CALIFORNIA
AIR RESOURCES BOARD

Landfill Methane Emissions, Community Perspectives, and Potential Regulation Updates

Community Meeting

Santa Clarita, CA

July 18, 2025

Community Panel: Living Near Landfills – Local Experiences

Potential Updates to the Landfill Methane Regulation

CARB Staff Presentation

Agenda

Potential Updates to CARB's Landfill Methane Regulation

- Background
- Goal and scope of potential changes to the LMR
- Regulatory concepts for changes to the LMR
- Next steps
- Open discussion

Background

CALIFORNIA AIR RESOURCES BOARD

Mission

- Leads California's fight against air pollution and climate change
- Protects public health, and promotes environmental justice, social equity, & sustainable communities
- Promotes clean, energy-efficient fuels and technology

Tackling Air Pollution

FEDERAL

US EPA

Sets & enforces national air quality standards.
Regulates interstate transportation.

STATE

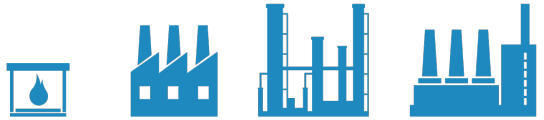
CALIFORNIA AIR RESOURCES BOARD

Regulates mobile sources of air pollution, greenhouse gases & consumer products.

LOCAL

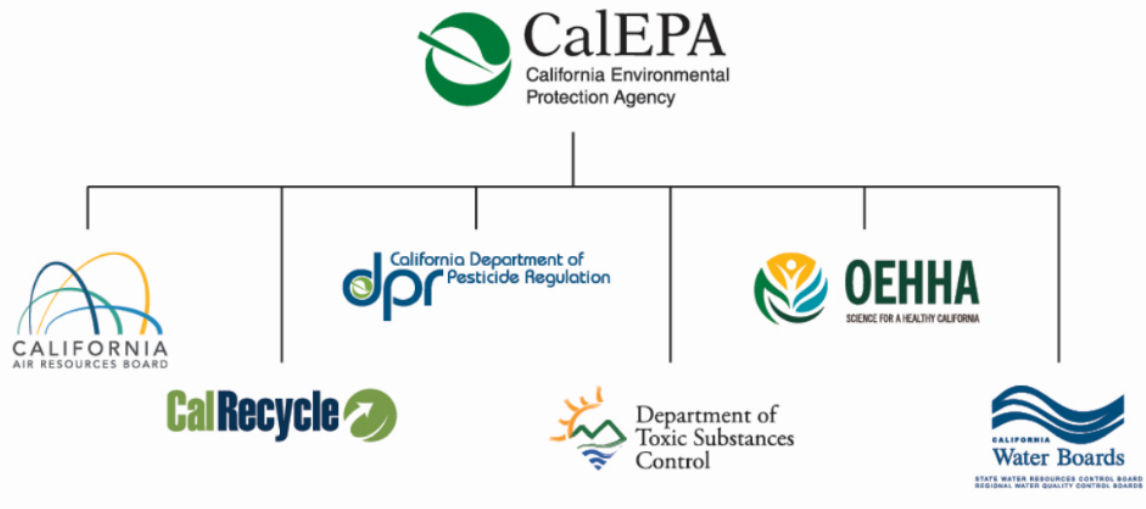
Local Air Districts

Regulates stationary & local sources of air pollution.



