



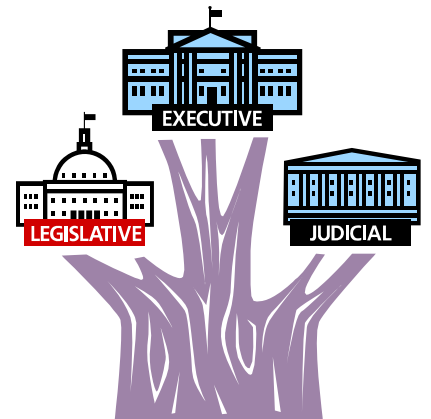
General Overview of EPA's Mandatory GHG Reporting Rule for Landfills

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Topics to Cover

- General Provisions of Rule
- Applicability for Landfills
- Monitoring Requirements for Landfills
- Reporting Requirements for Landfills
- Other Affected Sources in Solid Waste Industry
- General Combustion



GHG Reporting Rule Overview

- Final EPA Rule Signed: September 22, 2009
- Published in Federal Register: October 30, 2009
 - 40 CFR, Part 98
- Effective: December 29, 2009
- Affects GHG Sources with 25,000 Metric Tons (MT) carbon dioxide equivalent (CO₂E)
- Intended to Guide Future Policy to Reduce GHG Emissions
- Rule Includes Reporting for 31 Source Categories
 - Including Landfills

GHG Rule Overview (cont.)

- First reporting year is 2010
- The first official reporting date will be March 31, 2011
- Third-party verification not required, but will be treated like any Clean Air Act (CAA) reporting requirement
- GHG monitoring, data collection, QA/QC, and calibration requirements start January 1, 2010 (with 3-month grace period)

GHG Rule Overview (cont.)

- Emissions-based threshold of 25,000 MTCO₂E per year for most sources
- Capacity-based threshold, where appropriate and feasible
- Approximately 85% of total U.S. GHG emissions covered by the rule
- Approximately 10,000 reporters expected; over 2500 landfills

GHG Rule Overview (cont.)

- Reporting is on a facility-basis and should include all sources under “common control”
 - Are your landfill and LFG-to-energy (LFGE) facilities under common control ?
- Once subject to rule for one year, a facility can only exit the program after:
 - 3 yrs < 15,000 MTCO₂E
 - 5 yrs < 25,000 MTCO₂E

GHG Rule Overview (cont.)

- Covered gases are:
 - Carbon dioxide (CO₂)
 - Nitrous oxide (N₂O)
 - Perfluorocarbons (PFC)
 - Methane (CH₄)
 - Hydrofluorocarbons (HFC)
 - Sulfur hexafluoride (SF₆)
 - Other fluorinated gases including nitrogen trifluoride (NF₃) and hydro fluorinated ethers (HFE)

Covered Sources

- **Specific Industries**
 - Variety of Listed Industries that are know to emit one of more of the regulated GHG emissions
 - **Municipal Solid Waste Landfills** that generate CH₄ in amounts equivalent to 25,000 MTCO₂E per year or more
- **Supplier Sources (e.g., petroleum, industrial gasses, etc.)**
- **Combustion Sources**
 - 25,000 MTCO₂E per year or more from combined facility stationary combustion sources

Combustion Source Exception

- Maximum rated heat-input capacity for all stationary fuel combustion equipment combined is less than 30 MM BTU/hr, then the facility is presumed to emit less than 25,000 MTCO₂E and does not have to calculate or report emissions.
 - Excludes portable equipment, emergency generators, emergency equipment, agricultural irrigation pumps, hazardous waste combustors (except for co-fired fossil fuels), and flares.
 - CO₂ from biomass exempt from applicability determination

Overview – Landfills

- 40 CFR Part 98, Subpart HH
- Affects: MSW Landfills that Accepted Waste after 1/1/80
- No Hazardous Waste, Industrial or C&D Landfills
- Threshold = Generate Methane 25,000 MTCO₂E
- Includes Fugitive LFG, LFG Combustion Emissions, and Other Stationary Combustion Units



Compliance Timeline

- Determine Applicability: Now
- Evaluate Existing Monitoring Equipment/Programs: Now
 - Upgrade as Needed
- Prepare Written Monitoring Plan: April 1, 2010
- Begin Collecting Monitoring Data: January 1, 2010
- Best Available Methods: until April 1, 2010



Compliance Timeline (cont.)

