



Implementation of EPA's Mandatory GHG Reporting Requirements

Rural Counties' ESJPA

Board and Technical Advisory Meeting

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Sacramento, CA

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SCS Engineers

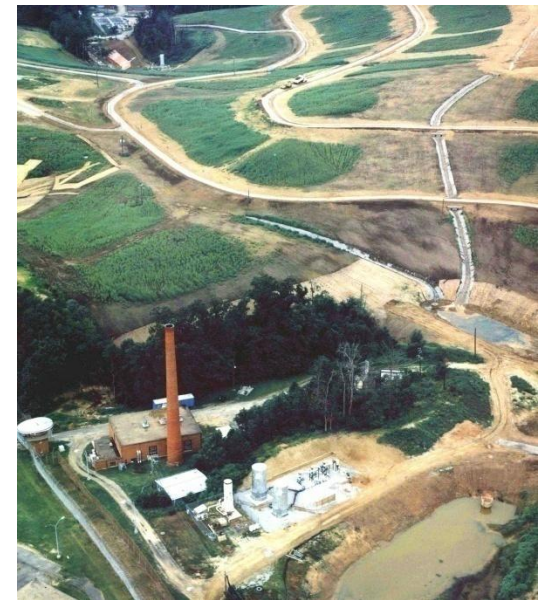
Speaker Bio

- Raymond Huff, R.E.A.
- Vice President, SCS Engineers
- 18 years of experience
- Western Regional Lead for
 - Closed Landfills
 - Regulatory Compliance
 - GHG Assessment, Reporting, and Verification
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Topics to Cover

- Summary Overview
- Applicability and Monitoring Requirements
- Reporting Requirements
- Recordkeeping Requirements
- Reporting and Monitoring Tips



Summary Overview

GHG Rule - Landfills Overview

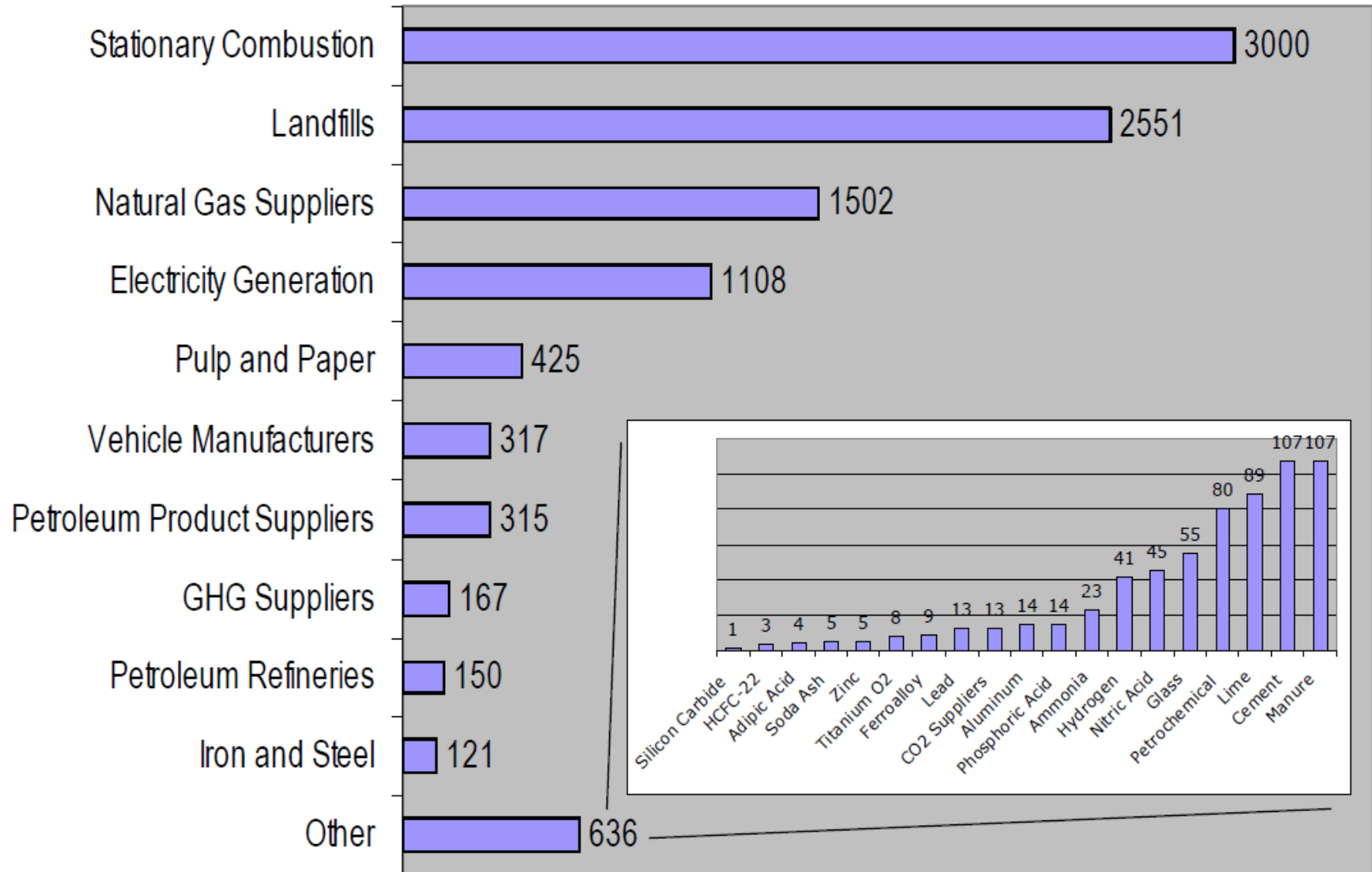
- First reporting year is 2010
- The first official reporting date will be March 31, 2011
- Third-party verification not required, but will be treated like any Clean Air Act (CAA) reporting requirement
- GHG monitoring, data collection, QA/QC, and calibration requirements start January 1, 2010 (with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

