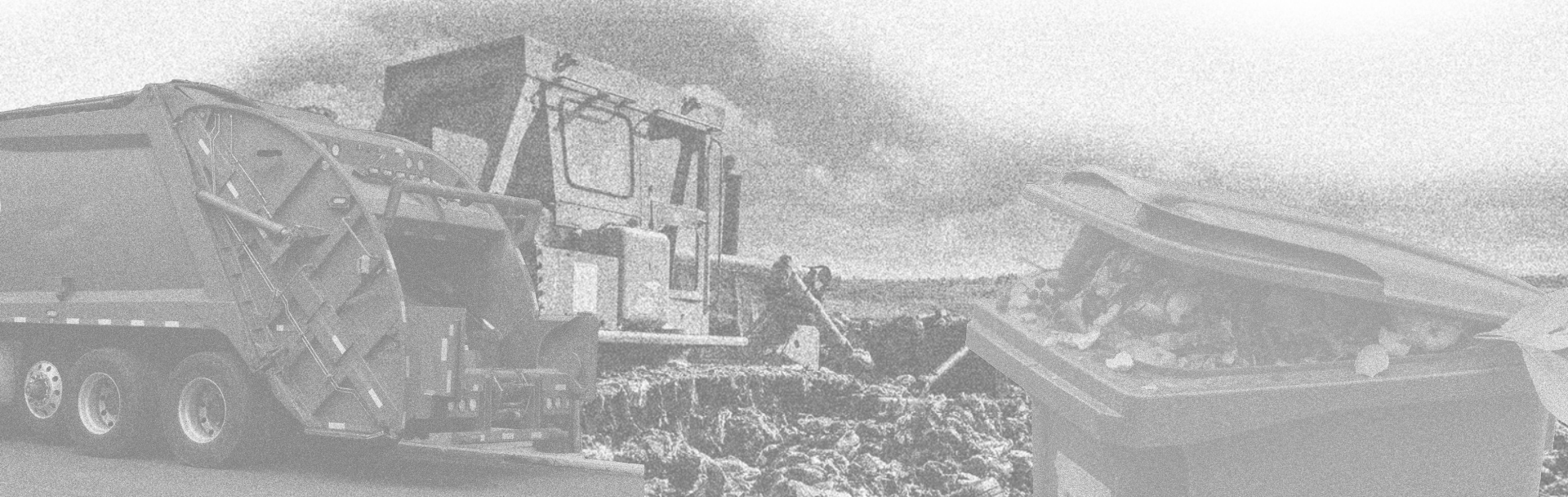


# Reducing Methane Emissions from Municipal Solid Waste Landfills

Maine Materials Management Task Force

3.18.24



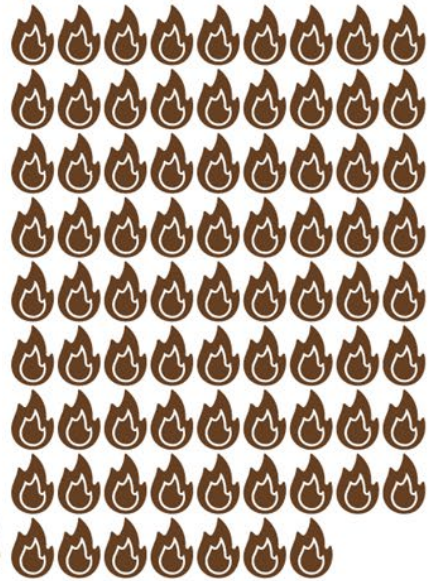
Landfills create  
14.3% of total U.S.  
methane emissions.

That's **295 million metric tons** of greenhouse gases per year.

Equivalent to 66 million passenger vehicles driving for a year.

