Maryland
Department of the Environment

Updating Maryland's Municipal Solid Waste (MSW) Landfill Regulations

Stakeholder Meeting #2 – June 23, 2021

Presenters: Tad Aburn - MDE, Eddie Durant – MDE

Topics for Discussion

- An Increased Focus on Leaking Methane from Landfills
- Recent Stakeholder Input
- Background
- Overview and Discussion of Potential Regulatory Requirements
- Wrap-Up/Next Steps


UMD METHANE RESEARCH

New Analyses

Why Leaking Methane From Landfills is an Even More Important Issue than We Previously Thought

- A significant amount of new research show that methane emissions from landfills are larger than earlier emission estimates had projected

- Maryland's recent efforts over the last year to update our inventory for the Greenhouse Gas Emission Reduction Act (GGRA) have covered all emission sectors for carbon dioxide (CO_2), methane and other greenhouse gases (GHG)

- MDE updates to the methane inventory for landfills have increased statewide methane emissions from landfills by a factor of three

Methane Emissions Research

- Research on methane emissions has increased dramatically over the past 3 years
- A significant national research interest driven by climate change and methane's high potency
- Researchers include
  - University of Maryland (UMD)
  - National Aeronautics and Space Administration (NASA)
  - National Institute of Standards and Technology (NIST)
  - National Oceanic and Atmospheric Administration (NOAA)
  - Others

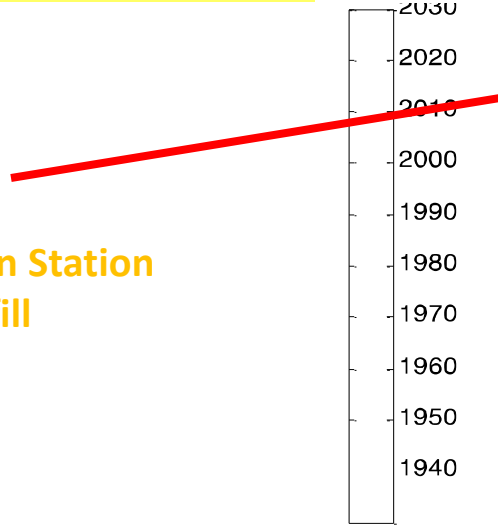
University of Maryland Methane Research

- U of M and NIST use airplanes, air monitoring towers and other measurement tools to study methane
- Their current research (plus NOAA) indicates that methane emissions across the country may be underestimated by a factor of almost two or more
  - This includes the MD inventory
- U of M has been working collaboratively with MDE to try and use the “top down” research to enhance the State’s “Bottom Up” estimates of statewide and source specific methane emissions