GHG Rule - Landfills Overview

- 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 2,550 landfill reporters expected

GHG Rule - Landfills Overview

Anticipated Facilities Covered



Source: US EPA

GHG Rule – Landfills Overview

- 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 – Landfills Overview

- 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: Now
- Begin Collecting Monitoring Data: January 1, 2010
- Best Available Methods until April 1, 2010



Compliance Timeline

- **BAMM Extension (TOO LATE)**
 - By January 29, 2010 to go beyond April 1, 2010
 - Detailed justification
 - Cannot go beyond December 31, 2010
- **Specify Designated Representative by:**
January 30, 2011
- **First Annual Report Due:**
March 31, 2011



Applicability and Monitoring Requirements

Landfill Applicability

- MSW Landfills that **GENERATE** Methane in Amounts Equivalent to 25,000 MTCO₂E or more per year.
 - 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
- Applicability not as clear as it should be

EPA Applicability Tool

<http://www.epa.gov/climatechange/emissions/GHG-calculator/categories.html>

- 350,000 MT (~385,000 tons) of waste in place
- 900 MT of methane collected
- PROVIDED BY EPA AS GUIDANCE ONLY

– *“The applicability tool and its contents do not constitute rulemaking or a decision by EPA...”*

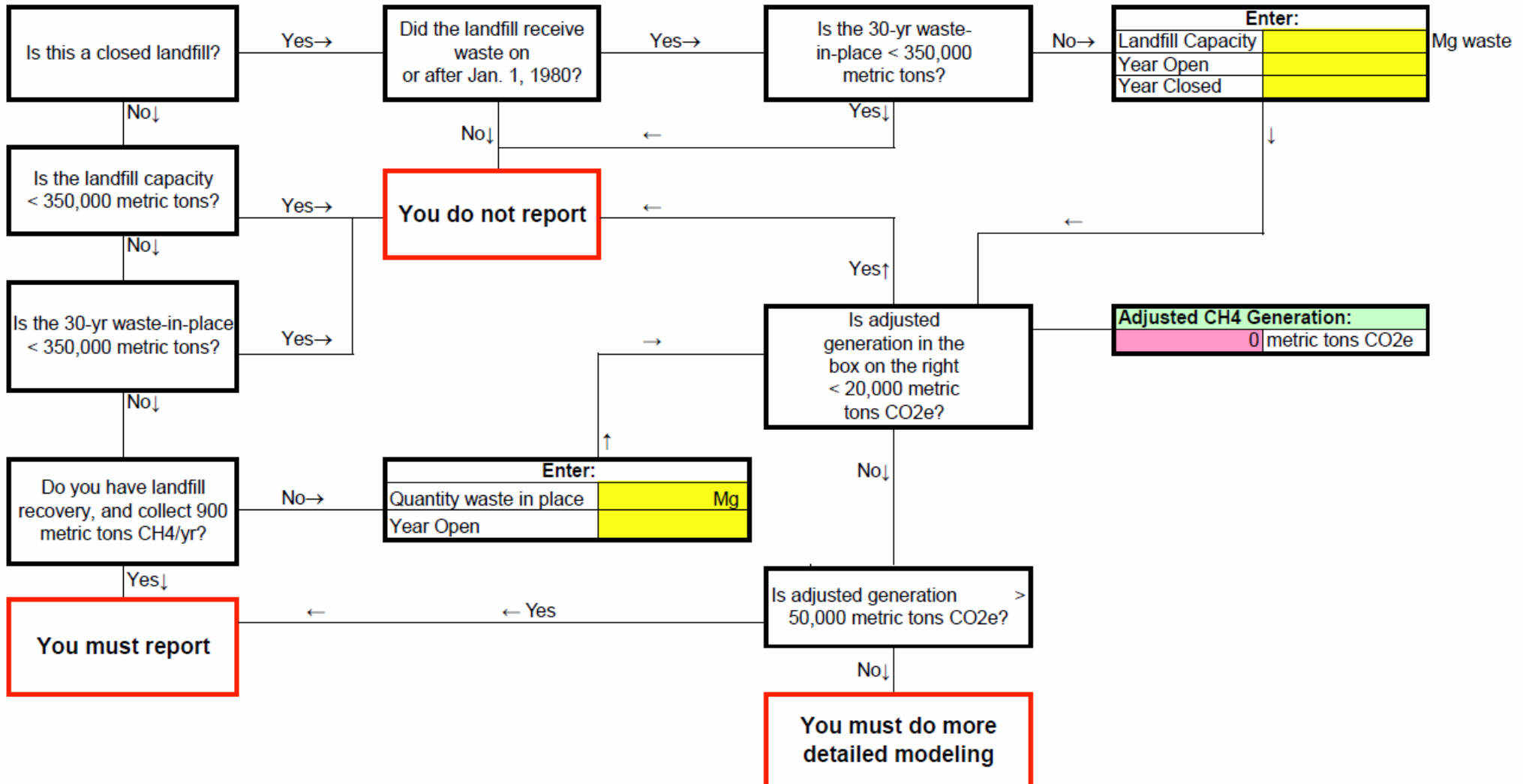
Use of this tool does not constitute an assessment by EPA of the applicability of the rule to any particular facility. In any particular case, EPA will make its assessment by applying the law and regulations to the specific facts of the case.”

EPA Applicability Tool

<http://www.epa.gov/climatechange/emissions/GHG-calculator/categories.html>

MSW Landfill Utility

Use this utility to help assess if your facility must report under the Mandatory Greenhouse Gas Reporting Rule

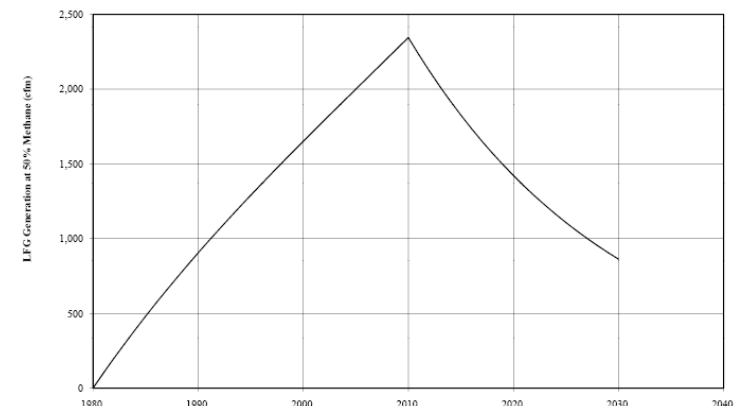


Determining Applicability

- Two Methods for Methane Generation Determination in Subpart HH
 1. Gas generation model (eq. HH-1 and HH-6)
 - All sites (Eq. HH-1-3, HH-5, and HH-6)
 2. Gas generation estimate using actual recovery data and collection efficiency
 - (eq. HH-4, HH-7/HH-8)
- You must use both methods to determine applicability under the Rule