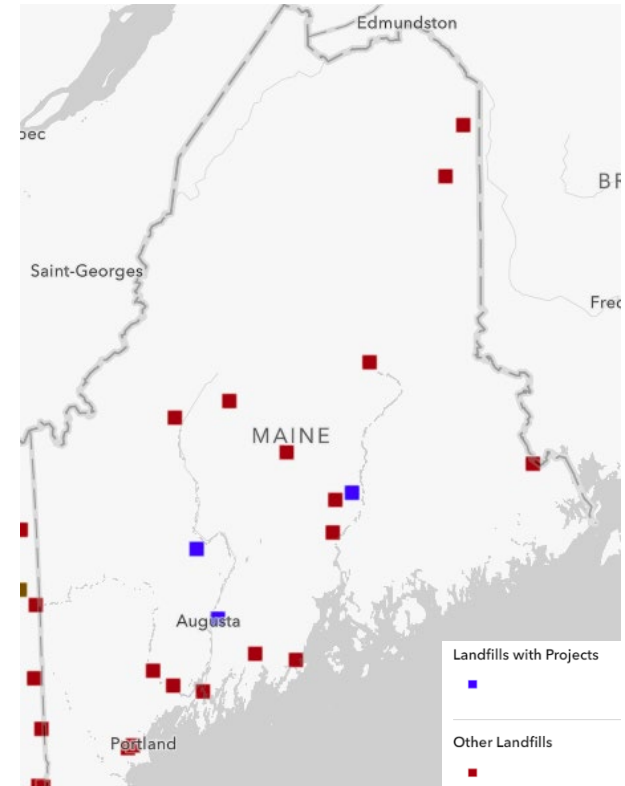


Or 79 coal-fired power plants



# Landfill methane emissions in Maine

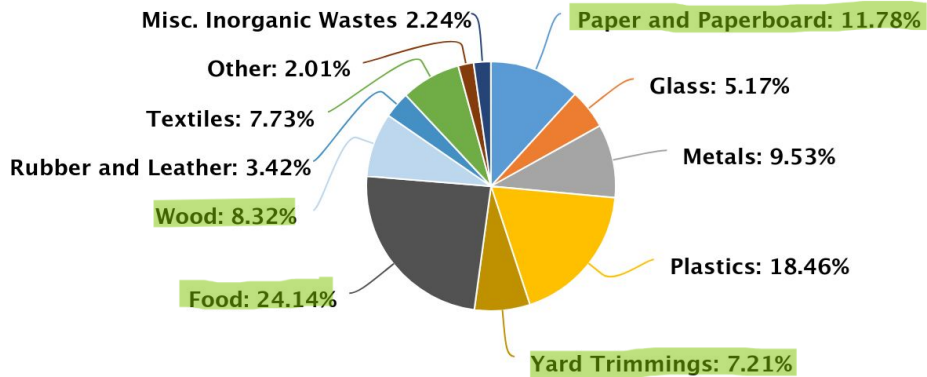
- In 2022, Juniper Ridge & Crossroads LFs were the **second** and **fifth** largest industrial methane emitters in Maine, respectively, emitting a combined **~270,000 tons CO<sub>2</sub>e (GWP20)**
- Maine is also home to more than a dozen non-reporting LFs, most of which are no longer accepting waste - but remember, closed landfills still emit methane