One Example of an Aircraft Flight Measuring Methane

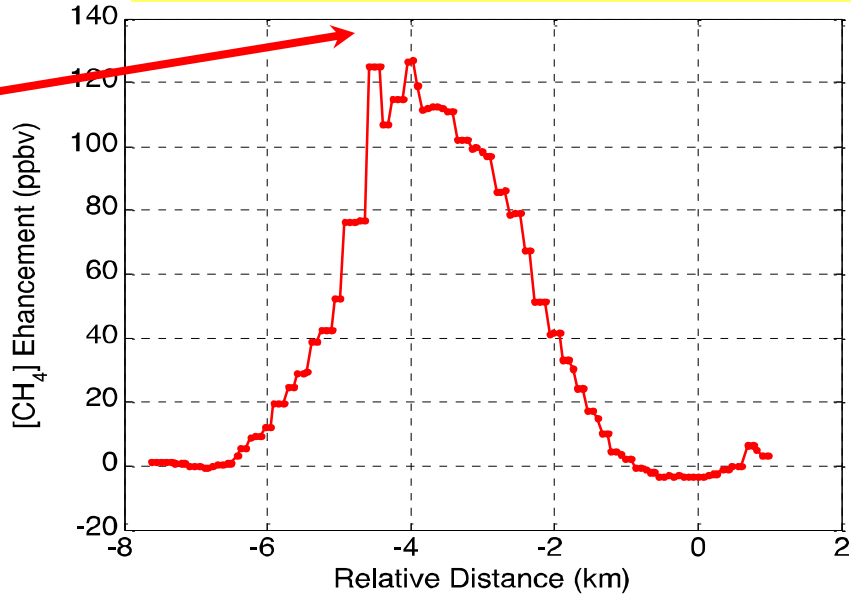
February 20, 2015

Flight Path and Concentrations



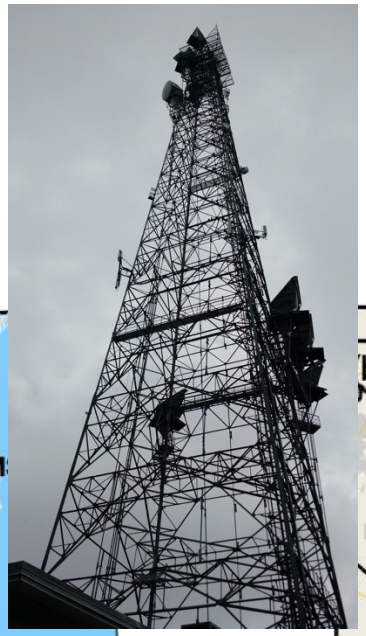
Brown Station Landfill

Concentrations Around Brown Station Road

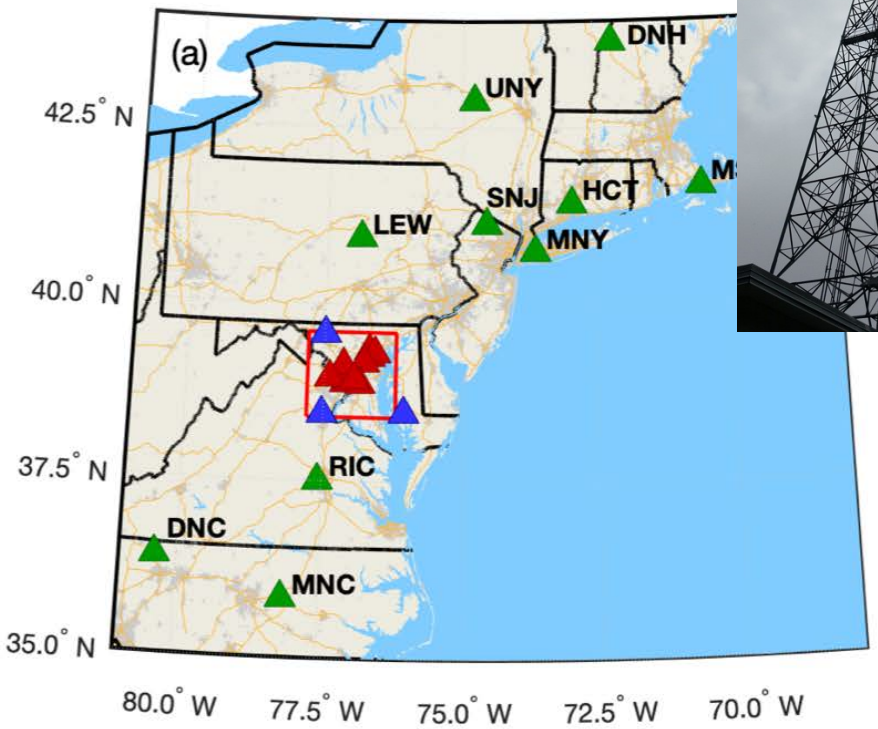


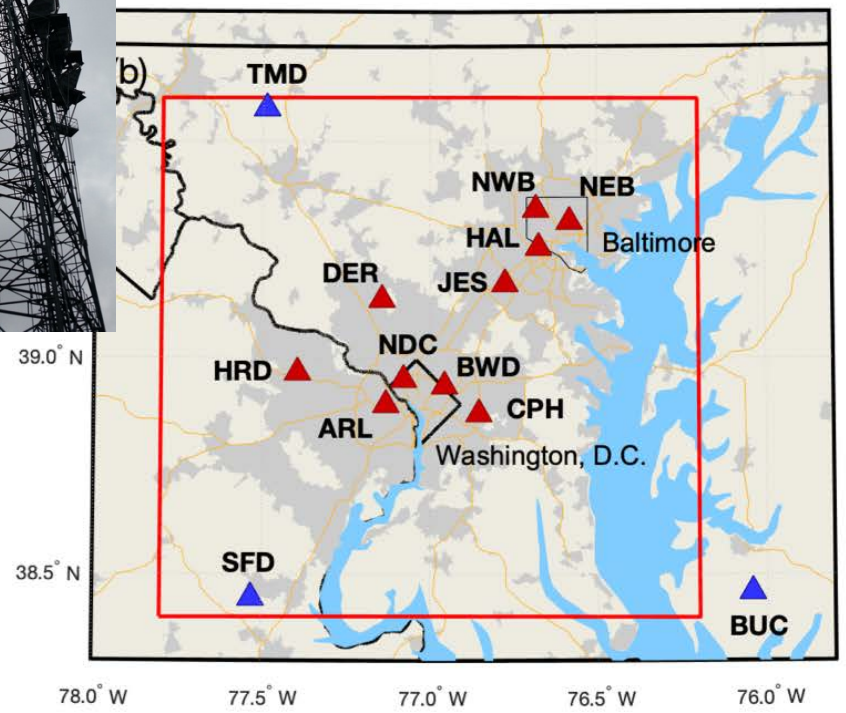
UMD, NIST, Earth Networks Tower Array for Measuring Methane

The array has been measuring methane since 2017. Two towers along the East Coast (BUC & GER) since 2012



Towers clustered in the Baltimore/Washington area - measure methane and CO_2 continuously