GCS		11/3/2008 By the Hour										
Date/Time	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG
10/1/2008 12:59:07 AM	3.1	1,073	249	0	0	54.4	0	0.57	69	21	4.2	
10/1/2008 1:59:15 AM	3	866	248	0	0	54.4	0	0.57	67	20.8	4.2	
10/1/2008 2:59:15 AM	3.1	985	216	30	0	54.6	0	0.45	65	19.5	4.2	
10/1/2008 3:59:11 AM	3.1	1,181	248	0	0	54.7	0	0.57	63	20.9	4.2	
10/1/2008 4:59:08 AM	3.1	1,189	247	0	0	54.6	0	0.57	61	20.9	4.2	
10/1/2008 5:59:03 AM	3.2	1,178	249	0	0	54.7	0	0.57	60	20.9	4.2	
10/1/2008 6:59:00 AM	3.2	1,177	250	0	0	54.7	0	0.56	58	20.8	4.2	
10/1/2008 7:59:58 AM	3.2	1,159	250	0	0	54.8	0	0.56	56	20.8	4.2	
10/1/2008 8:59:58 AM	3.1	1,158	248	0	0	54.6	0	0.56	58	8.3	4.2	
10/1/2008 9:59:37 AM	3	1,139	261	0	0	53.9	0	0.56	59	4.2	4.2	
10/1/2008 10:59:36 AM	3	1,157	250	0	0	53.4	0	0.59	62	4.2	4.2	
10/1/2008 11:59:22 AM	3	1,173	248	0	0	53.6	0	0.56	66	4.2	4.2	
10/1/2008 12:59:11 PM	3	1,197	248	0	0	53.8	0	0.57	69	4.2	4.1	
10/1/2008 1:59:13 PM	2.9	1,211	249	0	0	53.9	0	0.56	74	4.2	4.1	
10/1/2008 2:59:02 PM	2.7	1,197	247	0	0	53.9	0	0.59	72	4.2	4.1	
10/1/2008 3:59:54 PM	2.6	1,184	244	0	0	53.8	0	0.55	74	4	3.9	
10/1/2008 4:59:06 PM	0.3	233	32	0	0	51.5	0	0.07	74	0.5	0.5	
10/1/2008 5:59:34 PM	3.1	1,238	261	0	0	54.5	0	0.56	76	17.1	4.2	
10/1/2008 6:59:42 PM	3.1	1,222	247	0	0	54.9	0	0.54	76	21.2	4.3	
10/1/2008 7:59:53 PM	3.2	1,192	250	0	0	54.9	0	0.57	68	20.9	4.3	
10/1/2008 8:59:52 PM	3.2	1,211	249	0	0	55	0	0.56	63	20.9	4.3	
10/1/2008 9:59:50 PM	3.2	1,212	249	0	0	54.9	0	0.57	59	20.9	4.3	
10/1/2008 10:59:45 PM	3.2	1,217	252	0	0	54.8	0	0.57	55	20.9	4.3	
10/1/2008 11:59:41 PM	3.3	1,213	249	0	0	54.8	0	0.56	53	20.8	4.3	
10/2/2008 12:59:57 AM	3.3	1,208	251	0	0	54.8	0	0.55	52	20.8	4.3	
10/2/2008 1:59:54 AM	3.3	1,215	254	0	0	54.8	0	0.57	50	20.8	4.3	
10/2/2008 2:59:50 AM	3.3	1,196	249	0	0	54.7	0	0.56	49	20.8	4.3	
10/2/2008 3:59:46 AM	3.2	1,189	250	0	0	54.7	0	0.56	48	20.8	4.3	
10/2/2008 4:59:42 AM	3.3	1,218	249	0	0	54.7	0	0.57	49	20.8	4.3	
10/2/2008 5:59:38 AM	3.3	1,212	249	0	0	54.8	0	0.57	48	20.8	4.3	
10/2/2008 6:59:34 AM	3.3	1,153	251	0	0	54.9	0	0.56	47	20.7	4.3	
10/2/2008 7:59:30 AM	3.4	1,156	247	0	0	55	0	0.55	48	20.9	4.3	
10/2/2008 8:59:04 AM	4.7	428	61	222	0	54.9	0.16	0.13	48	17.3	4.3	
10/2/2008 9:59:02 AM	5.3	58	0	306	0	54.7	0.23	0	54	16.7	4.3	