# Organic waste generates methane in landfills

## Total MSW Landfill by Material, 2018

146.1 million tons



# Common sources of landfill methane emissions

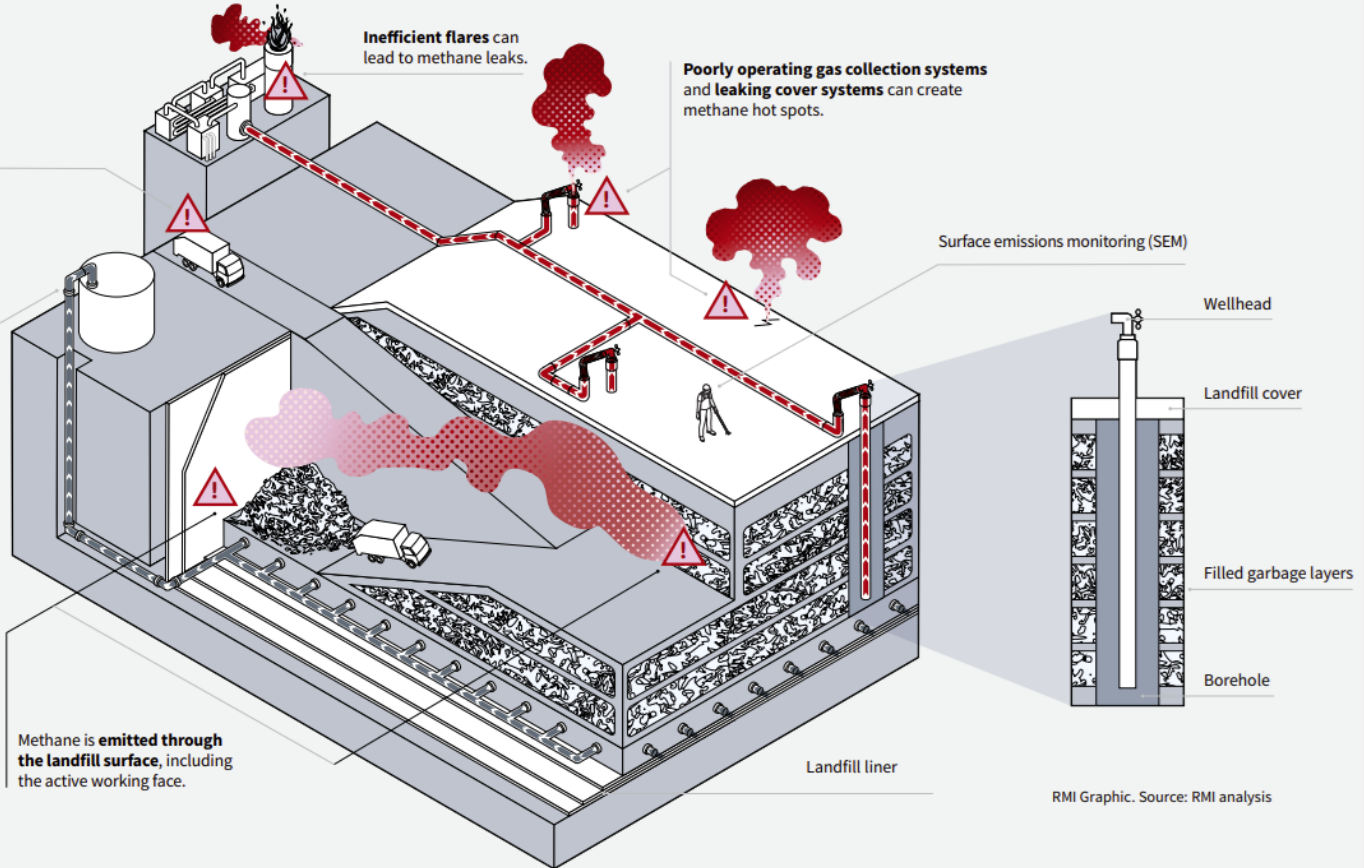
Landfill gas is generated when buried **organic waste** decomposes without oxygen. Over half of material sent to US landfills is organic.



Leachate collection system

**Key landfill components and common emissions sources**

--- Landfill gas  
--- Leachate



Methane is emitted through the landfill surface, including the active working face.