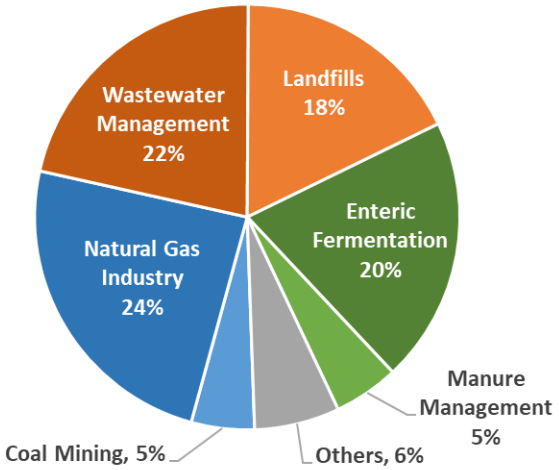




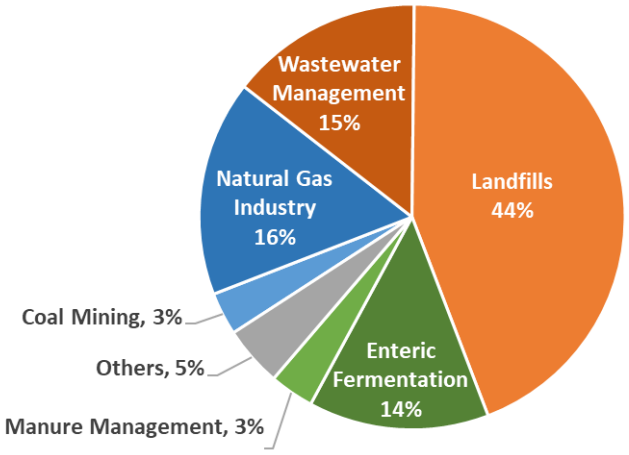
Changes to the Methane Inventory that are in the Works

- MDE has been working on an update to the statewide GHG inventory for all sectors for over a year
- All greenhouse gases including methane
- The update for leaking methane from landfills increases the estimated emissions of methane from landfills significantly

2017 Methane Emissions - Originally Published
(Total = 1.89 MMTCO2E, GWP=21)



2017 Methane Emissions - 2021 Update
(Total = 3.71 MMTCO2E, GWP=28)



What the Research and Other Analyses are Telling Us … *The Bottom Line*

- Methane emissions have been underestimated across the country for years
- Methane emissions from landfills are up to four times higher than we previously thought
- Our efforts to minimize leaking methane from landfills has always been important … now they are extremely important


RECENT COMMENTS

MDE Received Many Comments from Stakeholders Over the Past Few Months

- South Baltimore Community Land Trust
- Chesapeake Physicians for Social Responsibility
- Howard County Climate Action
- Sierra Club – Maryland Chapter
- National Waste & Recycling Association
- Howard County DPW
- Chesapeake Climate Action Network
- Clean Air Task Force
- Glen Echo Heights Mobilization
- Echotopia, LLC
- Takoma Park Mobilization Environmental Committee
- Baltimore 350
- Climate Law & Policy Project
- Cedar Lane Unitarian Universalist Church – Environmental Justice Ministry
- Assateague Coastal Trust
- Ji'Aire's Workgroup
- Black by Nature EJA
- Maryland Legislative Coalition
- Greenbelt Climate Action Network
- Nuclear Information Resource Service
- Environmental Integrity Project

- Most comments were from non-profits and advocacy groups and were driven by concerns over climate change and waste diversion
- Also received comments from landfill operators mostly driven by implementation concerns

Comments Generally Focused on the Following Issues

- Enforcement and compliance issues linked to the federal 2016 EG/NSPS for MSW landfills
- Concerns over duplicative requirements
- Waste diversion as the ideal strategy - diversion of organic waste and recyclable materials from MSW landfills
- Maryland should consider adopting stringent requirements for MSW landfills based on regulations previously adopted by other states
- The need for voluntary measures and incentives to supplement any regulatory requirements for MSW landfills
- More …
- All comments available for viewing at the MDE – Air Regulations Stakeholder Meeting web page under Stakeholder Meeting on MSW Landfills


