar power can be found at the following link:

https://mde.maryland.gov/programs/air/ClimateChange/Pages/Greenhouse-Gas-Emissions-Reduction-Act-(GGRA)-Plan.aspx

"The State Renewable Portfolio Standard (RPS) requires Maryland electric utilities to purchase increasingly large proportions of Maryland's electricity from renewable energy sources like solar, wind, hydropower, and qualifying biomass. The current RPS goal is for 50% of Maryland's electricity to come from renewable sources by 2030 through substantial increases in solar power and deployment of new offshore wind energy off the Atlantic coast.

The legislature intended the RPS law to establish support for the development of renewable electricity generation within Maryland and the PJM Interconnection region that includes Maryland, by requiring that power providers procure renewable energy credits (RECs) from renewable sources. The Maryland legislature updated the original legislation in 2017, to increase the goal to 25% of retail electricity sales by 2020, replacing the 20% by 2022 target. This includes a 2.5% carve-out specifically for solar energy. The RPS legislation has a clear and direct impact on GHG emissions from the electricity sector, by increasing the percentage of electricity that comes from zero emission generation sources

Maryland passed the Clean Energy Jobs Act (CEJA) in May 2019, which sets an RPS goal of 50% by 2030. CEJA allocates 14.5% of this target for mandated solar development and 1.2 GW of offshore wind solicitations, which are Tier 1 renewable energy credits (RECs).

One Maryland Energy Administration (MEA) program example - The Public Facilities Solar Program provides technical assistance to help institutions identify opportunities for solar in the built environment and capital to reduce the costs of implementation, thereby closing the financial barrier between solar on green fields and more expensive but likely more beneficial installations on buildings and parking facilities."

Appendix E – Waste Diversion

Purpose

The primary purpose of COMAR 26.11.42 – *Control of Methane Emissions from Municipal Solid Waste Landfills* is to reduce the amount of methane being released into the atmosphere from municipal solid waste (MSW) landfills. Landfills subject to the regulation will be required to monitor for methane leaks, perform leak repair and install emission controls as needed. Limiting the amount of methane generating waste that enters landfills is a primary strategy towards reducing methane emissions and meeting Maryland's climate goals. Maryland government, local and regional jurisdictions, businesses, and the public have all taken numerous efforts to help achieve this goal.

This document highlights several of the main practices that have been implemented to reduce, reuse, and recycle material that would have historically entered our landfills and incinerators. This practice is known as waste diversion. Many major programs are being run at the State and local level for waste diversion. Currently, the major programs implemented in Maryland fall under the categories of recycling, composting, anaerobic digestion, and food scrap programs. Other emission reduction programs and events that do not fall under the main four categories, such as toxic waste disposal days, are also being implemented at the state and local level. This appendix attempts to summarize recently passed, current, and future waste diversion programs throughout the State to demonstrate the broad focus and the goals and progress of reducing waste in Maryland. The information researched for this appendix is not all inclusive. Other information on different types of programs and strategies may be available.

Appendix E contains a table check-marking all identified state and local jurisdictions including the programs that are currently in order to reduce the amount of waste entering landfills. The Emission and Waste Reduction Programs and Strategies: State and Local Jurisdictions table includes information on recycling, composting, anaerobic digestion, food scrap programs, and other programs that are taking place within the jurisdiction area. Each jurisdiction has been linked to its own website for more information about the programs and practices that have been implemented. Links are also provided throughout Appendix E for easy access to references and additional details.

The information in this Appendix for the state of Maryland and Maryland counties was researched in November and December of 2021. Relevant information from 2022 has also been added to this Appendix.

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Recycling

The practice of recycling not only helps reduce emissions but allows landfills to become less congested. Recycled materials also have the potential to become broken down and reused to create other types of products and materials, such as cups, boxes, purses, or animal bedding. Recycling applied by state and local jurisdictions helps save energy, produce jobs, and conserve natural resources. A government contacts list is available with information on how to contact local jurisdictions for more information on recycling.

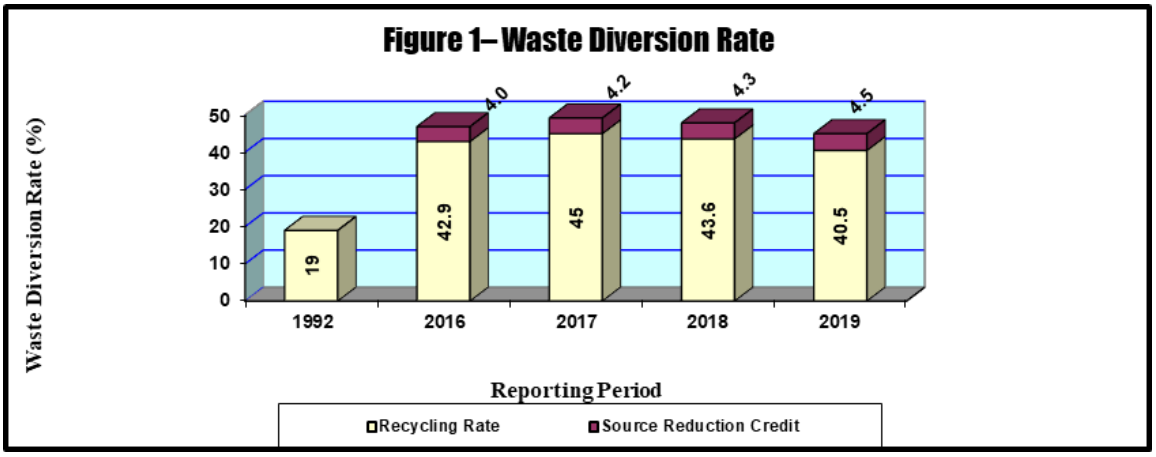
State of Maryland

In 1988, the Maryland Department of the Environment (MDE) enacted the Maryland Recycling Act (MRA) to reduce the disposal of solid waste in Maryland. The MRA states that each jurisdiction in the state must develop and implement recycling programs. Jurisdictions with a population greater than 150,000 must recycle 35% of their waste, and jurisdictions with populations less than 150,000 must recycle 20% of their waste. All state agencies must implement a recycling plan with a minimum 30% recycling rate. A list of materials that count towards the MRA recycling rate are listed on MDE's website. Other legislation implemented by the state include:

- The banning of yard waste that is separately collected from disposal at solid waste facilities.
- Permits are required for private wood waste recycling facilities.
- When developing solid waste management plans, counties shall consider the feasibility of composting solid waste.
- Composting shall be included in the definition of recycling and count it when calculating the recycling goal.
- COMAR 15.18.04.06 et. seq. - The Maryland Department of Agriculture product standards for compost that is intended to be used commercially.
- Manufacturers of mercuric oxide batteries shall be responsible for the collection, transport, and recycling or disposal of these batteries sold or for the purpose of promotion through in the state.
- A program or system shall be created in order to collect, recycle, or dispose of each cell, rechargeable battery, or rechargeable product that is sold in the state of Maryland.
- A voluntary, statewide waste diversion goal of 40% shall be established by the year 2005. This goal consists of a 35% MRA recycling rate plus an additional 5% credit for source reduction activities.

In 2019, Maryland achieved a statewide waste diversion rate of 45.0%, composed of 40.5% MRA and 4.5% Source Reduction (SR) credit. MDE generated a County Commodity Chart in 2019 determining the recycling and waste diversion rates for each jurisdiction in the state.

Figure 1 shows the historical breakdown of the state's waste diversion rate.



Source: Maryland Department of the Environment, n.d.

In March 2001, Executive Order 01.01.2001.02, Sustaining Maryland's Future with Clean Power, Green Buildings and Energy Efficiency, was signed requiring recycling state agencies to divert or recycle a minimum of 20% of waste that they generate annually. House Bill 1 became a law in 2012 requiring all owners and managers of apartment buildings or condominiums that contain 10 or more units to provide residents with recycling on or before October 14, 2014.

Maryland law also requires that counties must address the collection of recyclable materials for special events to be disposed of properly in the county's recycling plan starting by October 15, 2015.

On September 23, 2022, the MDE published a regulatory proposal to establish new regulations under COMAR 26.04.13 - Food Residuals - Organics Recycling and Waste Diversion. The purpose of the proposed regulations is to implement a law passed by the state legislature 2021. Beginning on January 1, 2023, the proposed regulation establishes certain regulatory conditions for persons required to divert food residuals from final disposal in a refuse disposal system. See page 37 of this Appendix for the fact sheet to the proposed regulation.

MDE's website includes a list of the most recent legislation (2019-2021) that have been passed, including House Bills targeting recycling. These bills include:

- HB 164 Ch. 289 - Recycling Market Development
- HB 264 Ch. 439 - Organics Recycling and Waste Diversion - Food Residuals
- HB 280 Ch. 631 - Recyclable Materials and Resource Recovery Facilities - Alterations
- HB 0510 Ch. 366 - Organics Recycling, Collection and Acceptance for Final Disposal
- SB 0370 Ch. 500 - Office Buildings Recycling

MDE has been working to improve its data collection and tracking of waste diversion in the state. In July 2017, a waste characterization study was conducted to pinpoint the materials that were still being disposed of in landfills. In April of 2019, the state's sustainable materials management goals and metrics were expanded, and currently efforts are being pushed towards commercial properties to increase reporting of recycling voluntarily through an online reporting system.

Sustainable Materials Management Maryland is a private sector-led group that focuses on recycling businesses and market development. Coordination between Commerce and MDE has become more efficient through this group when working on recycling business and permitting assistance projects.

Allegany County

Allegany County's Recycling Office focuses on reducing, reusing and recycling everyday products, resulting in a Reuse Directory that allows the public to review what can be recycled within the county, while also giving ideas on how to reuse and reduce certain items. An interactive list of recyclable materials has been created listing out what can and cannot be recycled by category, and how it can be disposed of. County Recycling Sites are located conveniently for the public to access. A recycling toolkit is available on Allegany County's website to help those who are interested in recycling, such as businesses, residential properties, and schools.

Allegany County created an educational program that instructs the public on the details of recycling. The Allegany County Recycling Coordinator may present and speak to schools and different organizations, per request.

Anne Arundel County

Curbside recycling is picked up daily (once a week) within the county at households participating in the recycling program. Materials must be sorted into two different types: materials accepted and yard waste, which includes leaves, grass, brush, and branches. Polystyrene and plastic bags are not accepted for recycling. The county provides residents with recycling bins in a variety of different sizes. A brochure was created for the public to easily understand items that can be collected for recycling, what to do with large collection items, location of recycling centers, Hazardous Household Waste drop off days, regular collection day information, and holiday schedules. The county suggests and supports businesses in operating a recycling program within their work environment. Non-county recycling centers are provided for businesses to dispose of recycled materials properly.

Anne Arundel County's Department of Public Works, specifically their Bureau of Waste Management Services, focuses on reducing and reusing materials. If materials cannot be reduced or reused, they may be donated to charitable organizations, drop boxes, vehicle donation centers, or consignment shops. Source reduction tips are available for both residential and commercial property owners.

Baltimore City

Baltimore City's Department of Public Works has weekly pick up of recyclables for residents. The city created a map that allows residents to type in their address to be informed of their collection day. Residents may put their recyclables on the curb or may take them to one of the Residential Drop-Off Centers free of charge. A list of acceptable recyclable items, as well as items that are not accepted, was created for resident use. The "Recycle Right" tool was created to give residents an interactive experience while educating themselves on the proper disposal of

materials. The city recently initiated the Residential Recycling Cart Program that will provide residents with a recycling cart free of charge. The city is also in the process of creating a Less Waste Master Plan to improve solid waste diversion, recycling, and disposal within the city.

Baltimore County

Baltimore County's Department of Public Works, Recycling Division, is active in advocating recycling, waste prevention, and reducing and reusing materials. Baltimore County's only active landfill is more than halfway full. Educating and encouraging residents to follow recycling and source reduction practices is essential in order to lessen waste entering the landfill. Baltimore County uses a single stream recycling collection program, and also has three recycling drop off facilities. A "Collection Connection" webpage was created to allow residents to know the current operating status of trash, recycling, and yard waste collection. Residents may also find information on collection issues and collection guidance and regulations.

The Recycling Division is recommending the public begin practicing waste prevention, such as using less materials. This not only benefits landfills, but it helps conserve natural resources and decreases pollution. The county has generated a list of waste prevention tips for at work, at school, at home, and during the holiday season.

Calvert County

Calvert County's Department of Public Works allows each household within the county border to receive a maximum of 2 free recycling bins for use to separate recyclable materials for drop off at convenience centers or the landfill. A list of the accepted materials is available for both the convenience centers and the landfill. The Calvert County Recycling Guide provides residents with information on different types of recycling in the county, where you can recycle, and the products that can be recycled.

Calvert County supports the idea for its residents to engage in source reduction. The county generated a list of waste prevention tips for homes, yards, and offices.

Caroline County

Caroline County currently has recycling containers at their courtesy drop off sites and different locations throughout the county. Curbside recycling pickup is by municipality. Hillsboro and Ridgely are a part of the curbside recycling program. More information on drop off sites in the Midshore Region and on accepted materials can be found on the Maryland Environmental Service's website. Residents may purchase a Homeowners Drop Off (HODO) sticker to access 3 drop off courtesy site locations. These are the only locations that require a permit.

Carroll County

Carroll County's Department of Public Works, Office of Recycling, focuses on waste reduction, reuse and recycling within the county. The county is working to educate the public on how to reduce the amount of waste they produce. Voluntary recycling opportunities are available for both residents and businesses. Opportunities to educate students and incorporate recycling into schools are available through the county. All customers using a hauler for trash have the option

to be a part of their curbside single stream recycling program. A drop off site is also available for recycled materials. Certain materials are only accepted for recycling. The county has provided the public with a waste management and recycling guide to provide information on recycling, as well as composting, in the county. Details on the Recycling Centers and how to recycle certain materials is included in this guide. Carroll County's main focus is to manage and reduce the amount of waste generated in the county by also implementing practices and policies that benefit the public.