Figure 1. LFG Generation Projection
Landfill Name, State



Generation 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)



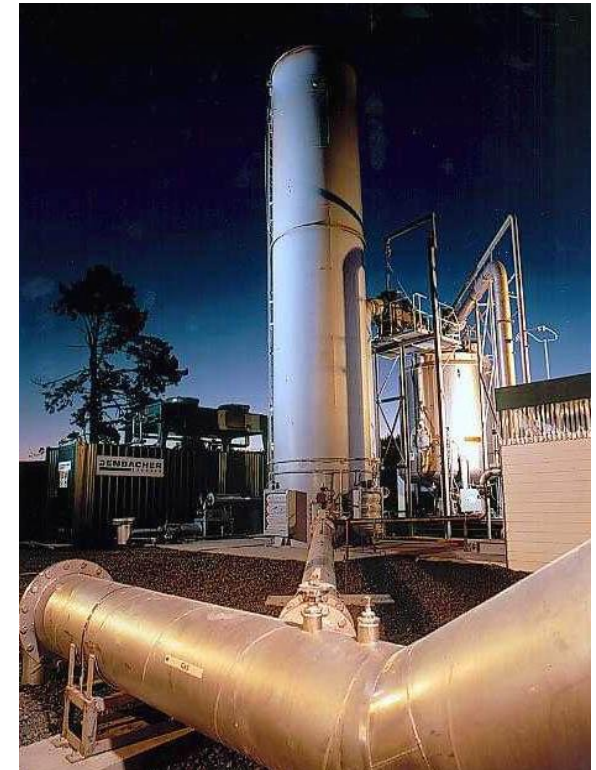
Generation Modeling Criteria

- 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 ??



Methane Generation Using Recovery Data

- Calculate CH₄ Destroyed (with GCCS)
- Calculate Actual CH₄ Emissions (GCCS & Oxidation)
- Alternate Calculation Required (using Collection Efficiency)
- Data used must meet monitoring/recordkeeping requirements



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



*EPA Correction to 60° F, **NOT** STP which EPA defines as 68° F

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
- Request into EPA regarding Annubar (self-averaging pitot tube) meters



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



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



Calculate Methane Emissions (for sites with no GCCS)

- Methane Generation via Model
 - Eq. HH-1 through HH-3
- Oxidation Factor: Apply to Uncollected Gas (10% Reduction)

$$MG = G_{CH_4} \times (1 - OX) \quad (\text{Eq. HH-5})$$

Where:

MG = Methane generation, adjusted for oxidation, from the landfill in the reporting year (metric tons CH₄).

G_{CH₄} = Modeled methane generation rate in reporting year from Equation HH-1 of this section (metric tons CH₄).

OX = Oxidation fraction. Use the default value of 0.1 (10%).