BACKGROUND

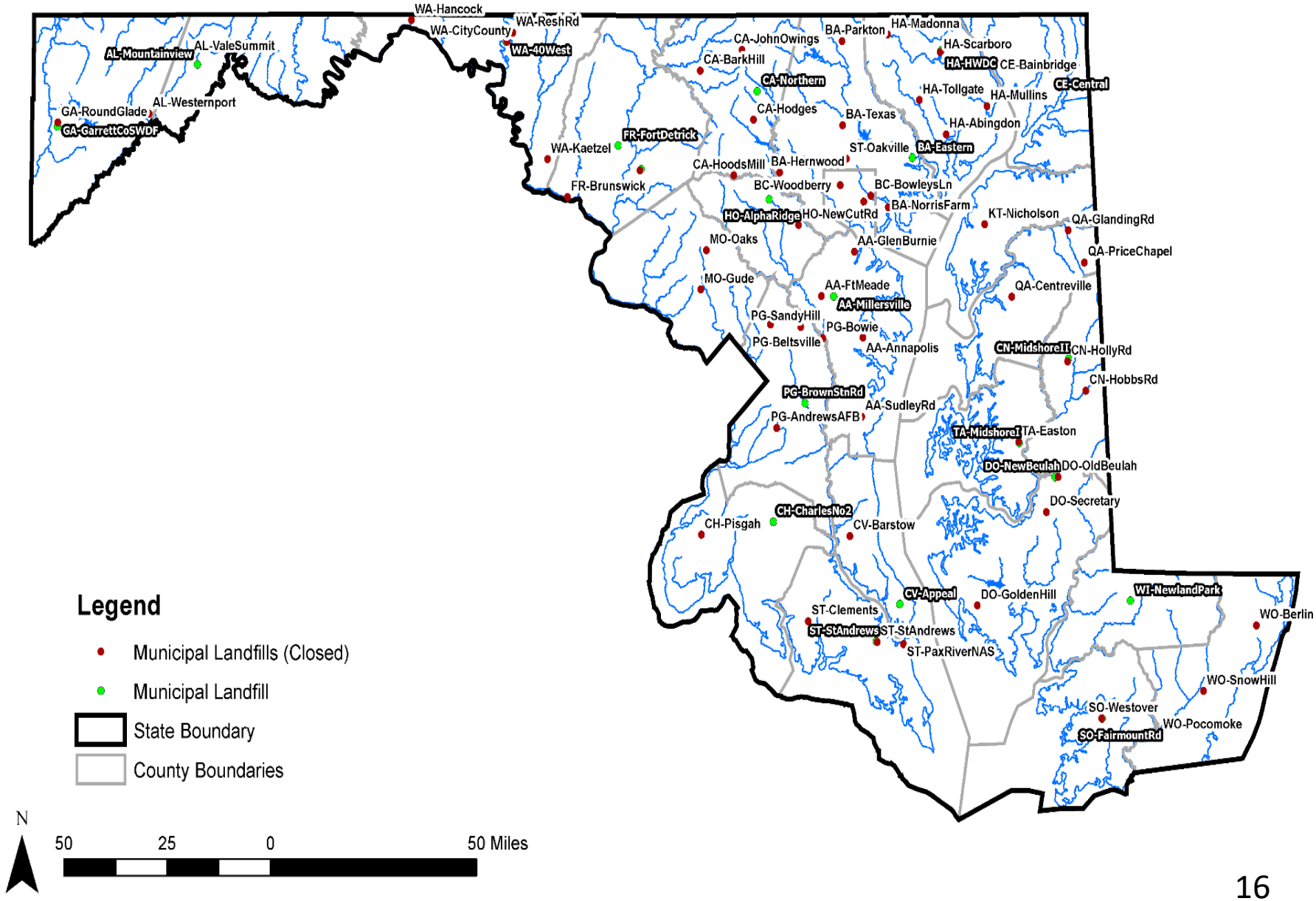
Types of Landfills in Maryland

- Municipal or Municipal Solid Waste (MSW) Landfills
  - Consists of household waste
- Construction & Demolition (C&D) Landfills
  - Consists of roadwork material, excavated material, demolition waste, construction/renovation waste
- Industrial (non-hazardous) Waste Landfills
  - Consists of industrial waste
- Landclearing Debris Landfills
  - Consists of land clearing waste, concrete, brick, concrete block, uncontaminated soil, gravel and rock, untreated and unpainted wood, and yard trash

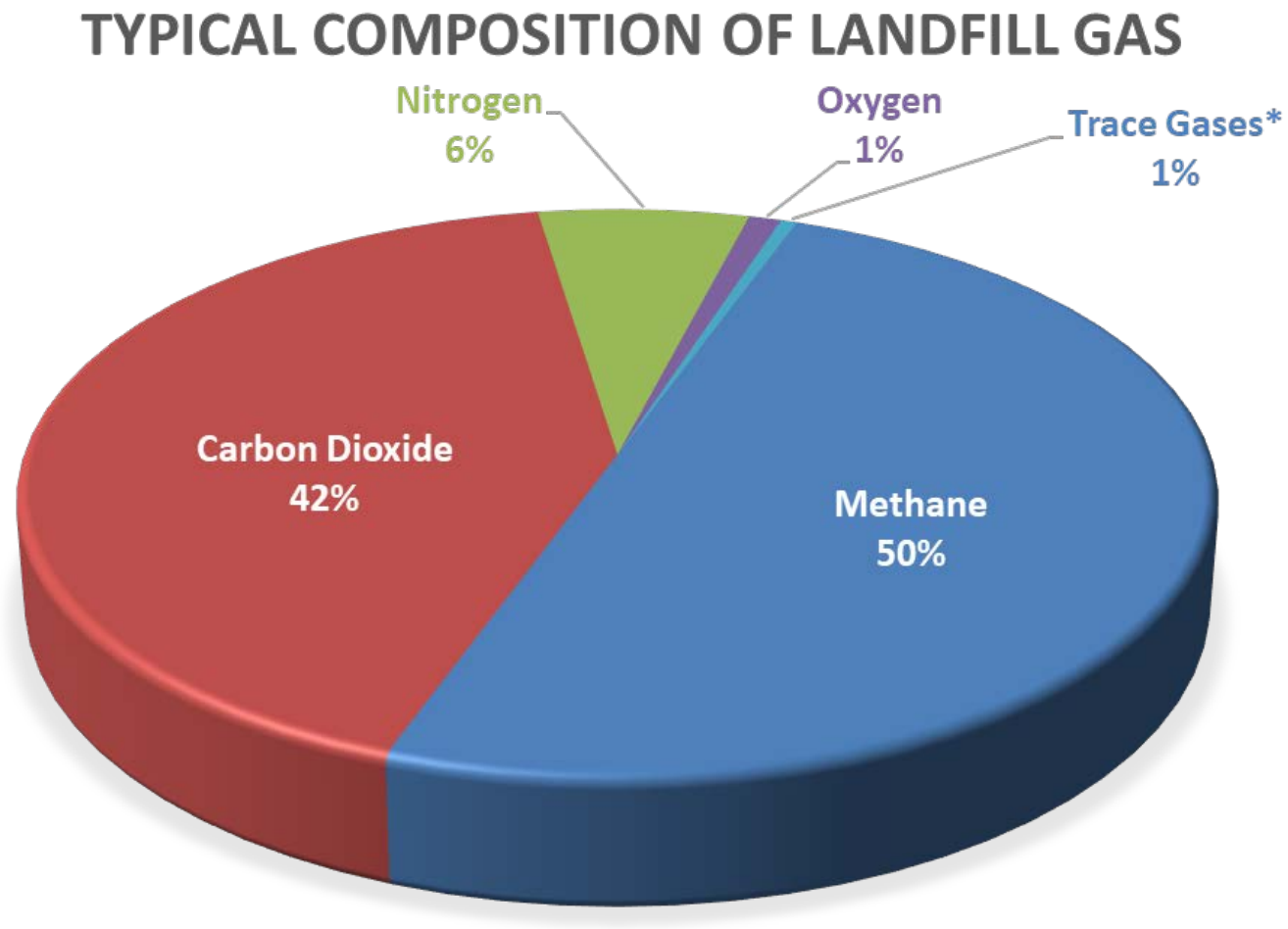
https://www.vecteezy.com/free-vector/factory

