

A satellite view of Earth from space, showing the Western Hemisphere. The Earth's surface is a mix of blue oceans, white clouds, and green and brown landmasses. The curvature of the planet is visible against the black background of space.

# **Proposed Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills**

**California Air Resources Board**  
June 25, 2009 – Cal/EPA Headquarters

# Overview

- Background
- Landfill Primer
- Proposed Regulation
- Environmental and Economic Impacts
- Comments
- Modifications to the Proposed Regulation
- Future Activities and Staff Recommendation

# Background



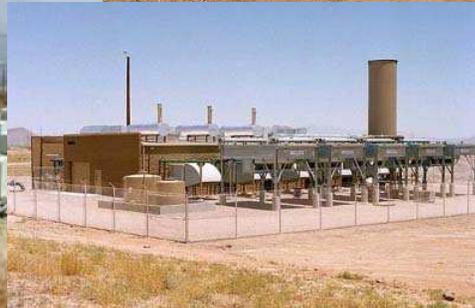
# Landfill Gas Measure Identified as a Discrete Early Action

- One of 9 discrete early action measures
- Methane is a potent GHG gas, 21 times the GWP of carbon dioxide
- Establishes statewide standards for municipal solid waste (MSW) landfills
  - Performance standards for newly installed and existing gas collection and control systems

# Proposed Regulation Will Achieve Significant Benefits

Early Action Item	2020 Reductions MMTCO <sub>2</sub> E
Low Carbon Fuel Standard	15.00
<b>Landfill Methane Capture</b>	<b>1.50</b>
Tire Pressure Check	1.40
Heavy Duty Smartway	1.00
Semiconductor Reduction	0.18
SF <sub>6</sub> Reduction	0.10
Shore Power (Ships)	0.27
Consumer Products	0.25
<u>Mobile Air Conditioner</u>	<u>0.26</u>
<b>Total</b>	<b>20</b>

# Landfill Primer



# Organic Waste Decomposition Generates Landfill Gas

- Natural decomposition of organic waste
- Rate of production depends on several variables
  - Waste type, age, moisture, temperature, etc.
- Landfill gas composition:
  - About 45 – 50 percent methane
  - About 40 – 60 percent carbon dioxide
  - Less than 1 percent trace gases

# Existing Landfill Gas Regulations

## Local Air District and Federal Regulations

- Required installation of gas collection and control systems at many landfills
- Targets primarily non-methane organic compounds, not methane

# Landfilling

## Three step process:

- Spreading the waste into thin layers
- Compacting the waste
- Covering the waste with soil or other approved cover material
  - Gas collection wells are installed later to collect landfill gas

# Gas Collection Systems

## ■ Active Collection Systems

- Landfill gas extraction wells and/or horizontal trenches
- Landfill gas moving equipment (e.g., piping and blowers)
- Combustion, energy recovery, treatment, or conversion equipment

## ■ Passive Collection Systems

- Cutoff trenches or vents
- Allow landfill gas to flow into the atmosphere

# Landfill Primer Gas Collection Systems

Passive system vent pipes



Active system gas collection well



# Gas Control Devices

- Flares (open or enclosed)
- Reciprocating engines
- Turbines
- Microturbines
- Boilers

## Landfill Primer

# Open Flare

- Less expensive
- Exposed flame
- Not easily source tested



# Enclosed Flare

- Most commonly used
- Located at ground level
- Efficient combustion
- Easily source tested



## Other Options

- Landfill gas to vehicle fuel (CNG/LNG)
- Landfill gas to pipeline quality natural gas
- Landfill gas to electricity

# California Municipal Solid Waste Landfills - Emissions

- 367 municipal solid waste (MSW) landfills with potential to generate methane emissions
- Second largest man-made source of methane in California
- MSW landfills represent about 1 percent of the statewide greenhouse gas inventory

# Greenhouse Gas Emissions

- Total GHG emissions from all MSW landfills:
  - 1990: 6.3 MMTCO<sub>2</sub>E
  - 2000: 5.8 MMTCO<sub>2</sub>E
  - 2020: 7.7 MMTCO<sub>2</sub>E

# Proposed Regulation



## Proposed Regulation

# Objectives

- Realize significant reductions of GHG emissions quickly
- Ensure early collection and reduction of fugitive methane emissions by requiring controls on uncontrolled MSW landfills
- Ensure that existing and newly-installed gas collection and control systems are being maintained and operating optimally
- Ensure no relaxation in conventional air pollutant controls

Proposed Regulation

# Public Process Used to Develop Proposal

- Technical Workgroup Meetings
  - Solid waste industry
  - Environmental organizations
  - Federal, State and local agencies
- Public Workshops
- Worked with CIWMB Staff

## Proposed Regulation

# Applicability and Exemptions

### Applicability

- All MSW landfills that received solid waste after January 1, 1977

### Exemptions

- Hazardous waste landfills
- Landfills that received only construction and demolition waste or non-decomposable solid waste
- Closed or inactive MSW landfills having <450,000 tons of waste-in-place