RMI Graphic. Source: RMI analysis



# A Two-Pronged Approach to Cut Waste Methane



**Organics  
Diversion**  
Prevent future  
landfill methane  
generation

Waste prevention &  
edible food recovery

Organics recycling

**Waste-in-place  
Controls**  
Mitigate methane  
at the landfill  
today

Smart landfill design  
& operations

Advanced leak  
detection & repair

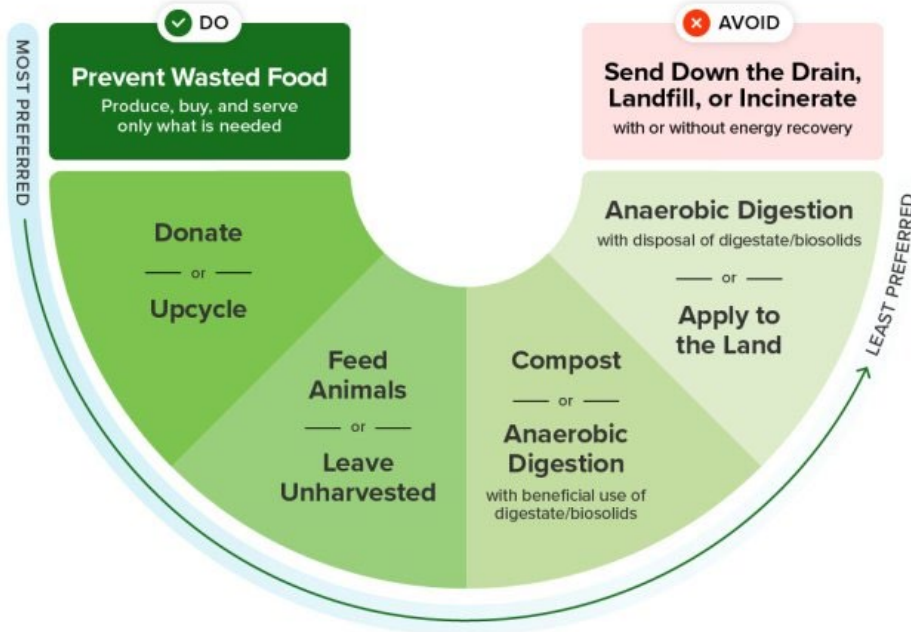


# Key strategies to prevent landfill methane generation



## Wasted Food Scale

How to reduce the environmental impacts of wasted food



October 2023



# Key strategies to mitigate methane from waste-in-place

## BMPs to reduce landfill methane emissions

**Expand Gas Collection System Coverage:** Install and expand the gas collection system early, within one year after waste is placed, to maximize gas collection. Installing horizontal collectors during the disposal of waste can help capture gas as the lifts are being constructed. Optimize well spacing (approximate 30% overlap of radius of influence) to ensure full coverage.

**Boost Gas Collection System Performance:** Optimize well-field tuning with automated systems and pressure/flow sensors to increase gas recovery while avoiding air intrusion. Actively manage liquid levels and maintain the well seal. Using gabion cubes on the bottom liner can help with drainage.

**Enhance Landfill Cover Materials and Practices:** Increase thickness and compaction of daily and intermediate covers to decrease permeability and allow for greater vacuum. Consider a vegetative layer or biocover to enhance microbial oxidation of methane escaping to the surface. Install intermediate and final cover early and on an ongoing basis. Minimize the exposed surface area of the daily uncovered working face.

**Ensure Beneficial Use or Efficient Destruction of Captured Gas:** Route captured gas to an energy project (e.g., electricity or RNG) that displaces fossil-based fuels. Ensure that any excess gas is routed to an enclosed flare with high destruction efficiency (>99%) to avoid methane slip. Pressure/temperature sensors can help confirm a flare is lit.

**Conduct Comprehensive Methane Monitoring:** Regularly survey the landfill surface and components to identify and mitigate any leaks and inform operational decisions to minimize surface methane. Leverage advanced monitoring technologies to improve the frequency, coverage, and scope of methane detection and improve response times.