- Request Extension by January 29, 2010 to go beyond April 1, 2010 for Available Methods
 - Detailed justification
 - Cannot go beyond December 31, 2010
- Specify Designated Representative: January 30, 2011
- First Annual Report Due: March 31, 2011

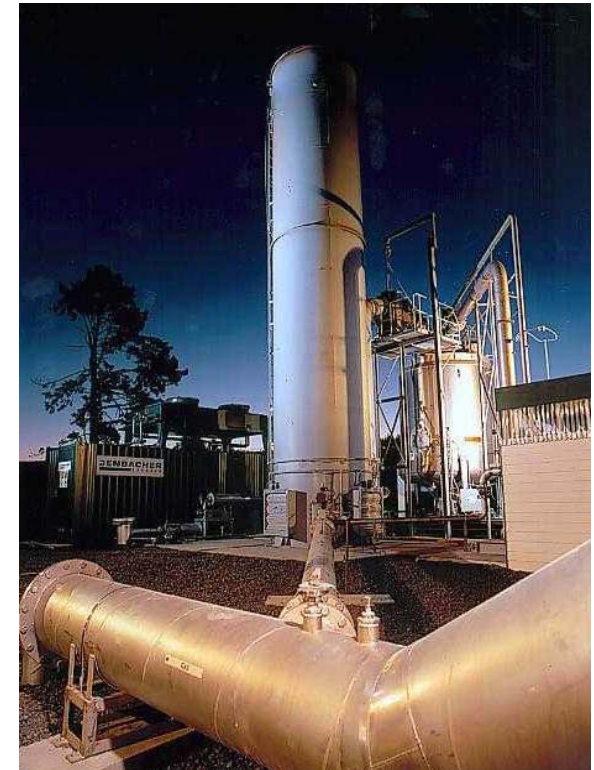


Applicability

- Methane Generation of 25,000 MTCO₂E
 - No reduction given for gas collection and control systems (GCCSs)
 - 10% reduction for methane oxidation in soils
 - About 270 cfm of LFG at 50% methane
- Two Methods for Methane Generation Determination in Subpart HH
 - Gas generation model (Equation HH-5)
 - Gas generation estimate using actual recovery data and collection efficiency (Equation HH-7)
- EPA Applicability Tool
 - 350,000 MT (~385,000 tons) of waste in place
 - 900 MT of methane collected

Calculating Methane Emissions - General

- Model LFG Generation Rate
- Calculate CH₄ Destroyed (with GCCS)
- Calculate Actual CH₄ Emissions (GCCS & Oxidation)
- Alternate Calculation Required (using Collection Efficiency)



LFG Modeling Criteria

- 1st Order Decay Equation
- Default (bulk waste) k and L_0 Coefficients
 - $L_0 = 0.067 \text{ Mg/Mg}$ ($\sim 100 \text{ m}^3/\text{Mg}$)
 - $k = 0.02$ (< 20 inches)
 - $k = 0.038$ (20-40 inches)
 - $k = 0.057$ (> 40 inches or leachate recirculation)
- L_0 and k can also be Determined by Waste Stream Data (IPCC)



LFG Modeling Criteria (cont.)

- Guidelines for Waste Disposal History
 - Scale house data must be used where available
 - Assume unknown years equal to oldest measured year
 - Assume average amount for each unknown year (using waste in place)
 - Scale based on population data (using waste in place)
- Do you need a scale now ??



Gas Collection – Flow Monitoring

- Continuous Flow Monitoring
 - Flow Correction for Temp and Pressure (automatic or weekly readings)
 - Calibrate before first year and then every 2 years or per manufacturer spec.
 - All collected gas to be accounted; may need multiple flow meters
 - Per HH, 60 F and 1 atm (not STP as defined in rule)



Flow Monitoring Methods

- **Acceptable Methods:**

1. ASME MFC-3M-2004 (...orifice, nozzle and venturi)
2. ASME MFC-4M-1986 (turbine meters)
3. ASME MFC-6M-1998 (vortex flow meters)
4. ASME MFC-7M-1987 (critical flow venturi nozzles)
5. ASME MFC-11M-2006 (coriolis mass flow meters)
6. ASME MFC-14M-2003 (small bore precision orifice meters)
7. ASME MFC-18M-2001 (variable area meters)
8. Method 2A or 2D

- **Thermal mass flow meters are allowed per EPA**

- **Annubar (self-averaging pitot tube) meters are allowed by EPA**



Gas Collection – CH₄ Monitoring

- Methane Monitoring
 - Continuous or Regularly (Not Less than Weekly)
 - Measure/correct for moisture if not on wet basis
 - Calibrate before first year and then every year or per manufacturer spec.
 - All collected gas to be accounted; may need multiple sample locations (generally same location as flow)



Methane Monitoring Methods

- Acceptable Methods:
 1. EPA Method 18
 2. ASTM D1945-03 (GC)
 3. ASTM D1946-90 (GC)
 4. GPA Standard 2261-00 (GC)
 5. UOP539-97 (GC)
 6. Method 25A or 25B (FID/IR)
- Portable gas composition analyzers (Landtec GEM-2000) acceptable per EPA
 - If use GEM, then must do annual correlation with lab test for methane (carbon filter ?)