Source: MDE - Land Management Administration (LMA) - Solid Waste Management in Maryland

Municipal Solid Waste Landfill Facilities in Maryland



Municipal Solid Waste (MSW) Landfill



*Trace gases includes ammonia, NMOC (non-methane organic compounds), sulfides, hydrogen, and carbon monoxide

Source: https://www.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


CLIMATE CHANGE … THE KEY POLICY DRIVER BEHIND THE EFFORTS TO MINIMIZE METHANE EMISSIONS

Climate Change in Maryland

Photo: https://pixabay.com/photos/thermometer-summer-heiss-heat-sun-4294021/

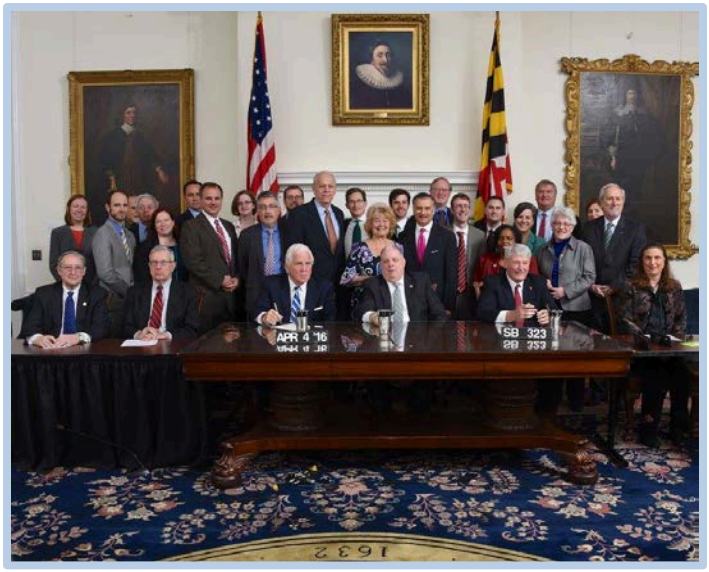
Addressing Climate Change and reducing greenhouse gas (GHG) emissions has become a major issue in Maryland for the past ten years

There are four key areas of focus:

1. The Greenhouse Gas Emissions Reduction Act (GGRA) of 2009 and 2016
   - Reducing leaking methane is a major part of the GGRA process
2. The Maryland Commission on Climate Change (MCCC)
3. Partnerships
   - Regional Collaborations
     - RGGI, ZEV MOU
     - United States Climate Alliance (USCA)
4. Pushing back on Federal backsliding
   - Many legal Challenges

The Greenhouse Gas Emission Reduction Acts (GGRA) of 2009 and 2016

- Climate change effort originated in 2007 by Executive Order
  - Resulted in a 2008 “Climate Action Plan”
- This led to the “Greenhouse Gas Emission Reduction Act” of 2009
  - 25% Greenhouse Gas (GHG) Emission reduction by 2020
- 2009 law reauthorized in 2016, adding new goals
  - 40% GHG reduction by 2030
- The Acts also require that the State’s GHG Reduction Plans support a healthy economy and create new jobs



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
- MCCC codified into law in 2015
- Established a balanced, bipartisan Commission
  - Representatives from the 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 General Assembly

Climate Change – Increasing Urgency (continued…)