Cecil County

Cecil County's Department of Public Works, Solid Waste Management Division, runs many different recycling programs for its residents. The county focuses on single stream recycling, but also has many drop off sites taking a variety of different recyclables, which includes yard waste. A flyer for residents was released in order for them to get a better understanding of what can or cannot be recycled through a single stream recycling program. The county also focuses on source reduction in hopes residents and businesses will reduce the amount of waste they produce.

Cecil County encourages schools to participate in recycling programs to educate students about reducing, reusing, and recycling. A list of different programs and contest ideas is available online for those interested in integrating recycling into their classrooms.

Charles County

Charles County offers curbside single stream recycling collection year-round. Curbside recycling is only offered to residents living in an area with a higher population. Yard waste may also be picked up through the curbside recycling program. Recycling may also be dropped off at one of the local recycling centers. Charles County offers a "Charles County Recycles" app available on the App Store or Google Play. Operating status is available online for residents to stay informed on the operation of facilities or pickups during the week.

A "Tag a Bag" program has been initiated in hopes that residents will turn towards recycling materials more frequently than throwing it away as trash. This program allows residents to dispose of household trash for $2.25 per bag. The goal for the county is to reduce waste, recycle more, and save residents money.

Dorchester County

Dorchester County participates in single stream recycling where residents can take their materials to 5 different drop off locations within the county. The county has created a list of materials that can or cannot be recycled at the drop off locations.

Frederick County

Frederick County's Division of Solid Waste and Recycling focuses on waste reduction in the county by offering tips on how to reduce, reuse, and recycle many different materials, including food waste. The county offers curbside single stream recycling collection for residential areas. Single-family households may put in a request for one recycling cart or two smaller recycling bins for no charge. An interactive webpage and a list of materials are available for residents who

are interested in knowing what materials can or cannot be recycled through the single stream recycling program. A flyer was also created for reference. Residents may check online for their curbside pickup schedule. Multi-family properties with 9 or fewer units became eligible for recycling services in April 2018. Drop off facilities are also available for regular and larger recyclable materials. Frederick County strives to ensure that residents recycle correctly, creating a list of tips, brochures, and resources to follow.

Resources are available for schools interested in integrating a recycling program into their classrooms. Resources are separated by primary or secondary schooling. Recycling informational kits for kids are available for schools, groups, or other programs interested in educating the youth on recycling. Recycling for businesses is recommended by the county not only to decrease waste, but to increase savings. Awards are given annually for businesses partaking in waste reduction and recycling efforts. Education and outreach programs are hosted by the county to educate residents on how to reduce waste. Event recycling containers are also available for loan for community events.

Garrett County

Garrett County focuses on source reduction, and aims for its residents to reduce, reuse, and then recycle. Recyclables may be taken to one of the refuse and recycling drop off locations in the county. A map of the drop off locations was created for reference. Information on what cannot be recycled at these locations has been provided for residents, as well as what may be dropped off. An A-Z list was created for residents to research specifically what materials can be recycled. Garrett County also created a list of recycled materials and the drop off location where residents may go to.

Harford County

Harford County residents that are a part of a trash collection service automatically are enrolled in the county's single stream recycling curbside pickup program. Harford County's Department of Public Works Recycling Office has created a flyer for residents interested in curbside collection to get a better understanding of what the program is and tips on how to recycle.

Those who are not a part of the curbside program can bring acceptable materials to the Harford Waste Disposal Center free of charge. Materials that are not a part of the program may be brought to the facility for a fee. The county created a question and answer facts webpage on recycling for residents' needs. A single stream recycling guide was also created for reference. The county encourages all residents and businesses to acquire knowledge on source reduction in order to reduce waste and save money, energy, and resources.

Harford County suggests that businesses implement a recycling program into their work spaces to increase the popularity of the business, save money, and help the environment. A free waste and recycling analysis and recycling education presentation through the Recycling Office may be requested.

The Office of Recycling offers programs and resources for teachers and students interested in recycling. Educational outreach services are also available for local groups in the community.

Howard County

Howard County's Department of Public Works Bureau of Environmental Services provides curbside recycling collection to residents who pay a yearly trash and recycling fee. Collections occur one day a week. The county provides residents with one free recycling container. Each additional container may be purchased. A list of acceptable and unacceptable materials was created for residents to get a better understanding of what can be recycled. A curbside collection guide is available for all materials that may be collected. Residents may also check their collection day through an online tool. The "Know Before You Throw" tool online lets residents click on materials to see where they can be properly disposed of. Recyclable materials may also be taken to the Alpha Ridge Landfill and Recycling Center.

The county has created a webpage with brochures, printable signs, and outreach materials for those interested in learning more about recycling, need more information on a certain topic, or want to educate others at work, in school, or at home. Schools in Howard County are encouraged to recycle in cafeterias and classrooms, and have partnered with Jenn-Kans Disposal for trash and recycling pickup. Businesses are asked to integrate recycling into their workplace. Those that do and complete an annual recycling report will receive a Work Green Howard certification. Information is available on the county website on how to start a recycling program for your business.

Kent County

Residents in Kent County have the opportunity to take recyclables to 5 different locations within county borders. A list of acceptable and unacceptable materials has been generated for residents interested in dropping off recyclable materials. Starting January 1, 2022, all Kent County residents must have a disposal permit and coupon book in order to enter drop off locations to dispose of waste.

Montgomery County

Montgomery County's Department of Environmental Protection strives to educate its residents on reducing, reusing, and recycling materials and provides different tips on how to reduce waste. Curbside recycling is available for residential properties, and residents may request to receive a recycling bin. Residents may also dispose of their recyclables at a drop off location. Fees may be required for certain materials. An A-Z list has been created for residents to understand what materials they can or cannot dispose of. Yard trim may also be recycled. It is against the law to dispose of yard trim in the trash.

Businesses are required to recycle in the county, and through the SORRT (Smart Organizations Reduce and Recycle Tons) Program, the county educates, offers information, and ensures employees and the practice as a whole understand recycling practices and policies. The county's website lists information on practices, decals, newsletters, recycling bins, annual reports, webinars, and more for businesses.

The county strives for schools to begin recycling programs to educate their students on the practices and policies of recycling, and how it benefits our environment. Information is available for public and private schools interested in integrating a recycling program into their school, as well as those interested in a recycling presentation or in need of more recyclable materials. The county includes information for schools on how to reduce waste, create a zero-waste lunch, the importance of buying recycled products, how to reuse materials, and how recycling can lower costs. Information on what your school is doing in regard to recycling in Montgomery County can be shared with the SORRT program.

Executive legislation pertaining to recycling may be found on the county's website.

Prince George's County

Prince George's County Department of the Environment's Resource Recovery Division offers curbside recycling services for residential properties. Yard trim and waste may also be put out for recycling pick up. Households are given one free recycling bin. Residents may request a recycling bin or cart in an eligible municipality. Residents who choose not to be a part of the curbside recycling program may drop off their materials at one of the Residential Convenience Drop Off Centers. The county generated a list of acceptable and unacceptable materials for residents interested in recycling, as well as a flyer. A recycling toolkit was created to educate the public on recycling and waste reduction.

Businesses are required to recycle in Prince George's County. Information on the requirement and how to start a recycling program in your office can be found on the county's website. Businesses are required to submit an Annual Recycling Report. Plan and report instructions are available for reference.

The county has created tips for the public on reuse/recycling activities, green cleaning products, and source reduction in order to promote reducing, reusing, and recycling in the county.

Queen Anne's County

Queen Anne's County provides residents with multiple recycling drop off locations. The county generated a list of acceptable materials that are able to be dropped off at the recycling center locations for reference.

Somerset County

Somerset County's Department of Public Works Solid Waste and Drainage Division does not offer a curbside recycling collection program. There are multiple drop off locations available for residents to dispose of their recyclables properly. Permits are required for households to enter county run facilities.

St. Mary's County

St. Mary's County Department of Public Works provides convenience centers located county wide for recyclable materials to be dropped off. A flyer was created for residents to reference the materials that are acceptable or unacceptable to drop off at convenience center locations. Permit

stickers are required for residents interested in using the convenience centers as well as the landfill. The county strives to educate and prioritize source reduction in order to create less waste and to follow the reduce, reuse, and recycle guidelines. Tips and guidelines are available for residents and businesses to follow. Flyers are also available for businesses and residents with facts and tips on source reduction.

An Environmental and Solid Waste Fee pursuant under Ordinance No. 2018-13 must be paid for by those who own an improved residential property in the county, meaning all improved properties residentially zoned and contain one or more dwelling units.

Talbot County

Talbot County, with the help of Midshore Regional Recycling Program (MRRP), provides residents with 10 collection stations within county limits for residents to drop off materials.

Washington County

Washington County provides residents with recycling drop off stations to dispose of materials properly. Permits are required to drop off recyclables. Certain materials may only be dropped off at certain locations. The county has generated lists for residents to reference. A list of locations not affiliated with the county for residents to take recyclables has also been provided, along with a list of private recyclers. Residents with questions on recycling in the county may gather information on the county's website. A Solid Waste Citizens Guide is also available.

Washington County provides tips on source reduction and how residents and businesses can begin to reduce waste in order to lessen the amount entering landfills, as well as decreasing pollution.

Wicomico County

Wicomico County's Department of Public Works provides residents with recycling drop off locations to dispose of materials properly. A permit is not required to drop off recyclable waste, and a flyer was created presenting the materials that can or cannot be dropped off at recycling locations. An interactive map was created to allow residents to view the locations of the county's solid waste facilities.

Worcester County

Worcester County provides multiple recycling drop off locations for its residents. A map is available for residents to locate drop off centers. The county has created a list of materials that may or may not be accepted for recycling. Residents residing in Snow Hill and Berlin have the opportunity to participate in curbside recycling collection. Yard waste may be recycled at Pocomoke or Central Landfills. A permit is required. Prepaid bag tags are needed in order to throw waste away in the landfills. The goal is to educate residents on composting, recycling, and other source reduction practices to keep landfills clear and save residents money by using less prepaid bags.

Recycling is promoted through the county by conducting public education events and programs for schools, civic groups, or other organizations. Tours are also offered, and activities are advertised in the local newspaper.

Composting

Composting is the process of breaking down decaying materials (decomposition), such as food and yard waste, to then be used as soil to add nutrients to different types of plants, such as vegetables and fruits. There are many different ways that composting can be done. According to the Environmental Protection Agency (EPA), these include Onsite Composting, Vermicomposting, Aerated (Turned) Windrow Composting, Aerated Static Pile Composting, and In-Vessel Composting.

State of Maryland

MDE currently has a composting section on their website specifically listing resources, fact sheets, regulations, contacts, and permit information for compost facilities, or those interested in composting. The Maryland Department of Agriculture (MDA) has a brochure available with tips on how residents can compost in their backyard, and what can or cannot be composted. There are currently 22 composting facilities with permits issued through MDE, and composting facility regulations, COMAR 26.04.11, have been passed in order to manage these facilities.

MDE's website includes a list of the most recent legislation (2019-2021), as well as older legislations (2011-2017), that have been passed, including House Bills targeting composting. These bills include:

- HB 248 Ch. 459 - Rights and Restrictions - Composting
- HB 171 Ch. 384 - Environment - Yard Waste, Food Residuals, and Other Organic Materials Diversion and Infrastructure - Study
- HB 1349 Ch. 374 - Compostable, Degradable, and Biodegradable Plastic Products - Labeling
- HB 878 Ch. 430 - Compost and Compost Based Products - Specifications
- HB 1440 Ch. 686 - Composting Facilities
- HB 817 Ch. 363 – Composting

In 2015, the state hosted a Compost Challenge for the members of the Maryland Green Registry with the goal to reduce or compost as much acceptable waste as possible. Starting in 2016, MDE began to host Food Recovery Summits. The summit hosts many speakers presenting a wide variety of topics pertaining to food waste and recovery. In March 2020, MDE created a food waste minimization toolkit that was made available for all schools in the state of Maryland.

Allegany County

Allegany County operates a Yard Trimming and Mulch Site for residents and businesses to drop off acceptable items and pick up free mulch. For those interested in composting at home, a brochure is available with information on what composting is, and the different types of composting that can be done.

Anne Arundel County

Yard waste is collected weekly from residents. Yard waste collection tips are given to better educate residents on the "dos and don'ts" of recycling yard waste. Composting is the alternative residents are given if they do not want their yard waste to be collected. At home composting kits are available for pickup for residential curbside customers. A compost guide was created to help residents learn how to build the specific type of bin or mound needed for composting. A brochure was created by Anne Arundel's Department of Public Works on backyard composting and the free bins that are given to eligible households.

Baltimore City

In an effort to reduce food waste within the city, the Food Matters Program was initiated through the Natural Resources Defense Council (NRDC) and the Baltimore Office of Sustainability (BOS). One of the few projects currently being implemented into the city is a community composting program. The program will include multiple drop off locations around Baltimore City. BOS has a goal to reduce half of the City's food waste by 2030.

The Baltimore Compost Collective, a youth empowered food scrap collection service, is a local service collecting food scraps from residences in Baltimore City. The program educates and engages the youth on composting practices and operations. Compost that is generated through this program is used by the Filbert Street Community Garden.

Baltimore City's Department of Public Works' website includes information on composting and its benefits for residents interested in integrating composting into their homes.

Baltimore County

Baltimore County's Department of Public Works hosted a compost bin and rain barrel sale, allowing residents to become involved in environmental practices. A compost guide is available for those interested in composting from home. The compost guide includes steps on choosing a compost system, collecting the materials needed to compost, fixing problems that may arise from composting, and how to use the compost when finished. Two types of composting practices are advertised by the county, including vermicomposting (composting with worms) and soil incorporation (burying food scraps).