*Still applicable to older/closed landfills without active gas capture*





# We have new tools to catch leaks and build emissions transparency

## Advanced methane monitoring technologies deployed today

### REGULATORY MONITORING

**Drone (ppm):** In-plume sensing near-ground (NDIR, FID, TDLAS)

**Methane emissions source**

**Walking SEM (ppm):** In-plume sensing (FID, TDLAS)

**Rover (ppm):** In-plume sensing (NDIR, TDLAS)

### VOLUNTARY MONITORING

**Drone (ppm-m):** Active imaging (TDLAS)

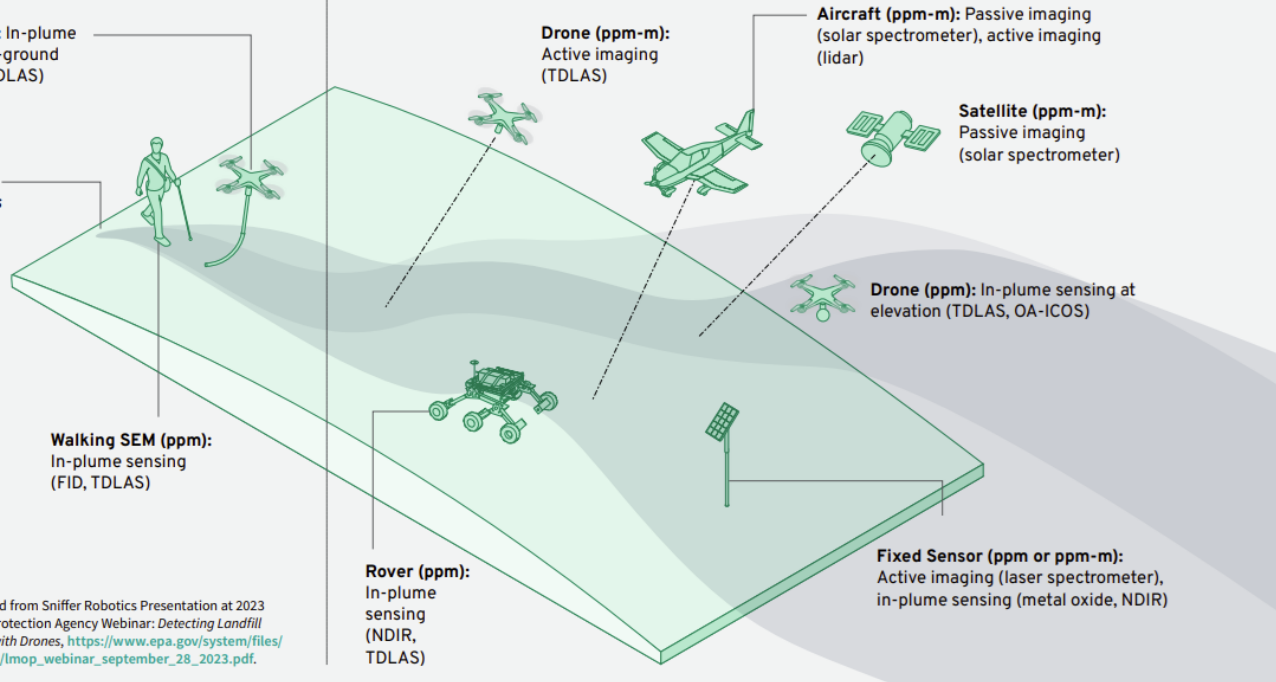
**Aircraft (ppm-m):** Passive imaging (solar spectrometer), active imaging (lidar)