Proposed Regulation

# Threshold Determination for Installing Controls

## Active MSW Landfills <450,000 tons of Waste-in-Place

- Comply with limited reporting requirements

## Active, Closed, or Inactive MSW Landfills $\geq 450,000$ tons of Waste-in-Place

- Install a gas collection and control system if the landfill's gas heat input capacity is  $\geq 3.0$  MMBtu/hr, or
- Demonstrate that the landfill generates an insufficient amount of landfill gas

# Gas Collection and Control Requirements

- Design Plan – flexibility for emission control methods based on site-specific conditions
- Active gas collection system
- Wellhead requirement
  - Negative pressure, except under certain conditions
- Component leak standard

Proposed Regulation

# Surface Methane Emission Standards

- Instantaneous Monitoring
  - 500 ppmv emission standard
  - Used to identify surface leaks
- Integrated Monitoring
  - 25 ppmv emission standard
  - Good indicator of how well the gas collection system is operating
- Effective – January 1, 2011

Proposed Regulation

# Monitoring and Testing Requirements

- Quarterly surface emissions monitoring for landfills
- Quarterly component leak testing
- Monthly wellhead monitoring
- Annual gas control device testing



Proposed Regulation

# Methane Destruction Efficiencies for Gas Control Devices

## Enclosed Flares and Most Other Gas Control Devices

- At least 99 percent

## Lean-Burn Engines

- Must meet a methane outlet concentration of 3,000 ppmv or less

## Proposed Regulation

# Recordkeeping and Reporting Requirements

- Waste acceptance rates
- Surface methane monitoring data
- Component leak checks
- Gas flow rates
- Control device destruction efficiency testing results

## Proposed Regulation

# Alternative Compliance Options

- Allows flexibility due to site-specific nature of landfills
- Landfill owner/operator must demonstrate need for an alternative and demonstrate equivalent levels of methane control and enforceability
- Subject to approval by Executive Officer

## Proposed Regulation

# Compliance Schedule - Uncontrolled Landfills

- Determine the need for controls within 90 days
- Submit Design Plan within 1 year of determining need to install a gas collection and control system (GCCS)
- Active - Install GCCS within 18 months of approval of Design Plan approval
- Inactive or Closed - Install GCCS within 30 months of Design Plan approval

Proposed Regulation

## Compliance Incentives

- 25-foot walking pattern spacing increased to 100-foot spacing
- Quarterly surface emission measurements reduced to annual for inactive or closed landfills
- Demonstration of past compliance with surface emissions monitoring standards

## Proposed Regulation

# Affected Municipal Solid Waste Landfills

Out of 367 landfills:

- 218 – may be subject to the proposed regulation
  - 72 are subject to reporting requirements only
  - 14 are uncontrolled and may require gas collection control systems to be installed
  - 132 already have gas collection and control systems installed
- Remaining 149 landfills are likely to qualify for an exemption

# Uncontrolled Municipal Solid Waste Landfills by District



# Role of the Local Air Districts

- Currently implement and enforce rules related to the control of non-methane organic compound emissions from landfills
- Work with local air districts in developing agreements to allow local air districts to implement and enforce the proposed regulation

# Environmental and Economic Impacts



# Emission Reduction Estimation Approach

- Estimated statewide baseline emissions
- Estimated controlled emissions reduction based on analysis of South Coast landfill
- Estimated statewide emissions reductions

# Uncertainties with Emission Reduction Estimate

- Baseline and controlled emissions for individual landfills vary
  - Existing landfill maintenance
  - Composition of waste in place
  - Effectiveness of control system
- Other approaches possible
- Staff committed to evaluate other approaches

Proposed Regulation

# Emission Reductions

Category	2020 Methane Emission Reductions (MMT <sub>CO2E</sub> )
Landfills with existing controls	1.1
Landfills potentially required to install controls	0.4
Totals	1.5

## Proposed Regulation

# Economic Impacts of Proposed Regulation

- Total cost: \$6 million to \$14 million annually
- Cost effectiveness: \$9.00 per metric ton of carbon equivalent reduced
- Per-household basis: \$0.10 per month

# Cost-Effectiveness Comparison of Discrete Early Actions

Discrete Early Action Item	Cost Effectiveness \$/MTCO <sub>2</sub> E
Consumer Products	0.22
SF <sub>6</sub> Reduction	2
<b>Landfill Methane Capture</b>	<b>9</b>
Mobile Air Conditioner	11
Semiconductor Reduction	21

# Comments

- Phase-in of the integrated surface monitoring standard
- Cost of Compliance
- 200 ppmv Instantaneous Standard

# Comments (cont.)

- Gas Collection Efficiency  
Uncertainties
- Impacts on Organic Waste Diversion

# Modifications to the Proposed Regulation

- Provide clarification on the administrative requirements for amended Design Plans
- Provide a definition for inert waste
- Several other minor modifications to improve clarity and readability

# Future Activities and Staff Recommendation

- Develop a guidance document to assist landfill owners/operators in complying with the proposed regulation
- Implementation Workgroup
- Analyze instantaneous surface monitoring data
- Adopt the proposed regulation