California Air Resources Board's Role in Landfill Regulation

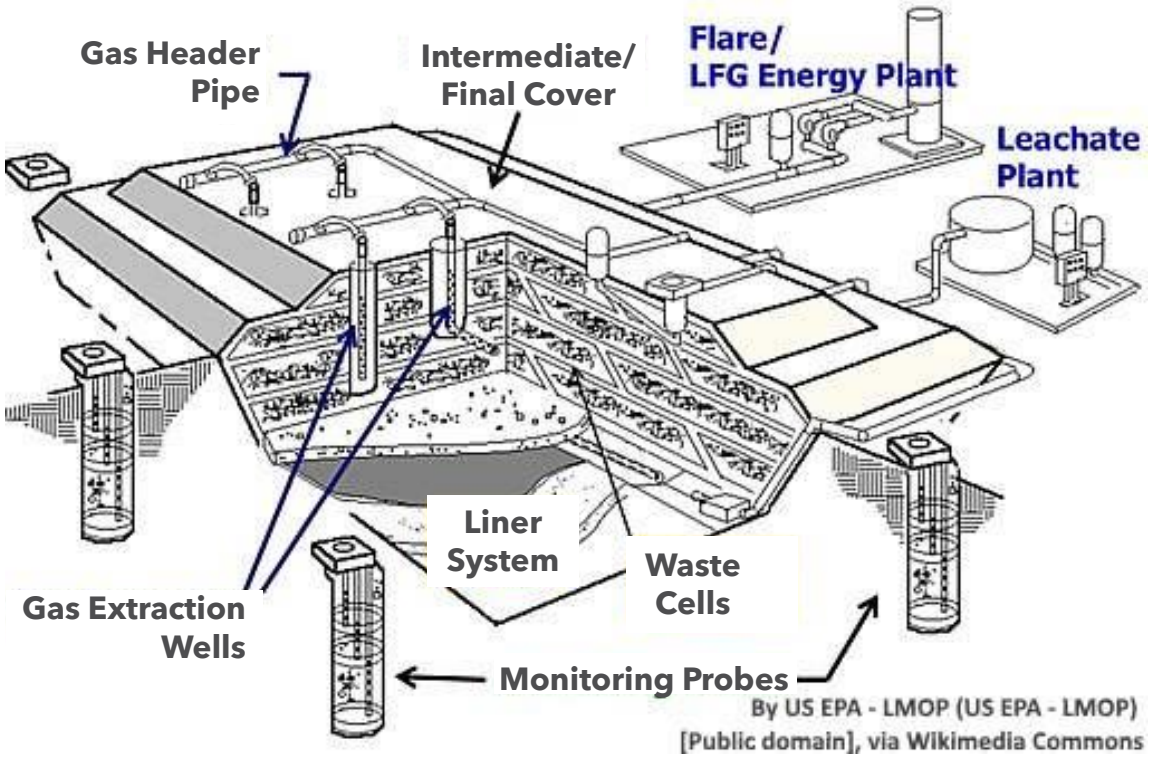
CARB staff work together with other state, local, and federal agencies who lead efforts on air pollutants, landfill permitting/design, toxics, and water pollution, including local air districts, the U.S. Environmental Protection Agency, and other departments within the California Environmental Protection Agency