**Satellite (ppm-m):** Passive imaging (solar spectrometer)

**Drone (ppm):** In-plume sensing at elevation (TDLAS, OA-ICOS)

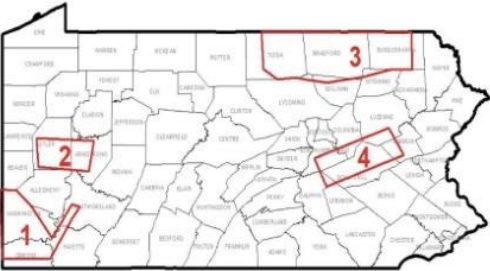
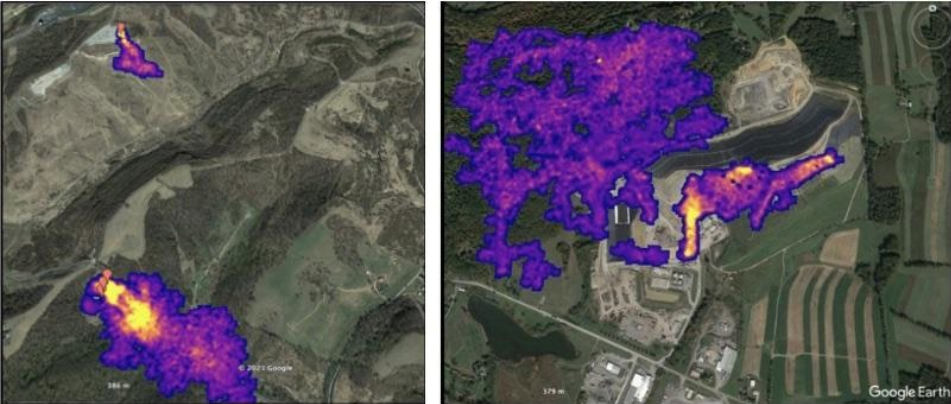
**Fixed Sensor (ppm or ppm-m):** Active imaging (laser spectrometer), in-plume sensing (metal oxide, NDIR)

RMI Graphic. Adapted from Sniffer Robotics Presentation at 2023 US Environmental Protection Agency Webinar: *Detecting Landfill Methane Emissions with Drones*, [https://www.epa.gov/system/files/documents/2023-10/lmop\\_webinar\\_september\\_28\\_2023.pdf](https://www.epa.gov/system/files/documents/2023-10/lmop_webinar_september_28_2023.pdf).





# State leadership (cont'd)



UC Climate Alliance  
 Proposed Flight Areas



# ACHIEVING ZERO FOOD WASTE

## A State Policy Toolkit

MAY 2023



# Future Opportunities for Maine

## 1. Strengthen waste-in-place methane controls

- Example: MD, OR, CA state regs
- Example: OR, CO programs for voluntary methane capture
- Example: PA, CA monitoring campaigns

## 1. Build out edible food recovery and organics recycling programs

- Example: CA, WA, VT statewide programs
- Example: MA, MD, CT applies to large generators

# Federal Funding Opportunities for Waste

Funding Opportunity	Source/Agency	Details
<b>Climate Pollution Reduction Grants (<a href="#">CPRG</a>)</b>	IRA - EPA	<b>\$5B</b> for climate planning & implementation grants to states, local governments, tribes, and territories. Waste is a focus area that can be built out in the <b>Comprehensive Climate Action Plan (CCAP)</b> .
<b>Greenhouse Gas Reduction Fund (<a href="#">GGRF</a>)</b>	IRA - EPA	<b>\$20B</b> to nonprofit financing entities and community lenders to support clean energy and air pollution reducing projects (e.g., landfill methane controls, composting). Financing will be distributed on an ongoing basis to eligible projects.
<b>Community Change Grants (<a href="#">CCG</a>)</b>	IRA - EPA	<b>\$2B</b> for projects that reduce pollution, increase community climate resilience, and build community capacity to address environmental and climate justice challenges. Waste a focus area.
<b>Solid Waste Infrastructure for Recycling (<a href="#">SWIFR</a>) Grant Program</b>	BIL - EPA	<b>\$275M</b> to assist states, local governments, tribes, and territories in making improvements to local waste management (including organics). <b>ME has funding to explore organics diversion.</b>
<b>Methane Monitoring Funding</b>	IRA - EPA	<b>\$20M</b> to advance landfill methane monitoring, including by loaning out monitoring equipment to states, local governments, and Tribes.
<b>Energy Efficiency and Conservation Block Grant (<a href="#">EECBG</a>) Program</b>	BIL - DOE	<b>\$550M</b> for to assist states, local governments, and Tribes in implementing strategies to reduce energy use, to reduce fossil fuel emissions, and to improve energy efficiency. Landfill methane capture is a focus area.