U.S. EPA Solid Waste Greenhouse Gas Inventory: Summary of Stakeholder Input

January 12, 2017

Rachel Schmeltz
Agenda

• Recap of the December 8th webinar
• Specific areas for stakeholder input
• Suggestions and studies received
• Preliminary suggestions for consideration
• Q&A
## Schedule of Events

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Today’s webinar to discuss options for improvement</td>
<td>Prepare public review draft of 1990-2015 Inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Follow-up discussions up to Public Review</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Stakeholder engagement period from December to mid-January

- (4 opportunities)

- EPA to prepare summary reports from stakeholder engagement

- EPA to decide on the path forward
Recap of the Dec 8th Webinar

• Discussed how the EPA accounts for landfill methane emissions (GHGRP and the Solid Waste Inventory)
• Reviewed in detail the data sources, activity data and emission factors for the Solid Waste Inventory
• Reviewed last year’s Inventory, the differences between public review draft and final, and why methodology changes are needed.
Input requested

We asked for your input on the following:

1. Use of the GHGRP annual waste disposal data in methane generation equation
2. Use of the methane generation equation with respect to the DOC value
3. Proper way to account for annual waste disposal data for facilities not reporting to the GHGRP

Input includes, but is not limited to, data on:

– Quantities of waste types disposed at individual or groups of landfills
– How the waste composition has changed over time
– Tipping receipts documenting the fraction of inerts
– Statistics on the changing waste composition
Context

• Presentation by those who provided input

• We may engage in follow-up conversations with individual stakeholders between now and the public review comment period (Feb. 17 – Mar. 19)

• As stated previously, this is not intended to serve as a formal consensus-based process

• Ultimately, the methodological improvements made will be EPA’s decision
Summary of Stakeholder Input Received

- Recommendations from Industry
- Summary of Study by Environmental Research and Education Foundation
Updating the U.G. GHG Inventory For Landfills

- Waste Management
- Republic Services
- SCS Engineers
- National Waste and Recycling Association
- Solid Waste Association of North America
Short-Term Implementation
Use GHGRP Subpart HH Emissions

- Subpart HH emissions calculations are more detailed and up-to-date than US GHG Inventory methodology
  - Reflects more representative emissions than 2006 IPCC methods
  - GHGRP is evolving to reflect new science (e.g., methane oxidation, influence of cover type)
- Reported emissions under GHGRP are subject to third-party validation to ensure accuracy
  - Validation done both automatically and by post-reporting review and questions from EPA
- Data submitted under GHGRP are “certified” by a designated representative
- Use of GHGRP data reduces burden on EPA/Contractor staff
  - Recognizes significant industry investment (time-money) to produce compliant and valid data on emissions
Use Subpart HH Emissions

- GHGRP represents Tier 3 level data under IPCC framework
  - Uses site-specific data
  - Employs complex calculations and systematic methodologies
  - Provides more rigorous and credible emission estimates
- Incorporate Methane Recovery Data (HH-4)
  - 88% of landfills reporting under GHGRP employ gas collection and control systems
  - GHGRP requires certified and validated annual methane flow rates and gas composition data
Use Subpart HH Emissions

- Reflects Site-Specific Oxidation Factors
  - GHGRP updated in 2013 to include new oxidation factors based on methane flux field data
  - More scientifically sound than IPCC default value
- Use HH-6/HH-8 for GCCS Sites to Quantify Emissions
  - Use results as-reported under HH-6 or HH-8 by sites
  - Both HH-6/HH-8 require site-specific data
  - Resulting reported emissions are certified and validated
- Use HH-5 for Non-GCCS sites to Quantify Emissions
  - Use as-reported by sites
- Use Annual Waste Disposal Data Reported under Subpart HH
Non-Reporting Sites?

- EPA has stated that GHGRP sites represent 85-95% of landfill emissions
- 10% correction factor is appropriate
  - This is consistent with national tonnage data showing only 7% of total U.S. annual waste is disposed in non-reporting sites
Accounting for 1990-2009

• Back-Cast using 2010-2015 GHGRP data
  – Include 10% adjustment for non-reporting sites
Summary of EREF Efforts Related to U.S. EPA’s Emissions Inventory
Mission: To fund and direct scientific research & educational initiatives for sustainable waste management practices to benefit solid waste field and the communities it serves.

- 501(c)3 charity began in 1992
- Non-lobbying organization
- Not a membership organization
EREF Programs

1) Data & Policy Analysis *(Internal Research)*

2) Education

3) Scholarships

4) Research Grants
EREF Efforts Related to EPA Emissions Inventory

1) MSW Management in the U.S.