Calvert County

In Calvert County's Recycling Guide, information is available on how residents can build their own compost pile, and the positive impacts that are created, such as saving money and resources, as well as improving soil health. The county lists 8 general composting rules for residents to follow along with a problems and solutions chart. For example, if your compost is producing an odor, you may need to turn it more frequently and add more brown material, if necessary.

Caroline County

There is no information available on programs or resources regarding composting through the county.

Mid Atlantic Organic Resource Company, located in Caroline County, uses agricultural waste, waste from hatcheries, and food waste to create organic soil for agricultural reuse. This composting facility helps keep 5,000 tons of waste out of landfills each year by turning it into compost. The compost also helps decrease pollution resulting from agricultural practices by decreasing emissions (ammonia) and runoff.

Carroll County

Carroll County recently had a compost bin sale, as well as rain barrels, for residents interested in composting at home. For those interested in composting, Carroll County created a brochure on how to compost, and has provided more information on their website on the materials that can or cannot be used, and the difference between slow and fast composting.

Cecil County

Cecil County has created a brochure with information on the materials you can or cannot compost, and links to appropriate websites to research how to compost from home. Mulch is available for a fee from two drop off locations in the county.

Charles County

Charles County provides residents with information on backyard composting and materials that can be used, as well as links to other respectable resources for those interested in beginning the composting process. A compost bin workshop will be held in the Spring of 2022 for residents to learn the best ways to compost and how to prevent issues from happening, and if issues do arise, how to solve them.

Piney Church Road Mulch Facility accepts commercial and residential yard waste for composting to be turned into mulch. Mulch is available for free to residents certain times through the year.

Dorchester County

Acceptable materials that have been dropped off at the recycling locations within the county are transformed into compost.

Frederick County

Frederick County has generated a list of materials available for residents interested in composting at home, including a "How to Compost" informational flyer, myths on composting, and a list of materials that may be used to compost. Free composting classes are hosted and compost bins are available for sale through the county. Frederick County's advanced composting program keeps compostable materials out of landfills to then become Revive compost, which is for sale to the public.

For residents unable to compost at home, Key City Compost has a residential composting service available. Commercial composting service is also available, as well as for cities, Homeowner Associations (HOA), and for groups. Materials other than backyard waste are accepted in the program.

Garrett County

Garrett County landfills accept yard waste for their compost pile only. All materials must be loose and cannot be mixed with other household waste. Biodegradable bags and food waste are not accepted and cannot be used in the compost pile.

Harford County

Yard trim, including Christmas trees, collected at the Harford Waste Disposal Center is turned into compost and mulch. When fully processed, mulch and compost becomes available for sale in the Harford Waste Disposal Center's Mulch and Compost Facility Monday through Friday from 7:00 a.m. to 2:45 p.m.

Harford County's Home Composting webpage includes information on what compost is and why residents should partake in composting. The county lists materials that can or cannot be used towards composting, and how to use compost when the process is completed. A chart is also available to troubleshoot any problems associated with the composting process. A brochure with more information on home composting is also available for residents. The county hosts a backyard composting workshop in the Spring.

Howard County

Howard County's Feed the Green Bin curbside collection program allows residents to compost from home. Residents may pick up a free bin to help convert organic materials into compost. Once collected, materials are then turned into HoCoGo compost, mulch, or topsoil that can be purchased. A list of acceptable and unacceptable materials is available for residents interested in participating in the program. The composting facility that the compost material is taken to is on 14 acres of land at the Alpha Ridge Landfill. The Wood Waste Area is also available for residents to drop off brush, yard trim, grass, leaves, barn cleanings, and wood chips to then be processed into compost, mulch, and topsoil. The county hosts Bag It Days where mulch, compost, and topsoil are sold by the bag/tub instead of in bulk.

Composting demonstrations are held for those interested in learning more about composting. Composting bins are available for free for Howard County residents. More information is available on the county's website about backyard composting and how to get started.

Montgomery County

The county hosts composting workshops throughout the year for those interested in learning the process of composting and what should or should not be done in order to create the best results. The county's website includes information for those interested in composting on why you should compost, how to get started, and myths about composting. A composting video is also available for residents to learn about composting. Compost bins are available for free for businesses and

residents of Montgomery County. Food scraps may also be composted by residents with a specific type of compost bin. Information about food scraps and composting is available on their website.

The Montgomery County Yard Trim Composting Facility (MCYTCF) produces and sells Leafgro, a compost used for soil improvement by residential homeowners and landscapers. Materials are transported to the facility from all around the county.

Prince George's County

Those receiving county trash and recycling curbside collection services are encouraged to participate in the Curbside Organics Collection program. Food and food soiled materials may be composted. This program only composts food, food related items, and optional yard waste. Yard waste may still be recycled outside of the composting bins, but organics must be placed in.

Prince George's County Organics Composting Facility collects yard trim and food waste from households in the county and produces compost. Leafgro compost is created and sold in bulk to wholesalers, and residents may buy it from retailers.

St. Mary's County

St. Mary's County Department of Public Works has a Ten Steps to Home Composting flyer available for residents interested in integrating composting into their backyards. The steps include how to build a compost pile, how to begin the composting process, what to do when an issue occurs, when compost is ready to be used, and how it can be used. More information on the ten-step composting process is available on the county's website. Mulch is available at no charge for residents and community and civic groups. Materials gathered from the yard waste debris program are used to mulch county buildings, as topsoil roadside maintenance and repair work, and on the construction of nature trails.

Washington County

Yard waste that has been dropped off at the 40 West Landfill will be transformed into compost or mulch. The material will then be available for purchase by the ton for residents.

Worcester County

Yard waste that has been taken to the Central Landfill is produced into mulch to then be used on landfill grounds. Christmas trees are also a part of the yard waste when drop off sites are available at the end of the year. The county also supports residents on integrating composting into their backyards.

Go Green OC is an environmental organization working towards zero waste in the Eastern Shore of Maryland, specifically Ocean City. The organization focuses on composting and recycling. In 2021, they were able to compost materials from 5 different restaurants in Ocean City. This new organization is working on gaining access to more restaurants in order to work towards the zero-waste goal.

Anaerobic Digestion

Anaerobic Digestion is the process through which bacteria break down organic matter without the use of oxygen. Organic matter can range from food waste to animal manure. Multiple types of organic matter can be combined inside of a digester, called co-digestion. Biogas forms from this process inside of a sealed vessel called a reactor. Other byproducts are created through this process, such as fertilizer and animal bedding. Figure 2 shown below displays the process of anaerobic digestion.

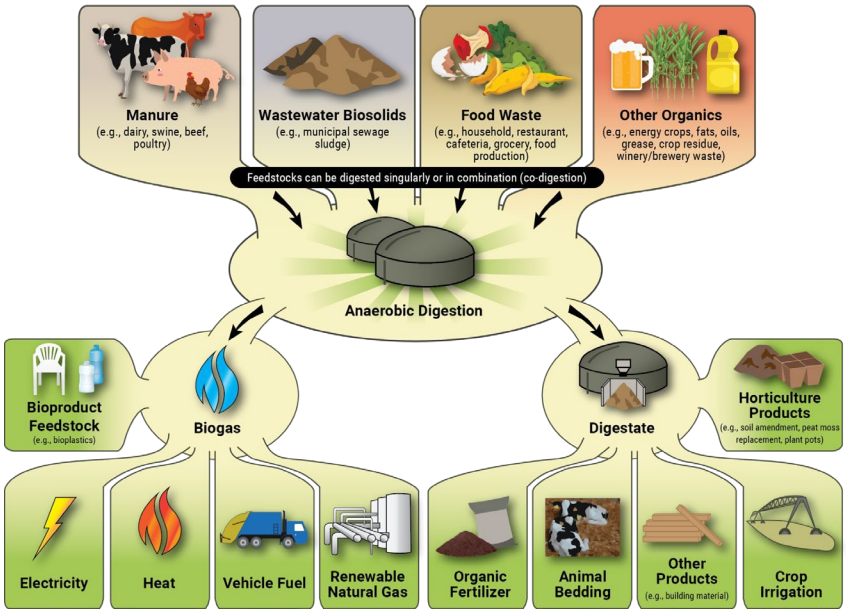


Figure 2. Anaerobic Digestion Process

Environmental Protection Agency, 2021.

State of Maryland

MDE's website includes a list of the most recent legislation (2019-2021) that have been passed, including House Bills targeting anaerobic digestion and recycling practices. These bills include:

- HB 264 Ch. 439 - Organics Recycling and Waste Diversion - Food Residuals
- HB 0510 Ch. 366 - Organics Recycling, Collection and Acceptance for Final Disposal MDE does not have a set of regulations or permits designed specifically for anaerobic digestion facilities. MDE's Permitting Guidance for Anaerobic Digestion Facilities lists off the potential requirements for these facilities and details on the specific permit and/or regulation.

Baltimore Gas and Electric Company (BGE) will be the first utility company to supply biogas, gas created from organic sources, in their distribution system through an interconnection pipe. The Maryland Public Service Commission (PSC) approved BGE's request in August 2021, and is hoping to spark a new industry in the state of Maryland. Bioenergy Devco will develop the largest anaerobic digestion facility in Maryland, located on the Maryland Food Center Authority Campus in Jessup. Bioenergy Devco expects operations at the facility to begin in Spring 2022.

With the recent passing of HB 264, food waste from large grocery stores, restaurants, and fresh produce distributors will no longer be sent to landfills, but instead sent to organic recycling facilities, such as anaerobic digesters. HB 264 will also require food waste to be donated for human consumption or sent to farms as feed for animals.

Food Scrap Programs

Food Scrap Programs are designed to help reduce food waste and emissions from landfills. The food scraps that are given can be recycled, composted, or used as feed for livestock. Different apps are becoming readily available for the food industry to allow the public to purchase food items at the end of their workday in order to reduce food waste from entering landfills. Too Good To Go is a platform listing different restaurants in the user's area that are selling leftover items for a reduced price. There are many different restaurants participating in this platform in the state of Maryland.

State of Maryland

MDE focuses on Food Scraps Management by encouraging source reduction such as donating edible surplus food to organizations county-wide, feeding animals food scraps, creating energy or fuel out of food waste, and composting. Landfill and incineration are a last resort option, and is the least supported practice through MDE. MDE follows EPA's Food Recovery Hierarchy, shown in Figure 3 below.

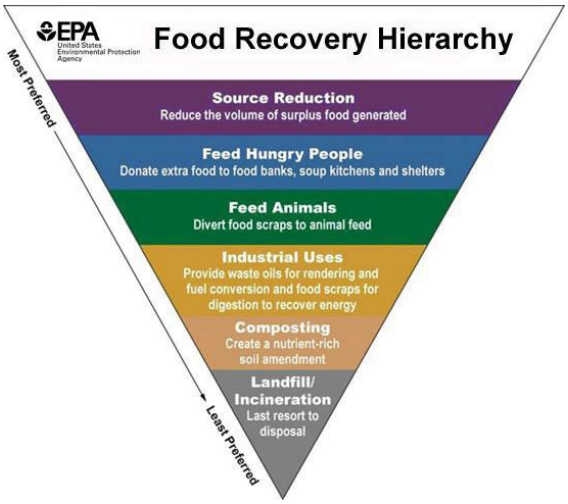


Figure 3. EPA Food Recovery Hierarchy

Environmental Protection Agency, 2021.

Anne Arundel County

Food Scraps and Food Soiled Paper may be recycled through the county and dropped off at any of the Recycling Centers. A list of items that are acceptable for recycling can be found on Anne Arundel County Department of Public Works's website.

Baltimore City

8Baltimore City's Department of Public Works initiated a Food Scrap Drop-Off Pilot Program that allows residents to drop off their food scraps at 5 different locations around the city. The food scraps that are dropped off are then used towards composting. This program's goal is to educate residents on food waste prevention, food rescue, and composting. A fact sheet was created to list the accepted materials, the unaccepted materials, and the location and days of operation for the drop-off sites.

Baltimore Free Farm is a volunteer organization working towards decreasing food insecurity, increasing food recovery, and granting those in need with fresh produce. Every Wednesday, Baltimore Free Farm hosts a food recovery day where they take produce from a wholesale market in Jessup and distribute it amongst those in the community that are in need of fresh produce. Foods recovered may have been exposed to mold and were to be thrown away in a landfill, but Baltimore Free Farm retrieves the produce then sorts and washes what can be given to the community. Produce that cannot be given out is composted.

Harford County

A Food Waste Facility opened in Havre De Grace that allows residents to drop off food waste to be turned into compost. The facility is located in Hutchins Park and is near the Havre De Grace farmer's market. Those who attend the farmer's market are asked to bring their food waste to be disposed of at the facility. A list of unacceptable items was created for those interested in participating.

Howard County

Through the Feed the Green Bin Program, food scraps are collected from those participating to then be turned into compost. Food scraps can also be dropped off at the Residents' Convenience Center at the Alpha Ridge Landfill.

Montgomery County

Montgomery County does not have a specific food scrap drop off program.

Montgomery County promotes businesses to run commercial food scraps programs. A video is available for businesses interested in setting up a program. Montgomery County is the first jurisdiction in the state and metropolitan Washington area to provide a Commercial Food Scraps Recycling Partnership Program with commercial businesses. This provides food scraps recycling services for businesses and organizations.

Residential properties may separate their food scraps and have them collected curbside. The county includes a list of food scrap collectors for those interested in curbside collection. Food scraps can also be composted in specific bins with a tight-fitting lid.

Prince George's County

Prince George's County does not have a specific food scrap drop off program.

Food scraps may be composted through the county's curbside composting program and shall be picked up weekly.

Other Programs

State and local jurisdictions host and promote a wide variety of events and programs outside of traditional recycling and composting programs, such as electronic and hazardous waste recycling and grasscycling. These programs help landfills steer clear of harmful waste, lessen the amount of hazardous and/or toxic pollution, and allow reuse of certain materials.