Actual Methane Emissions: Method 1 (all sites)

- Methane Generation via Model
- Oxidation Factor: Apply to Uncollected Gas (10% Reduction)
- Deduct Actual Methane Recovered from Generation
- Compute “Uncombusted” Methane using Destruction Efficiency (DRE)
 - Lower of 99% or manufacturer spec (source test data OK)



Actual Methane Emissions: Method 2 (sites with GCCS)

- Alternate Method; Not Based on Modeling
- Calculate Site-Wide Gas Collection Efficiency (CE)
 - Modified SWICS Method
 - Based on cover type
- Use Gas Captured and CE to Estimate Fugitive Emissions
- Apply Methane Oxidation and DRE per Method 1



Reporting Requirements

- Landfill Operations (Open/Closed/Year)
- Waste Disposal Calculations
- Waste Composition (If Available)
- Modeling Parameters Used
- Methane and Flow Data
- Landfill Area, Cover Types by Area, and Oxidation Fractions Used
- LFG Modeling Results

Reporting Requirements (cont.)

- Annual Methane Emissions (w/o GCCS)
- With GCCS, Report Includes:
 - Flow of Collected LFG
 - CH₄ Content of LFG
 - Temp/Pressure/Moisture Data of LFG
 - Description of Control Device(s); On/Off Site
 - Device Operating Hours
 - Description of GCCS, Landfill Areas and Waste Depths

Reporting Requirements (cont.)

- With GCCS, Report Includes:
 - Computed Annual CH₄ Volume Captured
 - Computed CH₄ Generated (Correct for Oxidation Using Model)
 - Computed CH₄ Generated (Correct For Oxidation Using Gas Recovery Flow and CE)
 - Methane Emissions, Method 1 (Modeling)
 - Methane Emissions, Method 2 (Gas Captured and Estimated CE)

Reporting Requirements (cont.)

- With GCCS, Report Includes (cont.):
 - Include Stationary Combustion Emissions
 - LFG Combustion Devices under Common Control (flares exempt)
 - Other fuel combustion (excludes mobile, portable, emergency, etc.)
 - Guidelines for Accounting for Missing Data Points

Other Sources

- Third-party LFGE not under Common Control (separate facility)
 - CO₂ from biomass (e.g., LFG) exempt unless co-fired, but CH₄ and N₂O included
- LFGE under Common Control
 - Must report under Stationary Combustion
- Flares
 - Account for methane that goes to flares under HH; exempt under Stationary Combustion
- Other Stationary Combustion
 - HH Landfills must report; except mobile, portable, emergency, etc. exempt

Calculations – Combustion

- The following methodologies can be used to calculate CO₂, CH₄, and N₂O emissions:
 - Combustion Facilities must calculate CO₂ emissions using one of four tiers:
 - **Tier 1** uses an emission factor that is multiplied by annual fuel use and a default heating value for that fuel.
 - **Tier 2** uses an emission factor that is multiplied by annual fuel use and a measured heating value of that fuel. Units that combust MSW or other solid fuels and generate steam must use steam production (in place of fuel use) and an emission factor.

Calculations - Combustion(cont.)

- Calculate CO₂, CH₄, and N₂O emissions (cont.):
 - Combustion Facilities (cont.):
 - **Tier 3** uses a calculation based on annual fuel use and measured carbon content of that fuel. For this tier, calculate emissions only for fuels that contribute 10 percent or more of the annual heat input to the unit.
 - **Tier 4** requires a CEMS. In general, reporters are required to calculate GHG emissions only for specific fuels that are listed in the rule, except that units larger than 250 MMBtu/hr also must calculate GHG emissions for any fuel that provides 10 percent or more of the annual heat input to the unit.

Calculations - Combustion (cont.)

- Biomass sources (e.g., LFG), except waste to energy (WTE), are Tier 1
- Biogenic CO₂ Emissions From Biomass Fuel Combustion: estimate CO₂ emissions from the combustion of the biomass fuels listed in the rule by Tier 1 (keep separate from fossil fuel)
- Diesel, gasoline, natural gas, and propane are Tier 1 also
- WTE: Tier 2 or higher

Calculations – Combustion (cont.)

- Calculating N₂O and CH₄ Emissions From Combustion
 - Most units can use an emission factor that is based on annual fuel use and the high heat value of fuel (using a default value prescribed in the rule if a measured heat value is not available).
 - Units covered under EPA's Acid Rain Program and other units that monitor and report annual heat input under 40 CFR Part 75 requirements will use an emission factor and the measured annual heat input.

Additional Information

- EPA Website:
<http://www.epa.gov/climatechange/emissions/ghgrulemaking.html>
- Questions to EPA: GHGMRR@epa.gov or (877) GHG-1188
- *MSW Landfill Applicability Tool: “MSW Landfill Utility”*
- Fact Sheets (available on website):
 - MSW Landfills
 - Stationary Fuel Combustion Sources
 - General Provisions