Landfills and the 1990 Statewide GHG Emissions Inventory

A Focused Technical Discussion of Landfills and the Statewide GHG Inventory

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Sacramento

Focused Discussion Topics

- AB32 requirements for 1990 statewide inventory
- Landfill portion of the 1990 inventory
- Current CEC landfill emission estimates for 1990
- Improved 1990 estimates
- Next Steps & Schedule

Statewide Inventory Requirements Under AB32

- Determine 1990 statewide emissions level
- Consider all six Kyoto gases
- Establish 2020 limit equivalent to 1990 level
- Ensure the most accurate determination of the 1990 level through best available data
- Present for Board consideration by January 1, 2008

Determining the 1990 Statewide Emissions Level

- Begin with existing state GHG inventory
  - Developed by Energy Commission (CEC)
  - Primarily top-down
  - Based on national or state-level data
- Document existing data sources and emissions estimation methods
- Acquire improved data where available for 1990
- Establish 1990 statewide, aggregate GHG emissions level

Landfills Category

- Landfills have the potential for generating significant amounts of methane
- Global warming potential of CH4 increases impact as compared with CO2 (SAR-21 GWP)
- Current estimates show landfills making up approximately 2 percent of the statewide emissions in 1990

Landfill Gas Combustion Emissions

- Landfill gas (LFG) is approximately 50 percent CO_2 and 50 percent CH_4 (by volume) with less than one percent other organic gases
- Predominant GHG emission from LFG combustion is CO_2
- N_2O emissions from combustion of LFG are minor as compared with impacts of CH_4

CEC 1990 Landfill Emissions Method

- Local air districts provide estimates of total organic gas (TOG) from landfills
- TOG = CH4 + Other organics (does not include CO2)
- ARB speciates TOG estimates to obtain CH4
- Key assumption: 98.6 percent of landfill gas TOG is CH4
- CH4 estimates provided to CEC for development of current 1990 landfill category estimate

CEC 1990 Landfill Estimate

- Based on TOG estimates from local air districts and provided to CEC by ARB
- Current 1990 estimate of landfill emissions: 8.13 Million Metric Tons of CO2 Equivalents (MMTCO2E)
- Current landfill inventory does not show significant variability over time

Source: California Energy Commission; Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004

Current Landfill Data Collection Efforts

- ARB, in collaboration with CIWMB, is currently conducting a survey of landfills in the state:
  - Year of installation of landfill gas collection system
  - Type(s) of landfill gas combustion device(s) and CH4 destruction efficiency
  - Amount of landfill gas collected and combusted for years 1990 to the present
  - Amount of other fuels combusted from 1990 to the present
  - %CH4 content of landfill gas by year for 1990 to the present

Current Landfill Data Collection Efforts *(cont.)*

- ARB is working with CIWMB's SWIS database to confirm landfill information and estimates of current waste-in-place
- Data is available on LFG-to-Energy facilities from US Energy Information Administration (EIA) and USEPA, and the ARB will use these data where available
- A CEC funded study to develop improved GHG inventory methods for landfills (Bogner) is beginning this year, but will not be complete before development of the 1990 statewide inventory

Proposed Landfill GHG Calculation Methodology

- ARB staff is proposing a single, consistent methodology for updating the landfill GHG inventory
- Methodology requires the following data inputs:
  - Amount of landfill gas collected for the given year (LFG-mmscf)
  - CH4 content of the landfill gas (CH4%)
  - CH4 destruction efficiency of those devices used to burn the landfill gas (DE%)
  - Assumed collection efficiency (CE%)
  - Assumed oxidation percentage of CH4 escaping the landfill (OX%)

Proposed Landfill GHG Calculation Methodology *(cont.)*

Landfill CH4 Emissions (in MTCO2E) =

[LFG-mmscf x CH4% x (1-CE%)/CE% x (1-OX%) + LFG-mmscf x CH4% x (1-DE%)]
x
[20.23 metric tons CH4 per mmscf of CH4] x [GWP* of CH4]

Assumptions:

- CH4%=0.50 (50%) – methane fraction of landfill gas
- CE%=0.75 (75%) – collection efficiency of landfill gas collection system
- OX%=0.10 (10%) – oxidation percentage of escaping methane
- DE%=0.98 (98%) – methane destruction efficiency of control device

**IPCC SAR: 21*

Proposed Landfill GHG Calculation Methodology *(cont.)*

- For simplicity, above equation reduces to:
  Landfill CH4 Emissions (MTCO2E) = 68.0 MTCO2E/mmscf of LFG

- *Example:* A landfill collecting 147 mmscf of LFG would generate 10,000 MTCO2E*

**Based on use of CH4 GWP of 21*

Landfill GHG Emissions Factors

- Using equation in previous slide, emission factors may be developed for different LFG collection efficiencies:

Collection Efficiency Assumed	MTCO2E/MMSCF-LFG
50%	195.4
75%	68.0
80%	52.0
85%	38.0
90%	25.5
95%	14.3

MTCO2E = Metric Tons of CO2 Equivalents

Potential 1990 Landfill GHG Inventory Improvements

- Staff currently reviewing available data sources to obtain landfill specific information on the following:
  - Landfill gas collection and fuel use
  - Methane content of landfill gas
  - Methane destruction efficiency
  - *Collection efficiencies?*
  - *Oxidation factors?*
- Best available data will be used in development of 1990 inventory

Next Steps

- On-going discussion with all stakeholders
- Collaboration with CIWMB and CEC
- Landfill survey

Schedule

- Public Workshop
  - Inventory & Mandatory Reporting
  - All sectors
  - May 23, 2007
- Staff Report in October
- Board Hearing late 2007

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GHG Mandatory Reporting Website
http://www.arb.ca.gov/cc/ccei/ccei.htm