State of Maryland

MDE's website includes a list of the most recent legislation (2019-2021) that have been passed. These House Bills ban the sale of or prohibit certain materials in the state of Maryland. With these laws in effect, less harmful waste will be sent to landfills and decrease pollution in the state. These House Bills include:

- HB 391 Ch. 610 - Prohibition on Releasing a Balloon Into the Atmosphere
- HB 1442 Ch. 471 - Expanded Polystyrene Food Service Products - Definition
- HB 910 Ch. 579 - Expanded Polystyrene Food Service Products – Prohibitions

The Maryland Department of Aging has started a "Maryland Durable Medical Equipment (DME) Re-Use" Program. The program provides durable medical equipment that has been donated for re-use for those in need, free of charge. Donations that are currently needed are wheelchairs, power wheelchairs and power scooters, rollators and walkers, toilet and shower supports, pediatric equipment, bathroom aids, and hospital beds. This program works to reduce waste in landfills and re-use products that may normally be thrown away while helping improve the health of Marylanders.

Allegany County

Outside of traditional recycling programs, Allegany County's Recycling Office hosted a "Too Toxic To Trash" event. This event allowed residents to dispose of Hazardous Household Waste (HHW) properly. Automotive, exterior, fuel, hobby, home improvement, household, household cleaners, lawn and garden, personal care, and other miscellaneous products were accepted.

Certain paints were also accepted. Medicine, electronics, tires, ammunition, explosives, and medical wastes were not accepted. A list of items is located on Allegany County's website.

Anne Arundel County

Electronic recycling pick up is offered year-round for the residents of Anne Arundel County. Residents may also take electronics to a Recycling Center free of charge. Electronics from businesses are only accepted at the Millersville Landfill and are charged following the fee

schedule. Scrap tire recycling is also available for residents. Recycling centers will accept 4 or less tires free of charge. A $7.00 fee will be applied for each additional tire. On-the-road tires are only accepted at the facilities.

The county suggests that residents become involved in Grasscycling or other alternatives, for example, the use of small branches as kindling and composting at home to reduce the use of fertilizers and topsoils.

Baltimore City

The Department of Public Works supports the implementation of Grasscycling into households, and includes information on what this practice is and its benefits on their website.

Baltimore County

Baltimore County's Household Hazardous Waste Program has been put into place guaranteeing that products will be properly recycled or disposed of if potentially harmful household chemicals are involved. The program has three drop off centers that accept many types of hazardous wastes. The county's website includes information on the types of hazardous waste, negative effects of the waste, tips for minimizing these materials at home, safety tips for using these materials, and how to recycle or dispose of them.

Baltimore County has partnered with The Loading Dock, Incorporated to accept reusable building materials from two facilities: The Eastern Sanitary Landfill and the Central Acceptance Facility. A few of the accepted materials for the Loading Dock Reuse Program include appliances, bathtubs, faucets, flooring, hardware, toilets, wallpaper, and windows. A full list is available on the county's website. An Electronics Recycling Program is also in place for unwanted household electronics. The county recommends residents contact electronic manufacturers and retailers to gather information on possible take-back or recycling programs through their business. It is also suggested that residents donate electronics to charity or a reuse organization. Residents may drop off certain electronics for recycling at the three drop off facilities in the county. A few of these electronics include auto equipment, cables, cords and communication wires, music playing devices, and smart watches and fitness trackers. A full list is available on the county's website.

The practices of Grasscycling and Leafcycling are promoted by the county to allow for natural processes to better residents' yards as compared to fertilizers or pesticides, and cuts back on the use of plastic bags used to bag yard waste materials. Clean Green Baltimore County is a program that is run through the county committed to environmental stewardship. Residents may participate by planting trees, helping in community cleanups, recycling, and switching to renewable energy. Clean Green Baltimore County hosts events and volunteer opportunities are available. Sources are available for residents to gain knowledge on how to reduce impacts on the environment.

Calvert County

A few Saturdays a year, Calvert County hosts Household Hazardous Waste Collection Days from 8:00 a.m. to 2:00 p.m. The collection days allow residents to dispose of hazardous waste

properly, free of charge. Unneeded or old medicines may also be disposed of. Tire recycling is available at the Appeal Landfill for a fee. Thermometers and thermostats containing mercury and yard debris may also be recycled at the landfill. Lightbulbs may be recycled at convenience center locations, as well as cooking oil. All information can be found on the Calvert County Recycling Guide.

Calvert County hosts county resident and business shredding events to destroy and recycle unwanted confidential papers and turn them into new products. Live Christmas tree and live greens recycling happens seasonally for county residents. Live materials are turned into mulch that is available for residents free of charge.

A Recycling Awards Program was initiated to recognize businesses, agencies, organizations, institutions, and individuals who have exceeded expectations on recycling in Calvert County. Documentation showing the amount of waste generated through recycling must be shared with the county in order to be eligible for the program.

Caroline County

Caroline County partakes in Midshore's Hazardous Household Waste Day every year. Electronics are also accepted at this event. Maryland Environmental Service has created a list of acceptable and unacceptable materials for this event. The event happens 2 times a year, once in the fall and once in the spring.

Carroll County

Many different products and materials may be recycled through Carroll County. Clothes and Textiles may be recycled at the Northern Landfill's Recycling Center. The county recommends that residents donate their clothes before taking them to the Recycling Center. A list of organizations is available. Habitat for Humanity, ReStore is a non-profit building materials reuse center taking donations for building materials in usable condition. These materials help build communities. Some of the materials needed include tile, floor covering, appliances, hardware, sinks, stairs, toilets, and windows.

Used oil may be recycled at multiple drop off locations in the county, including car garages. Electronics may be recycled at the Recycling Center everyday other than Sunday. The county has generated a list of acceptable and unacceptable drop off items. An aluminum can reimbursement program is available. Prices are subject to change due to the market value.

Household Hazardous Waste and Shredding events are held for residents to dispose of hazardous materials and shred personal documents. Carroll County's waste management and recycling guide lists recycling options for light bulbs and rechargeable batteries, as well as car batteries and white goods/scrap metal.

Grasscycling and composting yard trimmings are banned from entering the landfill. Yard trimmings are to be used by grasscycling or composting. The county includes information on

how to Grasscycle on their website for interested residents. Christmas tree recycling was offered to residents. Christmas trees would then be reused as compost, mulch, or chips.

Cecil County

Shredding events are available for residents who want to properly dispose of important documents and materials. A Household Hazardous Waste Day shall be hosted for residents interested in properly disposing hazardous and harmful materials properly from their homes. A list of materials that can be accepted for proper disposal is available for residents. Household paints may be recycled or disposed of through the county, and a flyer was created to educate residents on reducing, reusing, and recycling this product. Electronics recycling is also available for residents Monday through Saturday every week. A list of electronics that are able to be recycled was created by the county. Residents may also dispose of their flags properly by dropping them off at one of three disposal and recycling sites within the county.

Information on grasscycling and mulching leaves is available online with resources to help those interested in getting started.

Charles County

Litter Control Programs are currently active in the county. There are three full time crews that remove trash from right-of-ways, and community service volunteers are participating in cleanups on Saturdays. Others may volunteer in community clean ups, the Adopt-A-Road Program, and Watershed Cleanup Events. An Adopt-A-Stream event is available for residents to volunteer to monitor streams and organize clean up events twice a year. If littering has been witnessed, it may be reported online.

A Shred Event is available for residents interested in properly disposing of confidential materials. A Rain Barrel workshop is offered for those interested in learning about the benefits of installing one in your home, such as decreasing pollution from entering waterways. Rain Barrels may also be purchased. Christmas trees may be dropped off and recycled at 12 different locations in the county to then be turned into mulch. Grasscycling is also encouraged through the county for residents to participate in.

Household Hazardous Waste events are held for residents to dispose of their waste properly. A list of accepted materials is available on the county's website. Used motor oil and antifreeze may be taken to one of the drop off facilities within the county.

Frederick County

There are several motor oil recycling facilities in the county for residents to properly dispose of motor oils and antifreeze. Hazardous Household Waste drop off events are arranged for residents to drop off harmful materials to then be disposed of properly. The county created a list of acceptable and unacceptable materials for the event. Electronics may be recycled at the 9031 Reichs Ford Road site in Frederick, Maryland, or the Citizen's Convenient Center for a small fee. A list of acceptable materials was created for those interested in electronics recycling.

There are currently 6 drop off locations available for residents to drop off their Christmas trees to then be turned into compost or mulch. Yard waste is prohibited from being dropped off at the Frederick County Landfill. This does not include soil, land clearing debris, waste pavement, or any edible food products. Yard waste may be dropped off for free at certain locations to then be turned into compost or mulch. The county suggests residents to become familiar with Grasscycling to prevent waste and increase the health of soils.

An online event was hosted on October 21, 2021 on "How Recycling Really Works" for those who were interested in learning more about recyclable materials and the materials in plastics. A compost event, "Compost Happens", was hosted on November 9, 2021 online for those who were interested in composting at home. Shredding events are hosted for those interested in recycling shredded paper since it cannot be recycled through the county's curbside single stream recycling program. Family consignment sale special events allows residents to recycle clothing, furniture, toys, and other items to become available to others.

Garrett County

Residents and businesses in the county may take advantage of the electronic recycling program free of charge at 4 different refuse and recycling drop off locations. A list of accepted items has been created for residents and businesses interested in the program. The county has also generated a list of drop off locations for businesses to recycle fluorescent bulbs, lamps, and ballast. Scrap tire events are held in order for residents to dispose of their tires correctly.

Residents will be notified when these events are held. Used motor oil and antifreeze may also be recycled through the county.

The county created a list of alternatives for Household Hazardous Waste products to decrease pollution and increase the use of non-hazardous products. Appliances, bulk items, and white goods may be taken to one of the county's drop off locations to be disposed of properly, and bag stickers are available for a fee for those dropping off household refuse. Refrigerators, freezers, and air conditioners may also be recycled through the EmPOWER Maryland program.

The Swap Shop program that Garrett County has in place allows residents to drop off or pick up reusable items in good condition, such as bicycles, lamps, chairs, electronics, and vacuum cleaners. The county also advertises the Wheels For Wishes & Wellness program that allows residents to donate their vehicles to benefit local children's hospitals and charities in the state of Maryland.

Christmas trees may be recycled at the 3118 Oakland Sang Run Road, Oakland, MD landfill location free of charge after the holiday season. The county also recommends residents to recycle trees at home by placing cut branches and needles under shrubs and trees as mulch or chopping trees and adding them to a compost pile. A plastic toy recycling program launched by Mattel is advertised through the county to allow residents to donate old toys for reuse.

Harford County

The county's Adopt-A-Road Program allows any group, family, or single individual in Harford County to adopt a 1-3 mile portion of a county road for a minimum of 2 years to collect litter when needed. An Adopt-A-Road Participation Packet is given to those enrolling in the program. The Roadside Litter Control program collects litter from more than 1,000 miles of county roads and gathers help from those involved in Community Work Service, Absent Parent Programs, and the Adopt-A-Road Program.

The Harford Waste Disposal Center accepts recycled textiles and clothing year round, excluding carpets (this includes area rugs), pillows, plastic material (plastic collection bags are allowed), and wet clothing. A brochure was created with more information on textile recycling. Electronics may also be recycled at the Harford Waste Disposal Center free of charge. A list of accepted materials is available for residents interested. A reuse and recycle directory was designed for residents to learn where to donate items in reusable shape.

Household Hazardous Waste events are scheduled until the end of 2022 for residents to properly dispose of hazardous materials. A list of acceptable and unacceptable items is available for those interested in participating. Motor oil and antifreeze may be recycled year-round at multiple drop off locations. Latex paint may be brought to the Harford Waste Disposal Center for proper disposal year-round.

Harford County recommends that residents use the practice of Grasscycling on their lawn to allow natural nutrients to absorb into the soil and grass. It creates a healthier lawn, saves money, reduces time spent on maintenance, and saves water.

Howard County

The Harvest Heap event helps keep pumpkins out of landfills. Residents are asked to drop pumpkins off at one of the facilities available to be turned into compost. 8,000 pounds of pumpkin was diverted from the landfills in 2021. The Merry Mulch event asks residents to recycle their Christmas trees to be turned into compost. Alpha Ridge Landfill has created a list of reuse and recycle options for construction and demolition debris. Multiple shredding events are held every year for residents to properly dispose of personal information. A list of acceptable and unacceptable materials is available for residents interested in this event.

The county created a food waste prevention toolkit for those interested in reducing the amount of food waste that they generate. Additional resources are also available, including guides and tips, news sources, mobile apps, and ways to get involved.

Household Hazardous Waste is collected at Alpha Ridge Landfill for proper disposal every Saturday through November. During the winter season, special collection days will be held. A list of acceptable and unacceptable materials is available for residents interested in dropping off products.

The Business Recycling and Waste Reduction Award acknowledges businesses who put in an effort to recycle the following year.

Kent County

Midshore's Household Hazardous Waste Drop-off Day is held every year for residents to dispose of harmful products and materials properly. A flyer was created for residents interested in the event, which includes a list of acceptable and unacceptable materials that can be dropped off for proper disposal.

Montgomery County

Montgomery County has a ban on Polystyrene, Bill 33-20, and Expanded Polystyrene, Bill 41-14, requiring all county agencies, lessees, contractors, and food service businesses to use compostable recyclable food service ware, and prohibits the sale or use of this product.

My Green Montgomery is a resource for those interested in making changes to live a more eco-friendly lifestyle. Tips and resources are added by staff, local environmental experts, and the public. Recycling volunteer opportunities are available through the Recycling and Resource Management Volunteer Program. The county began giving out the Montgomery County Recycling Achievement Award to those who worked towards increasing recycling efforts in the county.

Paper shredding, recycling/reusing clothing, and household item collection events are hosted for residents interested in disposing of materials in a proper way, or to be reused. Shredded paper may also be recycled at home or dropped off at a separate location. Metal and Household Hazardous Wastes may be recycled or disposed of through the county or municipality you reside in. The ECOWISE program provided businesses that produce less than 220 pounds of hazardous waste Small Quality Generators (SQG) to conveniently and inexpensively dispose of these materials.