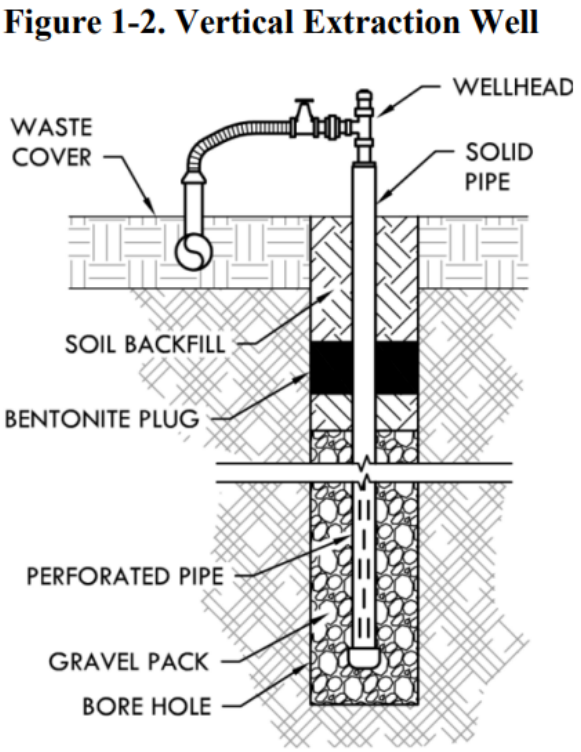


Landfill Methane Regulation

- CARB's Landfill Methane Regulation (LMR) was initially adopted in 2010
- The LMR set the most stringent threshold in the nation for landfill methane control
- Requires landfill owners and operators to:
  - Install and optimally operate landfill gas collection and control systems (GCCS)
  - Perform routine monitoring for surface emissions and other performance parameters
  - Repair gas leaks and other issues to ensure emissions are minimized
  - Report compliance data and actions to CARB and local air districts
- 22 local air districts have agreements with CARB to primarily implement and enforce the LMR
- 190 landfills are subject to the LMR and 150 operate a GCCS

Landfill Gas Collection and Control Systems

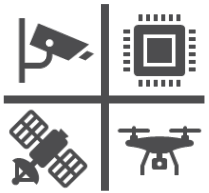




Goals and Scope of Potential Changes

Increase Stringency to Achieve CA's Ambitious Climate Targets

Harness Technological Advances



Incorporate Research and Lessons Learned

Improve Alignment with Federal Rules

Streamline Reporting

Set Example for Other Jurisdictions

Preliminary Nature of These Concepts

These concepts are preliminary. Their purpose is to solicit public feedback on potential changes prior to making any formal regulatory proposal.

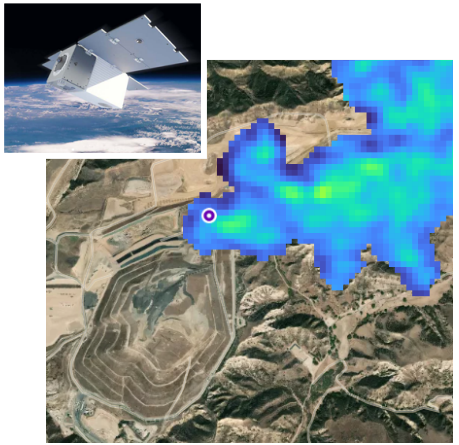
Feedback is requested by August 8, 2025: LMR Meetings and Workshops

Contact us: LMR@arb.ca.gov

Selected Major Regulatory Concepts

Satellite-Detected Emission Plumes Concept

- A decade of research demonstrates effectiveness of methane plume detection and notification
- CARB is already notifying landfills when methane plumes are detected by satellites
- Concept: Require operator to take action when notified by CARB of a satellite-detected methane plume



Source: Carbon Mapper Data Portal

CARB alerts operator of plume ⇨ **Operator inspects for leaks** ⇨ **Operator reports findings** ⇨ **Operator repairs any leaks found** ⇨ **Operator reports repairs**

Improved Coverage of Surface Emissions Monitoring Concept

- The current LMR requires surface emissions monitoring (SEM) quarterly with 25-foot spacing, but allows certain areas to be excluded for safety purposes

Concepts:

- Require an alternative technology be used in areas that cannot be safely accessed
  - For example, drones or handheld lasers could be operated without walking in the unsafe areas
- Allow emerging alternative technologies to be evaluated and approved for use across the entire landfill

Other Surface Emissions Monitoring Concepts

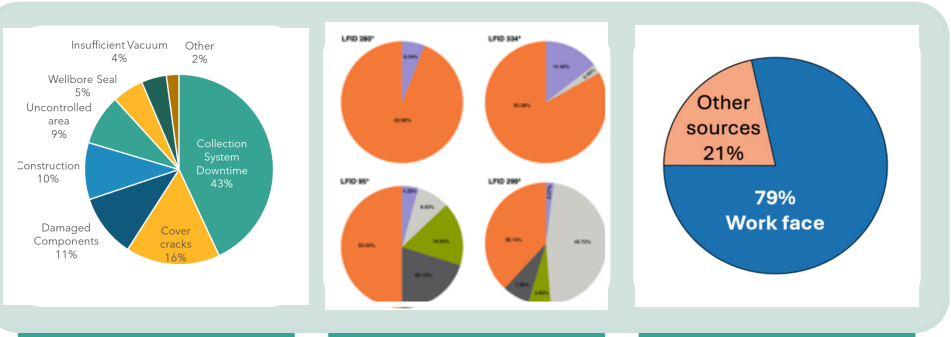
Significant updates to procedures to make SEM more effective and improve oversight, including:

- Reduce timelines for initiating repairs and completing new well installation or other approved remedy
- Confirm repairs are durable by additional re-monitoring 1 month after repair
- Do the following in monitoring grids with recurring exceedances:
  - Increase monitoring frequency from quarterly to monthly
  - Improve cover thickness and materials
  - Investigate the collection system and repair issues discovered

Gas Collection and Control System (GCCS) Operational Concepts

GCCS downtime, particularly at the working face, is a common cause of the largest emissions

- Multiple concepts to improve GCCS coverage and operational requirements:
  - Limit number of wells that can be offline at once
  - Minimize downtime of individual wells or GCCS components
  - Require earlier installation of gas collectors in new waste areas at large landfills



CARB research found 43% of plumes were caused by downtime

Research in Canada estimated working face emissions are 60% of total

Carbon Mapper & EPA attributed 79% of emissions to landfills with work face plumes

click on the graphic to access these studies

Expanded Digital Reporting Concepts

- Lengthy, non-uniform annual reports require significant time and resources to review and confirm compliance
- Potential new reporting data could:
  - Better support CARB's ability to confirm compliance
  - Improve understanding of causes of methane emissions
- Reporting concepts:
  - Require standardized digital reporting to accelerate data review
  - Require additional reporting parameters to improve oversight and transparency

Wellhead Monitoring Concepts

Wellhead Monitoring – Current Requirements

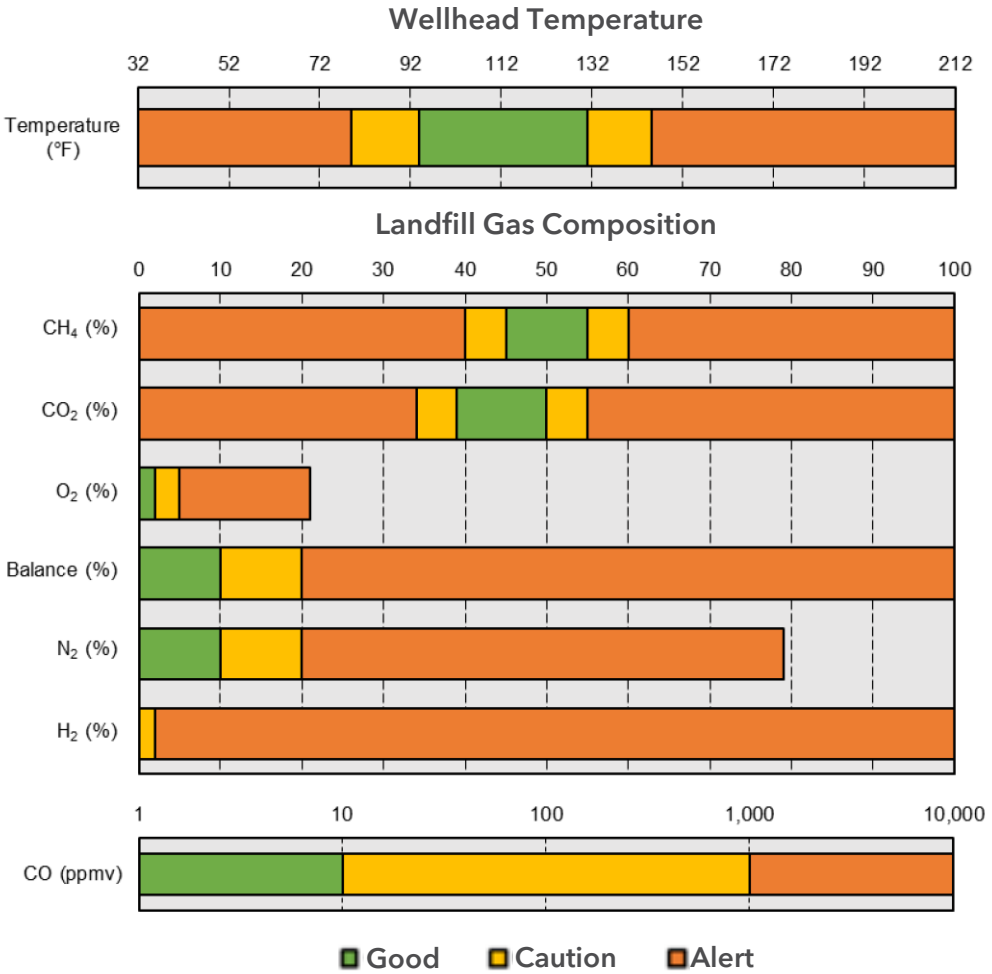
- The LMR requires wells to be under vacuum (suction), and confirm by monthly monitoring of gas well pressure
- Various local and federal rules* require monthly monitoring of temperature and either oxygen or nitrogen
  - Temperature must be maintained below limits (131-145 °F)
  - Oxygen (O_2) or nitrogen (N_2) must be reported when over limits
- Typical practice includes measuring gas flow rate and the methane (CH_4) and carbon dioxide (CO_2) content of gas