Calculate Methane Emissions

Method 1 (sites with GCCS) HH-6

- 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)
 - 99% or manufacturer spec



Calculate Methane Emissions

Meth. 2 (sites with GCCS) HH-7/8

- 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 98.3(c)

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

- 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

- 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

- 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

Recordkeeping Requirements 98.3(g)

Recordkeeping Requirements

- Keep records for a period of 3 years
 - Electronic or hardcopy
- Report Contents
 1. List of all units, activities, etc. for which GHG emissions were calculated
 2. Data used for calculations
 3. Annual GHG Report
 4. Missing data computations
 5. Monitoring Plan

Monitoring Plan

- Plan Must Include
 - Identification of positions of responsibility for collection of emissions data
 - Site Manager or Compliance Officer
 - Explanation of processes and methods used to collect necessary data for GHG calculations
 - Description of QA/QC, maintenance, repair procedures for required monitoring equipment
- Plan may rely on references to existing documents

EPA Clarifications/ Interpretations

EPA Clarifications/Interpretations

- Applicability
 - If an MSW Landfill operates a GCCS, it must use both methods (EQ. HH-5 and HH-7) to determine if it is subject to the rule. If it is over for either, they must report
- Modeling
 - Compost used as daily cover must be quantified and included in waste tonnage data for modeling purposes
 - In modeling, per HH-1, facilities don't need to include waste more than 50 years old in the model
- GHG Monitoring Plan
 - Due no later than April 1, 2010

EPA Clarifications/Interpretations

- **Monitoring Requirements**
 - Flow should be corrected to 60° F, NOT STP, which EPA defines as 68° F per 98.346(i)(1)
 - Portable methane analyzers (e.g. Landtec GEM-2000) and thermal mass flow meters are acceptable to meet monitoring requirements of Subpart HH
 - Still requires annual correction factor testing
 - Veris averaging pitot tubes are acceptable
 - Must meet accuracy requirements of 98.3(i)
 - Condensate knock-outs and blowers/compressors are NOT considered treatment, they are part of the collection system
 - EPA ‘prefers’ measurements to be made after knock-out or blower
 - Landtec GEM measures methane on a “wet” basis
 - Subpart HH monitoring requirements do NOT apply to backup flares
 - Must be able to defend “backup”

EPA Clarifications/Interpretations

- 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; mobile, portable, emergency, etc. exempt

EPA Clarifications/Interpretations

- Scales
 - Required under Subpart HH
 - Some BMM extensions approved already
 - Self Haul Weigh-in at Scales
 - No word yet from EPA (stay tuned)
- Comfort Heating/Hot Water Heaters
 - Included per EPA
 - Included for facilities subject to the Rule
 - Residential excluded
- Pipeline gas sent to a third party
 - Not required to monitor before leaving site, but can use off-site monitoring data from end-point

SCS Observations

- Active Sites w/o GCCS
 - Required to develop a monitoring plan
 - Essentially for collection of refuse tonnage data
 - Confirmed by EPA
- GEM Units
 - Calibration
 - Manufacturer recommends bi-annual calibration
 - Annual NMOC analysis
 - GEM IR detector is subject to hydrocarbon interferences (i.e. NOT a methane specific meter)
 - Therefore, it is subject to annual NMOC analysis cross check requirements in Subpart HH

COMPARISON: CARB AND FEDERAL GHG RULES

Category	CARB	Federal
Reporting Level	Report at facility and/or retailer/ marketer levels	Report at facility and/or supplier levels
Geographic Boundaries	California	United States
Reported Gases	Number of gases varies with each specific sector	
Biomass Combustion	Reported biomass combustion	
Baseline	N/A	N/A
Device Reporting	Device (meter) level fuel use required	Unit- or process- level, activity level data
Indirect Emissions	Report energy purchases	N/A
Non-Facility/ Entity	Suppliers of Fossil fuel and industrial GHG's	Retail Providers & Marketers
Industry Methodology	Reporting required using sector specific methods and protocols	

Category	CARB	Federal
Emission Factors	Some differences between emissions factors	
Estimation Methods	More prescriptive, specific methods required	
Reporting Period	1 full year of operations at a facility	Year or months covered by report
Missing Data	If over 20% of data for any source is missing report can not be verified.	Provide procedures which were used to fill gaps in monitoring data
Verification	Annual	N/A
De Minimis	3% and $\leq 20,000$ tonnes CO ₂ e; must report emissions	N/A
Reporting Tool	Online Reporting Tool	To be specified by the EPA
General	Focus on cap & trade quality data	
Transitional Reporting	May use best available data for the CY 2009 inventory	May use best available data for the first quarter of the CY 2010 reporting year

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

Contact Info

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