Grasscycling is promoted by the county to create healthier soil and grass in a natural way. It is against the law to throw away yard trimmings in the county, and grasscycling is a solution by using grass clippings.

Prince George's County

Keep Prince George's Beautiful is a non-profit working to create greener, cleaner, and litter free areas and communities. The organization has worked towards promoting litter prevention,

recycling, beautification, and clean-up programs and has been working with other organizations to initiate waste management programs. Polystyrene packaging and other loose film materials have been banned from the county, and businesses and retailers will be fined if caught using this material. Plastic straws have also been banned from the county. The county is working towards a Zero Waste goal and encourages residents, businesses and visitors to take initiative and change their actions in order to fulfill the zero waste goal.

A Christmas tree collection is run every year at the end of the holiday season. Trees may be put out for curbside collection. Electronics recycling is open year round for product disposal, and a list of acceptable and unacceptable materials for drop off is available for residents. Household Hazardous Wastes may also be dropped off for proper disposal.

The System Benefit Charge (SBC) is a fee paid by non-residential property owners in the county that helps supply funds for waste disposal systems. Funds are used towards building and maintaining these systems.

Queen Anne's County

Midshore's Hazardous Household Waste, Latex Paint, and Electronics Recycling Drop Off Day is hosted every spring and fall for residents to properly dispose of materials. A list of acceptable and unacceptable materials is available for residents interested in the event.

Computers may be recycled yearly at three of the county's transfer stations. Oil and antifreeze may also be recycled at any of the transfer stations in the county.

A fishing line recycling program has been initiated in the county with Plastic Free QAC. Fishing line recycling containers are placed at many local businesses and Public Landings in the county.

St. Mary's County

St. Mary's County has 30+ different recycling and waste reduction programs in effect. An A-Z list is also available. These programs include:

Aerosol Can Recycling
DROP N' SWAP
Bargain Barn/Habitat for Humanity/Restore
Electronics Recycling
Battery Recycling
Empty Pesticide Container Recycling
Bikes for Tykes Program
Fluorescent Bulb and Ballast Recycling Program
Boat Disposal
Buy Recycled Policy / Purchasing
Cardboard Recycling
Cartridge (Ink Jet) Collection
Christmas Tree Drop-Off
Clothing and Textile Recovery
Commingled Containers (glass, plastic, and metal containers)
Document Shredding

Hazardous Waste Days
Grasscycling
Home and Backyard Composting
Mixed Paper Recycling
Newspaper Magazine Recycling
Office Paper Recycling
Oyster Shell Recovery
Paint Disposal
Pharmaceutical Disposal
Phone Book Recycling
Plastic Recycling - Plastic Bag and Plastic Film Ban
Plastics Recycling
Propane Tank Recycling
Recycle for Sight
Reuse Directory
Scrap Metal and Used Appliances
Scrap Tires
Single Stream Recycling
Student Landfill Tours
Trailer Disposal
TreadSpread Pilot Project
Used Cooking Oil and Kitchen Grease
Used Motor Oil and Antifreeze
Vehicles for Veterans
Wheels for Wishes and Wellness
Yard Waste, Composting, and Mulching

The county provides a variety of different programs. Detailed information on each program is available on the county's website.

Talbot County

Midshore's Household Hazardous Waste Drop-off Event is held yearly for residents interested in disposing of harmful products and materials properly. A list of acceptable and unacceptable materials is available for residents interested in participating. Newspaper and aluminum can be dropped off at the Amish Market and Graul's Market sites through the Izaak Walton League to help support their scholarship fund.

Washington County

Scrap metal and tires may be recycled at the landfill for a small fee. More information on the programs can be found in the Solid Waste Citizens Guide.

Wicomico County

Electronics recycling is offered to residents at the multiple drop off locations within the county.

Worcester County

Christmas tree drop off sites are available for residents in Ocean City near the end of the year/beginning of the new year. Christmas trees are then processed and turned into mulch at the Central Landfill.

The Town of Ocean City hosts an annual Spring Cleanup Event allowing residents to dispose of bulk items and debris free of charge. A Bulk Pickup program in Ocean City allows residents to place bulk items, such as furniture or appliances, on the curb for pickup for a fee.

The Recycling Process Center in the county produces materials created from recyclable materials and creates products sold to a variety of retailers.

Electronics may be recycled at convenience centers or the Central Landfill. Businesses and commercial operators must take electronics to the Central Landfill only. Most items may be dropped off free of charge. A list of items is available on the county's website. Waste oil may be dropped off for proper disposal at convenience centers and the Central Landfill. Households generating waste oil in Ocean City must drop oil off at the 66th Street location. White goods and bulk items may be dropped off at the Central Landfill with a homeowner's permit.

Research was pulled on Waste Diversion sources from state and local jurisdictions in November 2021 and were summarized by MDE staff.

Jurisdiction	Recycling	Composting	Anaerobic Digestion	Food Scrap Program	Other
State of Maryland	X	X	X	X	X
Allegany County	X	X			X
Anne Arundel County	X	X		X	X
Baltimore City	X	X		X	X
Baltimore County	X	X			X
Calvert County	X	X			X
Caroline County	X	X			X

Carroll County	X	X			X
Cecil County	X	X			X
Charles County	X	X			X
Dorchester County	X	X			
Frederick County	X	X			X
Garrett County	X	X			X
Harford County	X	X		X	X
Howard County	X	X		X	X
Kent County	X				X
Montgomery County	X	X		X	X
Prince George's County	X	X		X	X
Queen Anne's County	X				X
Somerset County	X				
St. Mary's County	X	X			X
Talbot County	X				X
Washington County	X	X			X
Wicomico County	X				X
Worcester County	X	X			X

Maryland
Department of
the Environment

Waste Minimization and Diversion Efforts in Maryland

Stakeholder Meeting #2 – June 23, 2021

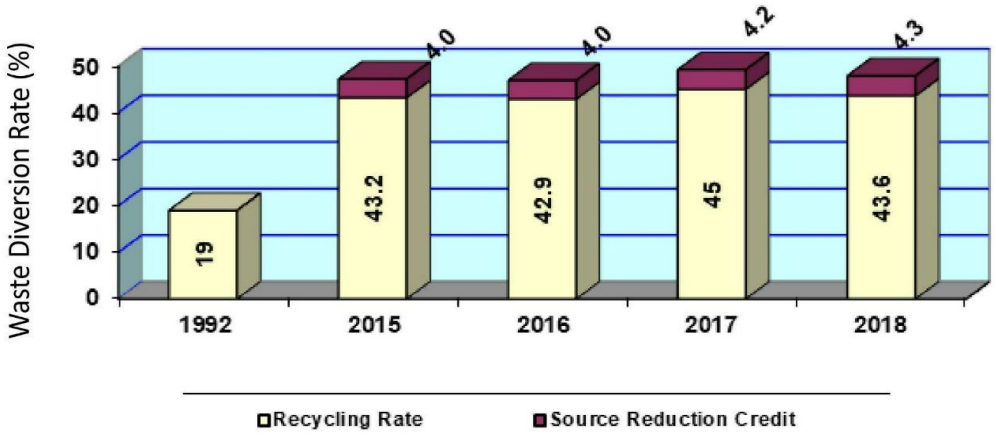
Presenters: Land Management Administration (LMA)

Maryland Recycling Act

- In 1988, the Maryland Recycling Act (MRA) (Chapter 536) mandated that Maryland reduce the overall amount of solid waste disposal in the state through improved management, education, and regulation
  - Each county, including Baltimore City, is required to develop and periodically update a recycling plan addressing certain topics
  - A county with a population greater than 150,000 is required to recycle 35% or more of its waste, and a county with a population of less than 150,000 is required to recycle 20% or more of its waste

2

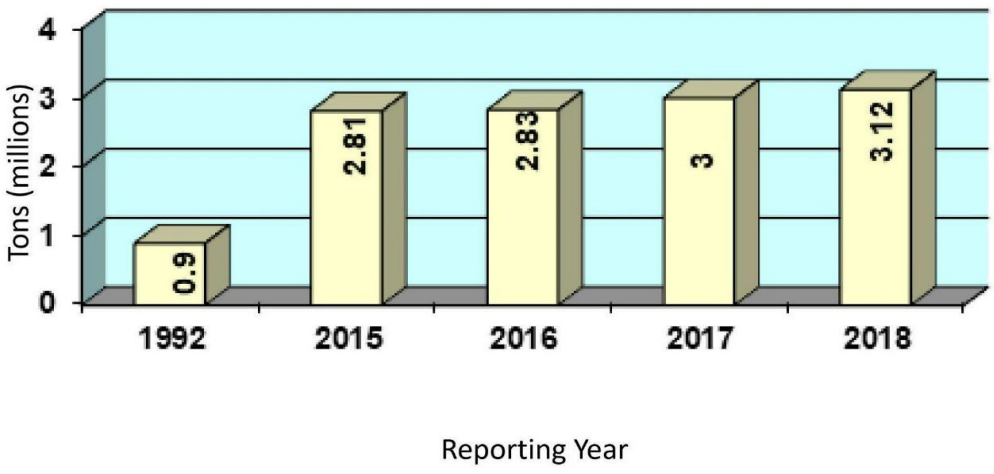
Waste Diversion Rates



Source: MDE – LMA, Waste Diversion and Utilization Program - Maryland State, County and City Recycling

3

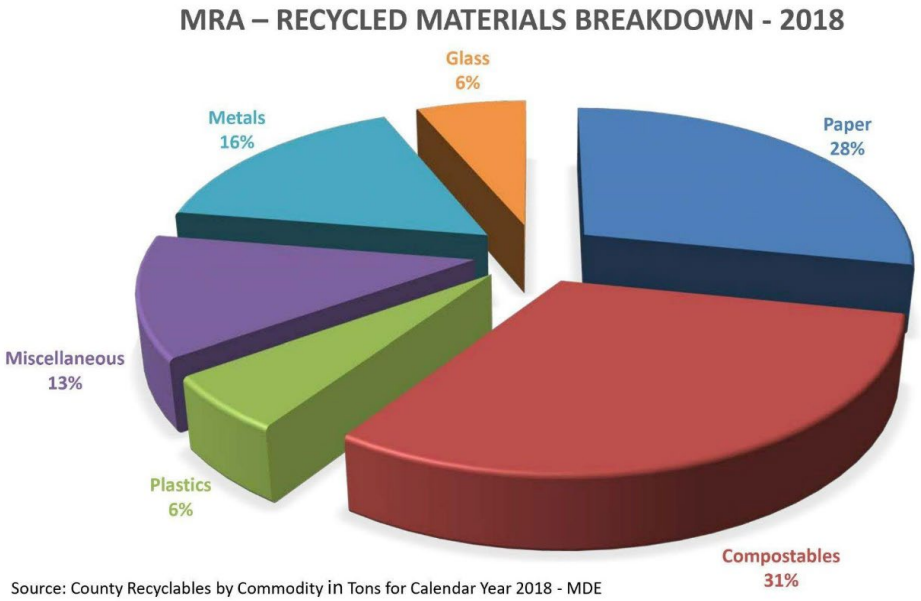
Recycling Tonnage



Source: MDE – LMA, Waste Diversion and Utilization Program - Maryland State, County and City Recycling

4

Materials Recycled



Source: County Recyclables by Commodity in Tons for Calendar Year 2018 - MDE

5

Sustainable Materials Management

- On June 27, 2017, Governor Hogan signed Executive Order 01.01.2017.13, *Waste Reduction and Resource Recovery Plan for Maryland.* The order emphasizes collaboration across state and local agencies, the private recycling sector, and citizens in order to establish and make meaningful progress toward waste diversion goals

- The executive order establishes a sustainable materials management policy for the state as follows:
  - Minimize the environmental impacts of materials management over their entire life cycles, including from product design to production, consumption, and end of-life management;
  - Conserve and extend existing in-State disposal capacity through source reduction, reuse, and recycling;
  - Capture and make optimal use of recovered resources, including raw materials, water, energy, and nutrients; and
  - Work toward a system of materials management that is both environmentally and economically sustainable in the long term

6

Sustainable Materials Management

- Sustainable materials management goals and metrics developed under the EO are available on MDE's web page at: https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Pages/Waste-Reduction-and-Resource-Recovery-Executive-Order.aspx

7

Waste Diversion in Maryland

8

Current and Upcoming Initiatives

- Improved data collection and tracking
  - Waste characterization study to identify and target the materials still being disposed in landfills (July 2017)
  - Expanded sustainable materials management goals and metrics (April 2019)
  - Efforts to encourage increased reporting of commercial recycling through online voluntary reporting (underway)
- Diverting food scraps from disposal
  - Composting regulations and general permit (22 operations currently permitted)
  - Organics diversion and infrastructure study (July 2019)
  - Anaerobic digestion regulatory guidance (July 2019)
  - Food waste minimization toolkit for Maryland schools (March 2020)
  - Food Recovery Summits (2016, 2018, and upcoming in December 2021)
  - New food residuals diversion requirement for certain large generators of food scraps (Ch. 439 of 2021)

9

Current and Upcoming Initiatives

- Recycling Business and Markets Development
  - Sustainable Materials Management Maryland (private sector-led group)
  - Greater coordination between Commerce and MDE on recycling business and permitting assistance
  - Sustainable materials management representative named at Commerce to assist prospective recycling businesses
  - Recycling market development
    - Viable markets and end uses for recycled materials are critical to diverting more material from the waste stream.
    - New market development program established under Ch. 289 of 2021
    - MDE's Office of Recycling will promote the development of markets for recycled materials
      - Conduct research, make recommendations, identify market development opportunities, provide resources to businesses, establish the "Maryland is Open for Recycling Business Campaign"

10


QUESTIONS …
11

Maryland Department of the Environment

Food Residuals Law

What You Need to Know

During the 2021 legislative session, the Maryland General Assembly passed House Bill 264, Solid Waste Management – Organics Recycling and Waste Division – Food Residuals, which would require certain "persons" that generate food residuals to separate said residuals and divert them from refuse disposal systems. This legislation was enacted under Article II, Section 17(c) of the Maryland Constitution - Chapter 439.