*Including air district rules and the federal New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and Emission Guidelines (EG) federal plan.

Landfill Gas Characteristics

- Data can signal the need to:
  - Adjust the level of vacuum (well "tuning" or blowers)
  - Repair the landfill surface cover
  - Investigate potential damage or obstructions in the well or other components
  - Investigate potential conditions that may risk subsurface elevated temperature events

Source: Figure 2 of U.S. EPA's fact sheet: *Indicators at Elevated Temperature Landfills – Landfill Gas*



Wellhead Monitoring Concept - Data

- Concept: Require monitoring of additional wellhead data and action based on results
  - Measure the following monthly at each wellhead:
    - Pressure (maintain suction)
    - Landfill gas temperature
    - Landfill gas flow rate
    - Landfill gas composition (methane, carbon dioxide, oxygen)
  - Measure liquid level twice per year
- Monitoring frequency would increase to weekly or continuously at wells with persistent issues
- Report data every quarter, instead of annually

Wellhead Monitoring Concept – Framework

Action is needed when measurements show

Trend changes

Action required for large changes compared to well's average value

Above a limit

Action required when a value is above a limit

Repeated issues

Additional action required when readings repeatedly over a limit

Targets prevention and early intervention

Wellhead Monitoring Concept: Temperature Requirements

- Wellhead temperature >131°F, or a rapid significant change in temperature:
  - Limit oxygen content in gas depending on temperature (see table to right)
  - If persists for 60 days, begin weekly enhanced monitoring
    [more detail on next slide]
- Wellhead temperature >145°F
  - Initiate corrective action within 5 days
  - Perform and implement rigorous cause and solution analyses and notify regulator if not quickly corrected
  - Violation if corrective action not complete within 120 days
- 24-hour regulator notification for extreme high temperature

Temperature	Oxygen Limit
131-145°F	<5% O_2
146-160°F	<2.5% O_2
160+ °F	<1% O_2

Wellhead Monitoring Concept: Enhanced Monitoring

- **Enhanced monitoring** means increasing from monthly to weekly, and measuring a wider range of information at all surrounding wells, including:
  - Downwell temperature measurement (every 10 feet) is the most reliable way to determine what is happening below the surface
  - Measuring carbon monoxide (CO) and visual indicators such as smoke indicate if a thermochemical reaction is occurring