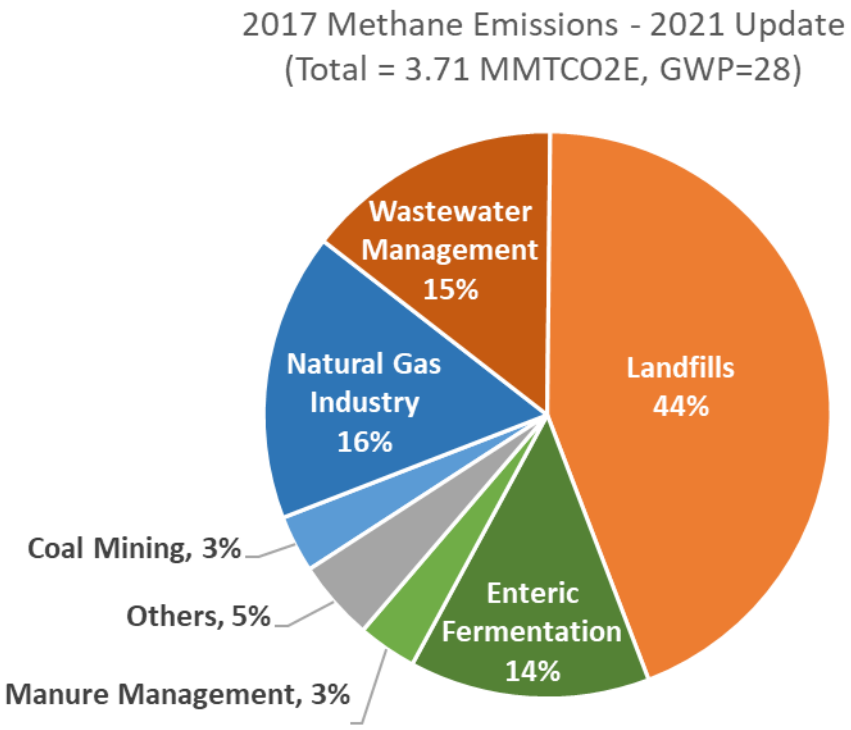
- The law calls for a reduction of GHG emissions of 40% by 2030 (from 2006 levels)
- Our 2030 GGRA Plan pursues a more ambitious goal, recommended by the Maryland Commission on Climate Change of 50% reductions by 2030
- Federal policies can help if the Biden Administration adopts effective federal control programs in certain areas like trucks, boats, locomotives and aircraft
  - Maryland would exceed the National Target of 50-52% reduction in GHGs from 2005 levels in 2030

The 2030 Plan – Some Highlights

- Establishes new climate solutions such as increased carbon sequestration in forests and agricultural soils
- Planting more than seven million trees and improved management of existing forests and farms to sequester more carbon in trees and soils
- Emission reductions from electricity generation, transportation, building energy, and natural gas infrastructure
- Investments in energy efficiency and clean and renewable energy solutions, clean transportation projects and widespread adoption of electric vehicles
- Investments in new industries and technologies and “green” jobs in the electric, transportation and buildings sectors, the largest sources of GHG emissions in Maryland

Why the Focus on Leaking Methane from Landfills?

- Methane is a super potent greenhouse gas
  - 28 times the warming impact of CO_2 over 100 years
  - 80 times over methane's 20-year lifetime in the atmosphere
- Early action is critical
- Landfills are the largest methane emission source in the MDE inventory
- As discussed earlier, research and other new analyses indicate that real world methane emissions from landfills may be significantly larger than originally estimated with strong daily variations that may cause significant misquantification
- MDE is currently evaluating these differences




DISCUSSION OF REQUIREMENTS

MDE's Potential 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
- These two separate, but related drivers will be blended in a proposed regulation
- MDE will look at prior and current regulatory efforts on landfills in other states

Source: https://pixabay.com/photos/antietam-maryland-burnside-bridge-80552/)

Other States And Organizations Working on Similar Regulations

- California has adopted regulations (effective 2010) to reduce methane gas emissions from MSW landfills
- Oregon is currently working on stringent requirements to reduce methane gas emissions from landfills
- The US Climate Alliance (USCA) a partnership between states to address climate change and reduce greenhouse gas emissions is also working on this issue
  - USCA has formed a working group to discuss and share regulatory approaches for addressing this issue
- MDE is looking at the regulatory approaches taken in other states and will be using this information and the technical support materials to build the MDE regulation

What Could the Proposed Regulation Look Like?