Categories

A *person*, as defined in the law, includes **large food waste generators** such as schools, supermarkets, business and institutional cafeterias, food manufacturers, etc. A *person* **does not** include a restaurant that accommodates the public and is equipped with a dining room with facilities for preparing and serving regular meals. Beginning **January 1, 2023**, the law applies to a person that generates at least 2 tons of food residuals each week and beginning **January 1, 2024**, it applies to a person that generates at least 1 ton of food residuals each week. Note that individual schools are considered separately under the law, as opposed to an aggregate of all school facilities within a school system.

Diversion Requirements

A person is **only required** to separate and divert food residuals if the residuals are generated within 30 miles of an organics recycling facility with capacity and willingness to enter into a contract to accept all of the person's food residuals. Diversion may be accomplished by any combination of the following: reducing residuals generated, donating servable food, managing residuals in an organics recycling system on-site, providing collection and transportation for agricultural use, and/or providing collection and transportation for processing in an organics recycling facility.

Documentation and Waivers

"Persons" should maintain documentation on-site, which includes items such as weight of food residuals generated each week and any correspondence between organics recycling facilities located within 30 miles.

The Maryland Department of the Environment may authorize a waiver from the requirement to divert food residuals if a person demonstrates food diversion costs in excess of 10% more than the cost of disposing the food residuals at a refuse disposal facility or for other reasonable circumstances.

Outreach, Education and Questions

Signup for our mailing list to learn about outreach and education at bit.ly/MDEFoodWasteSignup.

Please contact Shannon McDonald [Shannon.McDonald@maryland.gov, 410-537-3143] or Tim Kerr [Timothy.Kerr2@maryland.gov, 410-537-4205] in the Waste Diversion Division of the Land and Materials Administration with any questions.

1800 Washington Boulevard ▯ Baltimore, MD 21230 ▯ 800-633-6101 ▯ 410-537-3000 ▯ TTY Users: 800-735-2258

mde.maryland.gov

McDonald/LMA/Jun/2022

Appendix F - Emerging Landfill Emissions Monitoring Technologies

Aircraft Monitoring

For the last decade, scientists and researchers have used aircraft to both measure and monitor methane emissions. It involves the use of atmospheric methane concentrations and models that account for atmospheric transport from emitter observation towers and aircraft.

The method has several advantages, which include it can measure emissions from all sources in a sampled region and the methane emissions can be linked to CO2 emissions inventories. However, aircraft monitoring does have disadvantages and limitations. The method of emissions monitoring is not very cost-effective, is limited with regards to historical data, and subject to accommodating weather and scheduling issues. Also, while this method generally measures emissions from all sources in a sampled region, it may have difficulty attributing emissions to specific sources. There are also challenges with seasonal, diurnal, and meteorological variations on measurement accuracy.

Optical Gas Imaging

Optical gas imaging (OGI) employs the use of a portable infrared cameras that produces an image of gas leaks that would otherwise be invisible. The technology is commonly used to detect leaks in the upstream and midstream sectors of the oil and gas sector, which includes wellheads, compressor stations, petroleum refineries, natural gas processing plants, and gasoline distribution facilities.

Optical gas imaging has been increasing utilized in other sectors such as locating and detecting leaking landfill gas in landfills. While the technology is used for leak detection, it is currently not applicable for quantitative measurements (e.g., emission rates) from sources.

Drones

Drones are a low-altitude emissions monitoring technology that has been used extensively over the last decade in the oil and gas industry to detect localized methane leaks and hotspots. In recent years this technology has been adapted for use with landfills, specifically to prevent fires – as drones fitted with infrared (thermal) sensors can detect hotspots on the landfill surface. Landfill owners and operators can also use drones to detect and mitigate methane leaks over large surface areas. The technology can even be used to inspect areas of the landfill surface for poor cover integrity.

Drones have a slight costs and labor advantages over other monitoring methods that the drone operator can monitor and inspect surface areas of landfills more quickly than traversing the landfill with a handheld hydrocarbon device. This can eliminate the need to transverse active cells or potentially high-risk areas of the landfill to take measurements or conduct inspections.

However, like other monitoring technologies, drones cannot be used during adverse weather conditions such as rain or wind gusts.

Maryland
Department of
the Environment

COMAR 26.11.42 – Control of Methane Emissions from Municipal Solid Waste (MSW) Landfills

AQCAC October 24, 2022

Updating MSW Landfill Regulations Webinar

- Welcome to today's meeting!
- This meeting is being Recorded .
- mde.maryland.gov/programs/workwithmde/Pages/aq_cac.aspx

Maryland
Department of the Environment

Overview of Presentation

- Background
- Overview and Discussion of Regulatory Requirements
- Rulemaking Process

Why Leaking Methane From Landfills is an Even More Important Issue than We Previously Thought

- Maryland's recent efforts to update our inventory for the Greenhouse Gas Emission Reduction Act (GGRA) have covered all emission sectors for carbon dioxide (CO_2), methane (CH_4) and other greenhouse gases (GHG)

- Landfills are the largest methane emission source in the Maryland Department of the Environment (MDE) inventory

Maryland Commission on Climate Change (MCCC)

- Original Climate Change Commission established through Executive Order in 2007
  - Developed a 2008 Climate Action Plan that led to the 2009 GGRA
- GGRA reauthorized in 2016 with new goal of 40% GHG reduction by 2030
- MCCC codified in 2015, established a balanced, bipartisan Commission
  - Representatives from the Maryland General Assembly, state and local government, the private sector, environmental advocacy groups, labor, the general public & more

- Basic charge of the MCCC:
  - Provide recommendations on how to reduce GHG emissions and adapt to the impacts of climate change
  - Reducing leaking methane emissions has been a very high priority for the MCCC

Climate Change – Increasing Urgency

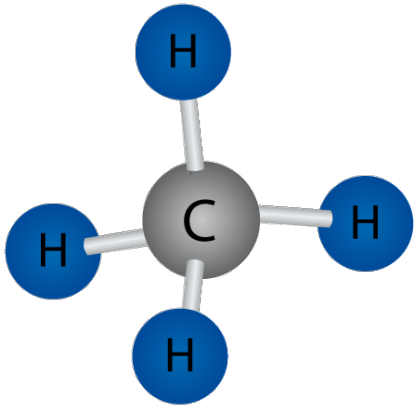
- MDE continues to rely on scientific evidence to guide its regulatory process
- The international research community is urging for quicker action to reduce GHG emissions to prevent negatively impacting public health due to rising temperatures and increases in the frequency of extreme weather events
  - This is exemplified by the experience of communities in Ellicott City, which have had to deal with three “once in a thousand-year rainfall events” over the last decade alone
- In early 2021, MDE submitted the final 2030 GGRA Plan to the Governor and the Maryland General Assembly

Climate Solutions Now Act of 2022

- Maryland now has the most ambitious GHG reduction goals of any state in the nation:
  - Reduce statewide GHG emissions 60% (from 2006 levels) by 2031
  - Achieve net-zero statewide GHG emissions by 2045
- 20-year global warming potential (GWP) for methane
  - More info on this on the next slide
- Landfill regulation is a critical measure for meeting the state's GHG reduction goals
- Building Energy Performance Standards
  - More on this soon

Methane Potency

- Climate Solutions Now Act of 2022 directs MDE to use the 20-year time horizon when considering the GWP of GHGs
- The 20-year GWP is now the standard measurement for evaluating progress towards Maryland's GHG reduction goals
- Methane is a super potent GHG
  - 28 times the warming impact of CO_2 over 100 years
  - Over 80 times the warming impact of CO_2 over 20 years



Source: mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx

Maryland's 2020 GHG Inventory

MDE recently released the MD GHG Emissions Inventory for 2020

- The state reached 30% reduction from 2006
- New goals
  - 60% reduction by 2031
  - Net-zero by 2045

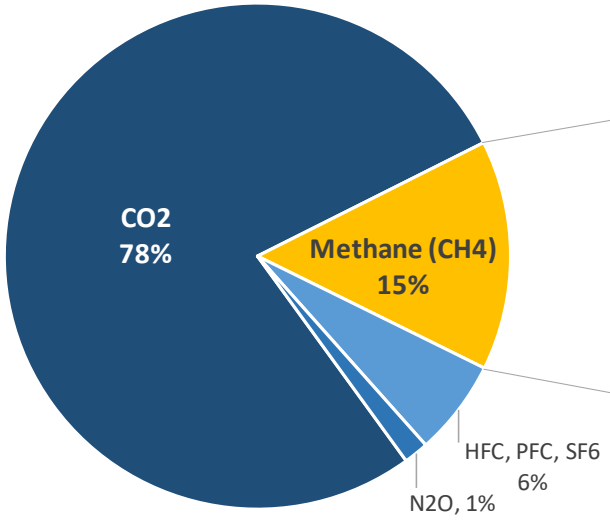
Methane makes up 15% of the state's GHG emissions

- Using the 20-year Global Warming Potential
- Methane = 84 times the warming impact of CO_2

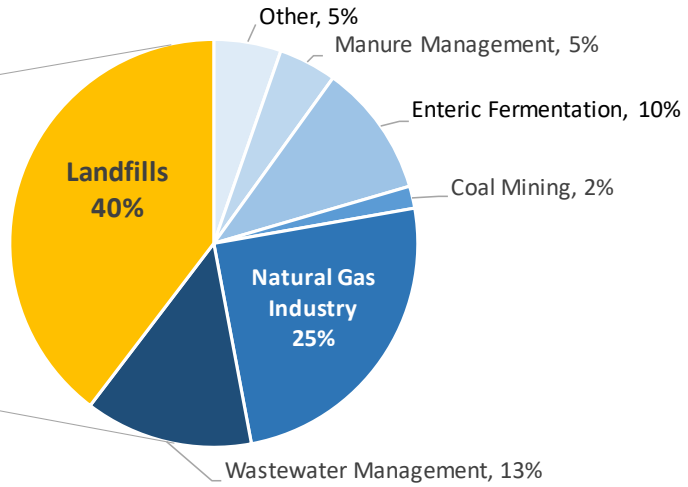
Landfills make up 40% of the state's methane emissions

- The largest methane emission source in the inventory

2020 MD Greenhouse Gas Emissions, % by gas
(total of 85.1 MMTCO2e, using 20-year GWP)



2020 MD Methane Emissions, % by source
(total of 12.5 MMTCO2e, using 20-year GWP)




RECENT COMMENTS

MDE Received Many Comments from Stakeholder Meetings Over Past 3 Years

Diverse comments and public input from advocacy groups, nonprofits, landfill owners and operators, and concerned residents

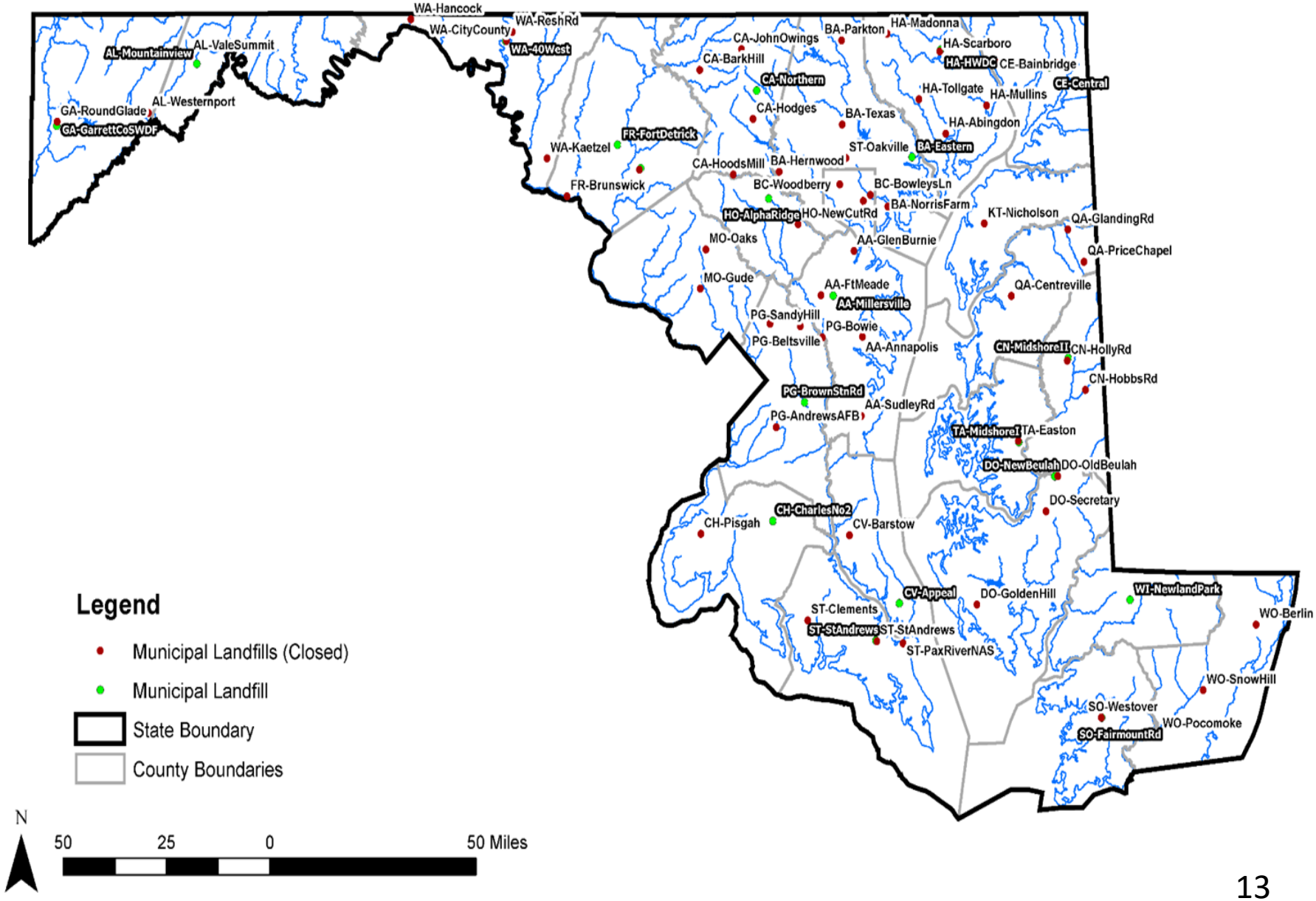
Most comments were driven by concerns over climate change and waste diversion