Weekly monitoring ensures operators and regulators have all the information needed to inform decision making and appropriate early intervention

Wellhead Monitoring Concept: Oxygen

Oxygen monitoring is not currently required under LMR, though most landfills are subject to local or federal rules that require it. New concept would require monthly monitoring and:

- If oxygen exceeds 5%, or there is a large rapid increase, do cover integrity and collection system assessments to find and fix the source of air intrusion *

- When temperature is above 131°F, take action to immediately limit oxygen

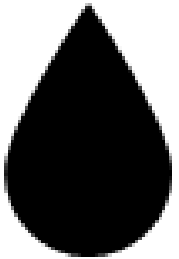
- Enhanced monitoring if repeated high oxygen levels are found

* Exception for "early" gas collectors because oxygen is expected to be present in fresh waste

Wellhead Monitoring Concept: Liquid Level Requirements

Liquid level monitoring is not currently required under LMR. New concept would require monitoring twice per year, and:

- If liquid level high (>50% of perforated length):
  - Remove liquids
  - Increase liquid level monitoring frequency to four times per year
- Install a pump if repeated high liquid levels found



Summary and Next Steps

Expected Outcomes of Concepts Presented Today

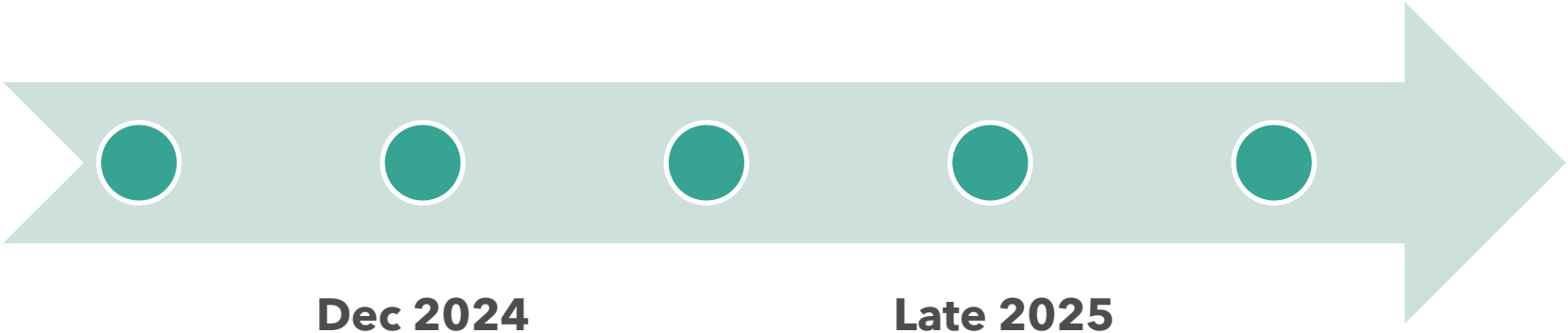
- Greater role for advanced leak detection technologies
- More and faster leak repairs through improved monitoring practices
- Earlier and more comprehensive identification of issues in wellhead monitoring data for prevention and early intervention
- Targeted additional action to address frequent or recurring issues
- Improved gas collection through earlier expansion and less downtime of the GCCS
- Better oversight by CARB and air districts through improved reporting and satellite plume notifications

Anticipated Timeline

May 2023
First workshop on potential updates

July 2025
Today's meeting

2027
Updated regulation is effective



Dec 2024
Second workshop on potential updates

Late 2025
Anticipated release of formal regulatory package

Open Discussion

Thank You!

Staff welcomes your input and participation as we develop these concepts into a regulatory proposal

- Written feedback is requested by August 8, 2025
- Submit feedback: LMR Meetings and Workshops

Contact us: LMR@arb.ca.gov

Subscribe for future updates: Landfill Methane Control Measure

Learn more about CARB's Research:

Landfill Methane Emissions in California

Methane Research