- For the remainder of the presentation, we will discuss the basic requirements of the potential, proposed regulation
- Remember … we are blending the new federal NSPS and EG requirements with additional requirements to minimize methane emissions
- The following tables compare the basic requirements of the new NSPS/EG to information MDE has gathered on how to combine the NSPS/EG and the potential, proposed requirements to minimize methane emissions
- The column identified as “Discussion Concept for MD Regulation” is built from comments we have received from stakeholders and final or draft regulations from other states
- The information in the “Discussion Concept for MD Regulation” column does not represent MDE policy. It is intended only to generate discussion. We hope to get significant input on these issues today … or in writing over the next month

Potential Requirements
Applicability and Exemptions

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Applicability	EG - Applies to existing MSW landfills constructed, reconstructed, or modified on or before 7/17/14, and accepted waste after 11/8/87 NSPS - MSW landfills constructed, reconstructed or modified after July 17, 2014	Applies to all MSW landfills that received waste after 11/8/87
Applicability - Size	≥ 2.5 million Mg waste mass and 2.5 million m^3 waste volume	450,000 tons of waste-in-place (WIP)
Exemptions	MSW landfills with design capacity < 2.5 million Mg (2.75 million tons) or NMOC emissions < 34 Mg/yr (37 tons/yr)	Closed and inactive MSW landfills with less than 450,000 tons WIP, hazardous waste landfills, C&D landfills, landfills regulated under CERCLA

Potential Requirements
Design Issues

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Implementation and Compliance - Design Capacity Report	Landfills ≤ 2.5 million Mg and 2.5 million m^3 must submit an initial design capacity report within 90 days of the EPA approved State Plan	Active MSW landfills < 450,000 tons waste-in-place must submit a waste-in-place report within 90 days of effective date of regulation
	Landfills ≥ 2.5 million Mg and 2.5 million m^3 must submit a NMOC emission rate report within 90 days of the EPA approved State Plan	MSW landfill has ≥ 450,000 tons of WIP or upon reaching 450,000 tons of WIP, must submit a landfill gas heat capacity report within 90 days of effective date of regulation
Implementation and Compliance - Design Plan	Within one year after determining NMOC emission rate is ≥ 34 Mg/yr (active landfills) or ≥ 50 Mg/yr (closed)	Within one year after determining landfill gas heat input capacity is ≥ 3.0 MMBtu/hr or measuring a leak on the landfill surface > 200 ppm based on surface methane demonstration test.

Potential Requirements
Gas Collection and Control System

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Installation of a Gas Collection and Control System (GCCS)	*Applicability*: For MSW landfills with a design capacity of ≥ 2.5 million Mg by mass and 2.5 million m^3 by volume:	*Applicability*: For MSW landfills with ≥ 450,000 tons WIP and gas heat input capacity ≥ 3.0 MMBtu/hr:
	Requirements: Within 30 months after NMOC emission rate is ≥ 34 Mg/yr, (includes most recent emissions test) or within 30 months after NMOC emission rate is 50 Mg/yr for closed landfill subcategory, or Tier 4 surface emissions monitoring shows a surface methane emission measurement of ≥ 500 ppm	*Requirements*: Within 18 months after approval of a GCCS design plan for active MSW landfills, or within 30 months after approval of GCCS design plan for closed or inactive MSW landfills

Potential Requirements
GCCS Issues

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Gas Collection and Control Systems – Efficiency	NMOC reduction efficiency of 98 percent. For enclosed combustion devices - reduce the outlet NMOC concentration to less than 20 ppmv, dry basis as hexane at 3 percent oxygen or less	Methane reduction efficiency of 99 percent for most control devices For lean-burn engines - reduce outlet methane concentration to < 3,000 ppmv, dry basis, corrected to 15 percent oxygen
Disposal Areas Requiring GCCS	Active areas where the first refuse deposited in the area has reached an age of five years or more, or areas closed or at final grade where the first refuse deposited two years or more	Any area where waste is buried
Types of GCCS Allowed	Carbon adsorption and passive gas collection systems allowed under certain conditions	Carbon adsorption and passive gas collection systems not allowed. Use of open flares are allowed under specific conditions

Potential Requirements
Testing and Wellheads

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Annual Source Testing for GCCS	Not Specified	MSW landfills must conduct an annual source test for GCCS using applicable test methods. Landfills may conduct the source test every three years if GCCS remains in compliance after 3 consecutive tests. If subsequent source test shows the GCCS is out of compliance the source testing frequency will return to annual basis
Wellheads	Collection system must be operated with negative pressure at each wellhead except under certain conditions (e.g., fire or increased well temperature, use of a geomembrane or synthetic cover, decommissioned wells)	Each wellhead must be operated under a vacuum or negative pressure except under certain circumstances

Potential Requirements
Leak Testing

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Component Leak Testing - GCCS	Not Specified	Operate the gas collection and control system so that there is no landfill gas leak (methane) that exceeds 500 ppmv at any component under positive pressure
	Not Specified	Components containing landfill gas and under positive pressure must be monitored quarterly for leaks. Leaks must be tagged and repaired within 10 calendar days
Component Leak Testing (Landfill Gas-to-Energy Facilities)	Not Specified	Component leak testing at MSW landfills having landfill gas-to-energy facilities may be conducted prior to scheduled maintenance or planned outage periods

Potential Requirements
Surface Emissions Monitoring

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emissions Monitoring (SEM) - Integrated Emission Standard	Not Specified	No location on the MSW landfill surface may exceed an average methane concentration limit of 25 ppmv as determined by integrated surface emissions monitoring
	Not Specified	Integrated surface readings must be recorded and then averaged for each grid
	Not Specified	Conduct integrated surface monitoring of the landfill surface quarterly
	Not Specified	Individual monitoring grids that exceed an average methane concentration of 25 ppmv must be identified and remediated
	Not Specified	The wind speed must be recorded during the integrated sampling period