Other comments were driven by implementation concerns and enforcement and compliance issues

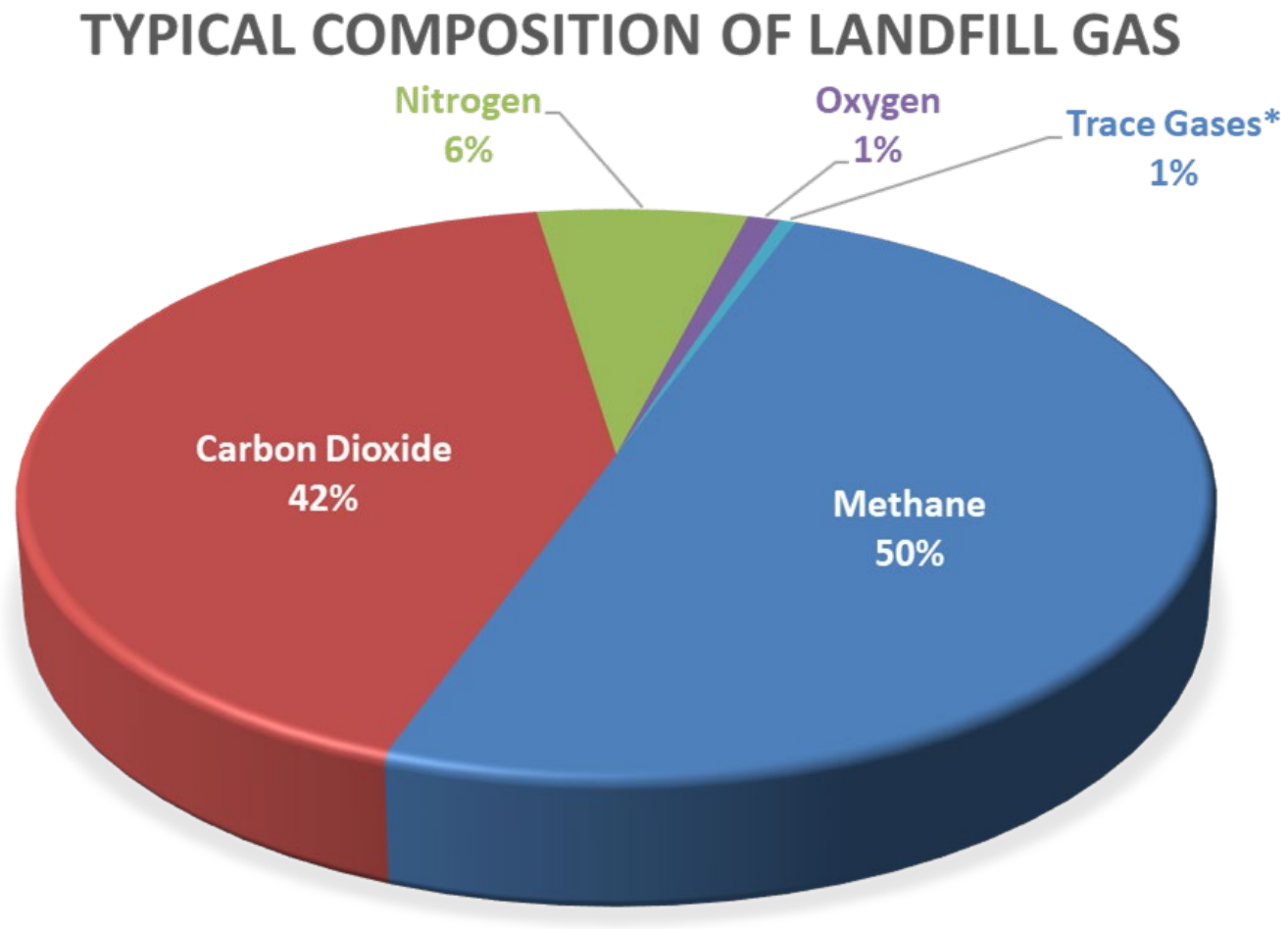
Some comments encouraged the use of voluntary measures and incentives to supplement any regulatory requirements for MSW landfills


BACKGROUND

Municipal Solid Waste Landfill Facilities in Maryland



Municipal Solid Waste (MSW) Landfill



*Trace gases includes ammonia, non-methane organic compounds (NMOC), sulfides, hydrogen, and carbon monoxide

Source: atsdr.cdc.gov/HAC/landfill/html/intro.html

Existing MD Regulations Applicable to MSW Landfills

- Subtitle: Regulation of Water Supply, Sewage Disposal, and Solid Waste
  - COMAR 26.04.07.04 - Sanitary Landfills — General
  - COMAR 26.04.07.06-08 - Sanitary Landfills — Municipal Landfills — Phase I-III Reports
  - COMAR 26.04.07.09 - Sanitary Landfills — Municipal Landfills — Other Requirements For Permits
  - COMAR 26.04.07.10 - Sanitary Landfills — Municipal Landfills — Minimum Operating Procedures
- Subtitle: Maryland CO_2 Budget Trading Program
  - COMAR 26.09.03.03 - Landfill Methane Capture and Destruction Project Standards
- Subtitle: Air Quality
  - COMAR 26.11.19.20 - Control of Landfill Gas Emissions from Municipal Solid Waste Landfills

Federal Regulations Applicable to MSW Landfills

- 40 CFR 60, Subpart Cf (Emission Guidelines) (*August 29, 2016*)- applies to MSW landfills that accepted waste after November 8, 1987 and have commenced construction, modification, or reconstruction on or before July 17, 2014

- 40 CFR 60, Subpart XXX (New Source Performance Standards) (*August 29, 2016*)– applies to MSW landfills for which construction, reconstruction, or modification commenced after July 17, 2014

- 40 CFR 63, Subpart AAAA (National Emissions Standards for Hazardous Air Pollutants) for MSW landfills (*March 26, 2020*)

- 40 CFR 62, Subpart OOO (*May 21, 2021*) – applies to existing MSW landfills in states without a state plan


DISCUSSION OF REQUIREMENTS

MDE's Regulatory Approach

- Two basic drivers:
  - The new federal New Source Performance Standards (NSPS) and Emission Guidelines (EG) for MSW landfills
  - The need for additional requirements to minimize leaking methane emissions as part of the State's climate change efforts
- MDE looked at prior and current regulatory efforts on MSW landfills in other states

Source: https://pixabay.com/photos/antietam-maryland-burnside-bridge-80552/)

MSW Landfills - Applicability

Requirement	NSPS (Subpart XXX) and EG (Subpart Cf)	COMAR 26.11.42
Applicability	**Type**: MSW Landfills	**Type**: MSW Landfills
	Size: ≥2.5 million megagrams (Mg) waste mass and 2.5 million cubic meters (m^3) waste volume	**Size**: ≥450,000 tons of waste-in-place (WIP)
	Age: EG - Existing MSW landfills constructed, reconstructed, or modified on or before July 17, 2013, and accepted waste after November 8, 1987 NSPS - MSW landfills constructed, reconstructed or modified after July 17, 2014	**Age**: MSW landfills that received waste after November 8, 1987

MSW Landfills - Exemptions

Requirement	NSPS (Subpart XXX) and EG (Subpart Cf)	COMAR 26.11.42
Exemptions	**Size**: <2.5 million megagrams (Mg) waste mass and 2.5 million cubic meters (m^3) waste volume	**Size**: Closed and inactive MSW landfills with <450,000 tons WIP or a design capacity less than 2.75 million tons and 3.26 million m^3 that last accepted waste on or before December 31, 1993
	Types: Hazardous waste landfills, C&D landfills, landfills regulated under Environmental Response, Compensation, and Liability Act (CERCLA)	**Types**: Landfills permitted to accept controlled hazardous substances as defined in COMAR 26.13.01.03B, landfills regulated under CERCLA
		Additional: Closed or inactive MSW landfills (or closed or inactive areas of an active MSW landfill) that have installed and operated solar panels or arrays on or before January 1, 2024 that meet certain conditions

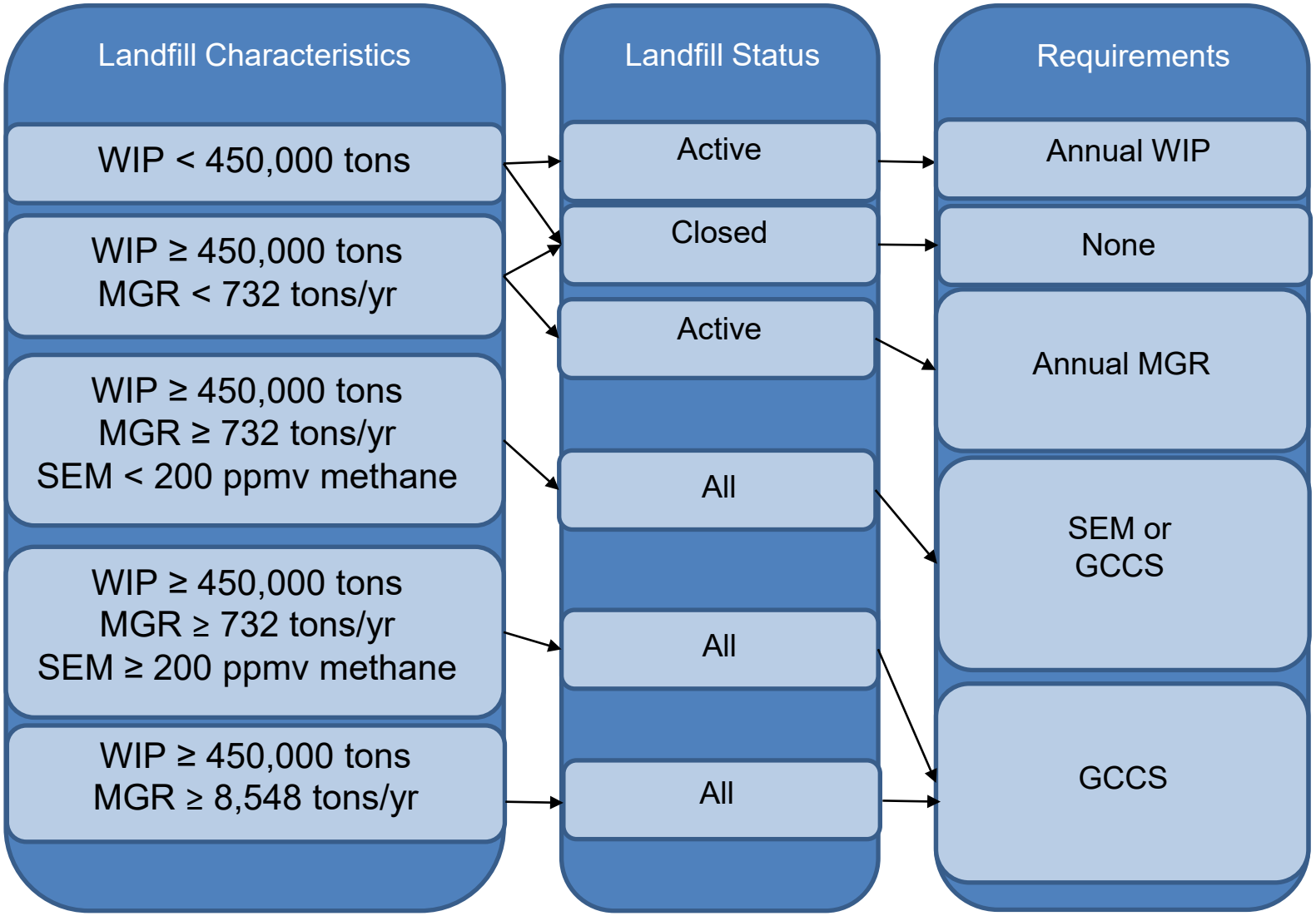
Proposed Requirements For MSW Landfills

Requirement	MSW Landfills <450,000 Tons WIP	MSW Landfills ≥450,000 Tons WIP
Reporting – Waste in Place (WIP)	**Active MSW Landfills**: Submit annual tonnage reports until WIP ≥450,000 tons or submittal of closure notification to MDE	**Active and Closed MSW Landfills**: Submit initial waste-in-place report
Methane Generation Rate Report	Not Applicable	**Active and Closed MSW Landfills**: Calculate the methane generation rate and submit report to MDE
Liquids Addition (Bioreactor Landfills)	Not Applicable	Landfills that add liquid other than leachate in a controlled fashion to reach a minimum average moisture content of at least 40 % by weight to accelerate or enhance the anaerobic biodegradation of the waste are required to install and operate a gas collection and control systems and comply with requirements of the regulation
Maintenance Standards	Maintain cover integrity and implement program for cover repairs	Maintain cover integrity and implement program for cover repairs