Potential Requirements
SEM - *Instantaneous Emission Standard*

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emissions Monitoring - Instantaneous Emission Standard	Operate the collection system so that the methane concentration is less than 500 ppm above background at the surface of the landfill	No location on the MSW landfill surface may exceed the 500 ppmv methane concentration limits, as determined by instantaneous surface emissions monitoring
	Not Specified	The owner or operator must record any instantaneous surface readings of methane 200 ppmv or greater, other than nonrepeatable, momentary readings
	Not Specified	The wind speed must be recorded during the instantaneous sampling period

Potential Requirements
SEM - Frequency, Exceedances and Testing

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emission Monitoring - Frequency	Monitor surface concentrations of methane for each collection area on a quarterly basis	Conduct instantaneous surface monitoring of the landfill surface quarterly
Surface Emissions Monitoring - Exceedances	Any reading of 500 ppm or more above background at any location shall be recorded as a monitored exceedance and the actions specified in the regulation shall be taken	Surface areas of the MSW landfill that exceed a methane concentration limit of 500 ppmv must be marked and remediated
Surface Emissions Monitoring - Surface Area Testing	Tests to be conducted where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. Areas with steep slopes or other dangerous areas may be excluded from the surface testing	The landfill surface areas with cover penetrations, distressed vegetation, cracks or seeps must also be inspected visually and with a hydrocarbon detector

Potential Requirements
SEM - Instrumentation, Coverage and Spacing

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emissions Monitoring - Instrumentation	The portable analyzer shall meet the calibration, performance, and instrument specifications provided in EPA Method 21, except that methane shall replace all references to VOC	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
Surface Emissions Monitoring - Landfill Area	Not Specified	The entire landfill surface must be divided into individually identified 50,000 square foot grids (both integrated and instantaneous monitoring)
Surface Emissions Monitoring – Spacing and Patterns	The entire perimeter of the collection area and along a pattern that traverses the landfill at 30-meter intervals (or a site specific established spacing)	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

Potential Requirements
SEM - Meteorological Issues

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emissions Monitoring – Meteorological Conditions	Testing may be performed during typical conditions	Conditions for surface testing: Cannot be performed when average wind speed exceeds 5mph or the instantaneous wind speed exceeds 10mph 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

Potential Requirements
SEM - Optional Testing and Corrective Actions

Requirement	New NSPS (Subpart XXX) and EG (Subpart Cf)	Discussion Concept for MD Regulation
Surface Emissions Monitoring – Optional Tests	Using optional Tier 4 procedures - Any closed landfill that has no monitored exceedances of the operational standard in four consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 ppm or more detected during the annual monitoring requires the owner or operator to submit a GCCS design plan	Optional surface demonstration test can be used if landfill gas heat input capacity is ≥ 3.0 MMBtu/hr (for uncontrolled landfills only). This test is used for determining when a GCCS is required to be installed and is based on surface methane emissions being < 200 ppmv for 4 consecutive quarters (regardless if the landfill is closed, active, or inactive)
Surface Monitoring – Corrective Actions	10 calendar days	10 calendar days

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‡:

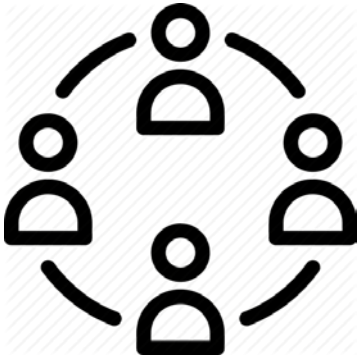
Category	Avg Costs (Est.)
Landfills Subject to Reporting Requirements Only	$500 - $12,000†
Landfills Subject to Reporting, Monitoring and Control Requirements:	
Reporting	$800 - $12,000†
Monitoring	$2M - $6M†
Capital Costs	$35,000 – $1.4M
Operation and Maintenance (O&M)	$700,000 - $4.5M†
Total	$2.7M - $12M

† - Costs on an annual basis
‡ - Based on Economic Impact Analysis – CA Landfill Methane Regulation

Regulatory Schedule – Key Dates

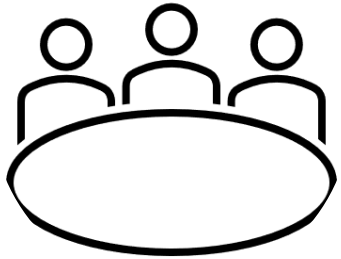
Draft Regulation and Stakeholder Process

Ongoing



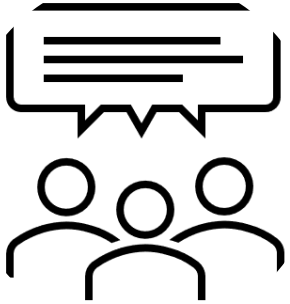
Brief MCCC and MCCC Working Groups

Ongoing



Propose Regulation and Present to AQCAC

December '21



Adoption Process with Hearing

Approximately 9 Months


QUESTIONS … DISCUSSION