Proposed Requirements
Methane Generation Rate

Calculated Methane Generation Rate	MSW Landfills <450,000 Tons WIP	MSW Landfills ≥450,000 Tons WIP
<732 tons/yr	Not Applicable	**Active MSW landfills**: Calculate annually until methane generation rate ≥732 tons/yr or submittal of closure notification to MDE **Closed or Inactive MSW Landfills**: Submit final methane generation report and closure notification report to MDE
≥732 tons/yr - <8,548 tons/yr	Not Applicable	**Active and Closed MSW Landfills**: Install and operate a GCCS or demonstrate via quarterly surface emission monitoring (SEM) methane concentration levels <200 ppmv
≥8,548 tons/yr	Not Applicable	**Active and Closed MSW Landfills**: Install and operate a GCCS and comply with the requirements of the regulation

Flowchart of Requirements for MSW Landfills



Proposed Requirements
Surface Emissions Monitoring

Quarterly SEM	MSW Landfills <450,000 Tons WIP	MSW Landfills ≥450,000 Tons WIP
Methane Concentration Levels <200 ppmv	Not Applicable	**Active MSW Landfills**: Recalculate methane generation rate annually, continue quarterly SEM, and submit annual instantaneous SEM report to the Department **Closed MSW Landfills**: Submit final WIP report, closure notification, final 1-yr SEM report, and satisfy requirements for permanent shutdown and removal of GCCS
Methane Concentration Levels ≥200 ppmv	Not Applicable	Install and operate a GCCS and comply with the requirements of the regulation
Timetable and Frequency		Monitoring must be conducted four times a year (quarterly) Quarterly surface emission monitoring must be conducted no less than 90 days after submitting methane generation report

Proposed Requirements
Gas Collection and Control Systems

Requirement	Description
Design Plan and Installation – Timetable	If a GCCS meeting the requirements in the regulation has not been installed, landfill owners and operators must submit a design plan within 1 year of: • Effective date of the regulation, or • Detecting any measured concentration of methane of 200 ppmv or greater during surface emission monitoring
	Landfill owners and operators must install and operate the GCCS within 30 months after approval of the design plan
Operating Standards and Requirements	Stipulates landfill owners and operators must satisfy certain standards and requirements when operating a GCCS, including routing or drawing the landfill gas to the gas control device

Proposed Requirements
Gas Collection and Control Systems

Requirement	Description
Operating Standards and Requirements	**Enclosed Flares**: Must achieve a destruction efficiency of at least 99% by weight and meet certain specifications in the regulation **Open Flares**: Landfill owners and operators are allowed to operate existing flares until January 1, 2025; after this date only with approval by MDE; flares must be operated in accordance with 40 CFR §60.18 **Control Devices other than Flares**: Allows for the use of control devices other than flares if it meets one of the following requirements: The device is a process heater or boiler with a design heat input capacity ≥44 megawatts; the collected gas is routed to an energy recovery device or series of devices; or the collected gas is routed to a treatments system for subsequent sale or use

Proposed Requirements
Gas Collection and Control Systems

Requirement	Description
Performance Testing	**Timetable**: Landfill owners and operators must conduct performance test using test methods and procedures specified in the regulation within 180 days of startup for new devices (initial performance test) and 180 days of the effective date of the regulation for existing units
	Additional Requirement for New Devices: Conduct subsequent annual test with 45 days of the 1-year anniversary of the initial performance test
	Conditions: Tests may not be conducted during periods of malfunction
	Schedule: Annually, but if the device remains in compliance after three consecutive performance test, the owner or operator may conduct performance tests every 3 years, but if any device is out of compliance during the 3-year test schedule, the frequency returns to an annual basis
	Exemptions: Performance tests are not required for boilers and process heaters with a design heat input capacity ≤44 megawatts that burns landfill gas in accordance with the requirements for control devices other than flares

Proposed Requirements
SEM – Instantaneous Emissions Standard

Requirement	Description
SEM- Instantaneous Emissions Standard	**Emission Limit**: *With GCCS*: No location on the MSW landfill surface may exceed the 500 ppmv methane concentration limits, as determined by instantaneous surface emissions monitoring *Without GCCS*: The owner or operator must record any instantaneous surface readings of methane 200 ppmv or greater, other than non-repeatable, momentary readings
	Method: Walking pattern with 25-foot spacing interval and traverse each monitoring grid
	Frequency: Quarterly. Closed or inactive landfills or closed or inactive areas of active landfills can shift to an annual basis. The frequency returns to an annual basis with an exceedance of the methane concentration limit
	Corrective Actions: Include cover maintenance, cover repair, or well vacuum adjustments

Proposed Requirements
SEM – Integrated Emissions Standard

Requirement	Description
SEM - Integrated Emissions Standard	**Emission Limit**: No location on the MSW landfill surface may exceed an average methane concentration limit of 25 ppmv as determined by integrated surface emissions monitoring
	Method: Integrated surface readings must be recorded and then averaged for each grid
	Frequency: Quarterly. Closed or inactive landfills or closed or inactive areas of active landfills can shift to integrated monitoring on an annual basis. The frequency returns to an annual basis with an exceedance of the methane concentration limit
	Corrective Actions: Individual monitoring grids that exceed an average methane concentration of 25 ppmv must be identified and remediated

Proposed SEM - Frequency, Exceedances and Testing

Requirement	Description
SEM - Frequency	Quarterly for both instantaneous and integrated SEM. Closed or inactive landfills or closed or inactive areas of active landfills can shift to monitoring on an annual basis. The frequency returns to an annual basis with an exceedance of the methane concentration limit
SEM - Exceedances	Surface areas of the MSW landfill that exceed a methane concentration limit of 500 ppmv must be marked and remediated
SEM - Surface Area Testing	The landfill surface areas with cover penetrations, distressed vegetation, cracks or seeps must also be inspected visually and with a hydrocarbon detector

Proposed Requirements
SEM - Instrumentation, Coverage and Spacing

Requirement	Description
SEM - Instrumentation	Any instrument used for the measurement of methane must be a gas detector or other equivalent instrument must meet the calibration, specifications, and performance criteria of EPA Reference Method 21, “methane” replaces all references to VOC
SEM - Landfill Area	The entire landfill surface must be divided into individually identified 50,000 square foot grids (both integrated and instantaneous monitoring)
SEM - Spacing and Patterns	The walking pattern must be no more than a 25-foot spacing interval and must traverse each monitoring grid. Spacing intervals can be modified after successful quarterly tests over a specific timeframe

Proposed Requirements
SEM – Testing Conditions

Requirement	Description
SEM–Meteorological Conditions	**Conditions for conducting surface emissions monitoring**: Testing cannot be performed when average wind speed exceeds 25 miles per hour (mph) A wind barrier (similar to a funnel) shall be used when onsite average wind speed exceeds 4 mph (2 meters per second) or gust exceeding 10 mph The wind barrier must surround the surface emission monitoring monitor and make contact with the ground to ensure wind turbulence is blocked Average wind speed determined using 15-minute average using an on-site anemometer with a continuous recorder for the entire duration of the monitoring event Surface emissions testing must be conducted only when there has been no measurable precipitation in the preceding 72 hours

Proposed Requirements
Gas Control System Equipment Monitoring

Equipment	Requirements
Enclosed Flares	Install, operate and maintain the following equipment according to manufacturer's specifications: • A temperature monitoring device equipped with a continuous recorder which has an accuracy of plus or minus (±) 1 percent of the temperature being measured, and • A device that records the gas flow to the control device(s) and the bypass of the control device
Boilers and Process Heaters	Similar to enclosed flares except a temperature monitoring device is not required for boilers and process heaters with a design input capacity >44 MW
Devices other than Enclosed Flares	Install, operate and maintain the following equipment according to manufacturer's written instructions and specifications: • An operating description of the gas control device • Operating parameters that would indicate proper performance, and • Monitoring procedures

Proposed Requirements
Gas Control System Equipment Monitoring

Requirement	Description
Component Leak Testing	**Component Leaks**: Components containing landfill gas and under positive pressure are required to be monitored for leaks on a quarterly basis: • Component leaks of ≥500 ppmv are to be tagged and repaired within 10 days • Component leaks of ≥250 ppmv are to be recorded
	MSW Landfills with Landfill Gas to Energy Facilities: Quarterly component leak testing conducted prior to scheduled maintenance or planned outage periods
	Additional: Gauge pressure in the gas collection header applied to each individual well must be measured on a monthly basis. • If positive pressure exists (unless otherwise noted), action must be initiated to correct the positive pressure within 5 days. • Any attempted corrective action may not cause exceedances of other operational or performance standards

Proposed Requirements
Wellhead Monitoring

Requirement	Description
Monitoring Parameters	Requires monthly monitoring of each individual wellhead to determine and record the gauge pressure, temperature, and nitrogen and oxygen content of gas emissions
Corrective Actions (Exceedances)	Requires corrective action for positive pressure at wellheads (exclusions for well raising and wellhead sampling)
	Requires corrective actions for a well that exceed the operating parameter for temperature be initiated within 5 days
Additional	Landfills may not cause exceedances of other operational or performance standards from any attempted corrective measures

Proposed Requirements Monitoring Systems – Malfunction, Repair and Other Activities

Requirement	Description
Applicability	Apply at all times except for periods of monitoring system malfunctions, repairs associated with monitoring system malfunctions, and required monitoring system quality assurance or quality control activities
Malfunctions	Any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data is considered a monitoring system malfunction Monitoring system failures that are caused in part by poor maintenance or careless operation are not malfunctions
Repairs	Monitoring system repairs completed in response to monitoring system malfunctions to return the monitoring system to operation are to be completed as expeditiously as possible

Proposed Requirements – Additional Requirements and Standards for MSW Landfills

- Alternative Compliance
- Recordkeeping and Reporting
- Permanent Shutdown of GCCS
- Test Methods and Procedures

Solar Panels and Arrays at MSW Landfills

- Land Management Administration (LMA) at MDE approves solar panel requests
- Landfills that meet the following criteria are exempt under the regulation:
  - Closed MSW landfills or inactive areas of active MSW landfills that closed or last accepted waste prior to July 17, 2014
  - Have less than 2,750,000 tons or 3,260,000 cubic yards of MSW
  - Have solar panels or arrays that were installed prior to January 1, 2024

Solar Panels and Arrays at MSW Landfills (cont.)

- Maryland encourages and supports solar development at landfills
- After January 1, 2024, closed MSW landfills or closed areas of active landfills with less than 2,750,000 tons or 3,260,000 cubic yards of MSW that newly install and operate solar panels or solar arrays will be required to meet certain requirements
- Large landfills with waste capacity over 2,750,000 tons can install and operate solar panels or arrays and will be required to meet certain requirements
- Requirements:
  - An approved plan from MDE Solid Waste for the installation and operation of solar panels
  - Comply with specific maintenance requirements
  - May be required to submit an alternative compliance plan for surface emissions monitoring

Estimated Emission Reductions

- Factors to consider when estimating methane gas emissions from landfills…
  - Landfill gas generation is a function of temperature, waste composition, landfill size, waste compaction, liners and covers, moisture content, pH level, etc.
  - Rate of landfill gas generation occurs in four phases – generation is greatest 5-7 years after waste is placed (Phase II), gas is produced for several decades (Phase III), and exponentially declines after cessation of waste placement (Phase IV)

- MDE anticipates a reduction in methane gas emissions as a result of increased monitoring, minimizing and fixing leaks, and increased methane capture

- MDE estimates a 25-50% reduction in landfill gas emissions (CO_2 and CO_2e methane – using a GWP of 28) from landfills subject to the proposed regulation when fully implemented

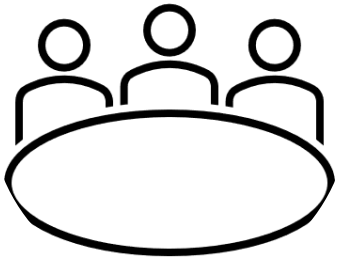
Estimated Costs - Compliance

Estimated compliance costs (per landfill) would vary based on applicability, status (i.e., closed or open), reporting and monitoring requirements, and control costs‡:

Category	Avg Costs (Est.)
Landfills Subject to Reporting Requirements Only	$4,000†
Landfills Subject to Reporting, Monitoring and Control Requirements:	
Reporting	$4,000+†
Monitoring	$60,000†
Capital Costs	$1-3 Million
Operation and Maintenance (O&M)	$150,000-$400,000†

† - Costs on an annual basis

Regulatory Schedule – Key Dates

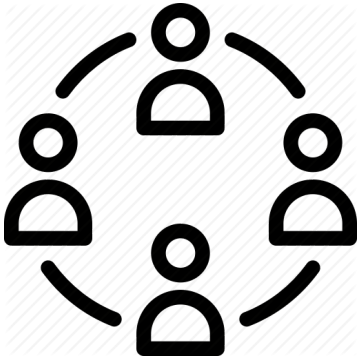


Propose Regulation and Present to AQCAC

October 2022

Signatures for Adoption Process, AELR Review

November 2022



Proposed Regulation

December 2022

Public Hearing and Final Adoption

Approximately 5 Months


QUESTIONS & DISCUSSION

Appendix H – Links to Oregon and California Landfill Methane Regulations

California (California Air Resources Board (CARB))

Landfill Methane Regulation (Main Page): Landfill Methane Regulation | California Air Resources Board

Current Regulation (2010): Methane Emissions from Municipal Solid Waste Landfills Regulation (ca.gov)

Landfill Methane Regulation Implementation Guidance Document: Implementation guidance document for the regulation to reduce methane emissions from municipal solid waste landfills (ca.gov)

California State Plan for Compliance with U.S. EPA's Landfill Emission Guidelines: California State Plan for Compliance with U.S. EPA's Landfill Emission Guidelines | California Air Resources Board

Memoranda of Understanding: Memoranda of Understanding with Air Districts | California Air Resources Board

Oregon (Department of Environmental Quality (DEQ))

Landfill Gas Emissions 2021 (Main Page): Department of Environmental Quality : Landfill Gas Emissions 2021 : Rulemaking at DEQ : State of Oregon

Staff Report (includes current regulation): EQC Staff Report (oregon.gov)

Presentation Slides: Landfill Gas Emissions Rulemaking (oregon.gov)