2) Estimating DOC in MSW Landfills

3) Beneficial Use of Landfill Gas
MSW Management in the U.S.
MSW Managed in the U.S. Tonnages

- Methodology used a facility-based, bottom up approach

- 347 million tons MSW managed (2013)
  - 6.8 lbs/person-day

- Majority is landfilled

- Collectively, about 27% is recycled or composted
**MSW Organics Tonnage**

- Total MSW Managed = 347 million tons
- Organic fraction = 48.8%

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Million Tons MSW Organics Managed</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfills</td>
<td>133.6</td>
<td>79.0</td>
</tr>
<tr>
<td>Composting</td>
<td>21.3</td>
<td>12.6</td>
</tr>
<tr>
<td>Waste-to-Energy</td>
<td>11.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Mulching</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Anaerobic Digestion</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Tons MSW Organics Managed</strong></td>
<td><strong>169.2</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

- Mulching tonnage based EPA estimates
- Re-use/On-site management tonnage is unknown
MSW Entering MSW Landfills

• The amount of MSW that entered landfills in 2010 and 2013 was recently assessed by EREF using a facility-based approach.

• Results, based on EPA definition of MSW:
  • 2013 landfilled MSW: 222.0 million tons
  • 2010 landfilled MSW: 224.4 million tons

• Regional and state breakdown of MSW landfilling is provided in MSW Management in the U.S.: 2010 and 2013 pp. 12, 29-33.
Organics in Landfilled MSW
Food Waste in Landfilled MSW

The graph illustrates the discarded food waste fraction over the years from 1994 to 2016. The data is represented for various states and regions, with the national trend shown in orange. States and regions include Georgia, Indiana, California, Oregon, Wisconsin, Connecticut, Tennessee, North Carolina, and Iowa.
• MSW (both degradable and inert) from residential, commercial, and institutional sources.

• 45 states allow for non-MSW Subtitle D wastes to be deposited in MSWLFs, but what they are vary:
  • construction and demolition (C&D) waste (41 states),
  • industrial waste (32 states),
  • municipal sludge/biosolids (28 states), and
  • ash (21 states).

• Thus, 2 scenarios for materials entering MSW landfills:
  1. MSW only entering LF
  2. MSW and Non-MSW materials entering LF
Non-MSW Entering MSWLFs

• Analysis used data from 14 states with 2013 data. These states represent:
  • 35% of open MSWLFs
  • 37% of landfilled MSW tonnage

• Total waste deposited in these landfills was:
  • 2/3 MSW
  • 1/3 Non-MSW

Detailed results for all 14 states are shown in *Estimating DOC in MSW Landfills and the Impact of Non-MSW* Appendix D.
Estimating DOC in MSW Landfills
Degradable Organics Carbon and the Impact on Emissions Estimates

A fixed amount enters the landfill but it is based on waste composition.

Biogas from DOC, beneficially used or as emissions.

Only a fraction of DOC degrades, the remainder is sequestered.

Municipal Solid Waste (MSW)

DOC

DOC

DOC

Non-MSW in 45 states

Remaining Carbon
Estimating DOC in MSWLFs

- DOC values were calculated for the waste streams entering MSW landfills using available data

- Sample-and-sort data:
  - MSW-only waste stream
  - C&D waste stream
  - Industrial waste stream

- State reporting data:
  - Bulk waste stream (all Subtitle D wastes entering MSWLFs)
# Resulting DOC Estimates

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>State Sample-Sort Data</th>
<th>U.S. EPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>DOC bulk waste</td>
<td>0.161</td>
<td>0.118 - 0.180</td>
</tr>
<tr>
<td>DOC MSW</td>
<td>0.184</td>
<td>0.142 - 0.209</td>
</tr>
<tr>
<td>DOC C&amp;D</td>
<td>0.136</td>
<td>0.103 - 0.180</td>
</tr>
<tr>
<td>DOC Industrial</td>
<td>0.167</td>
<td>-</td>
</tr>
</tbody>
</table>
Beneficial Use of Landfill Gas
**EREF Study and Comparison to GHG Reporting/LMOP**

- Number of landfills identified for this study = 1,577  
  *(only Subtitle D LFs actively accepting waste were included)*
- Landfills that provided beneficial LFG usage data = 70.4 %

### Number of Facilities: Comparison to GHG Reporting & LMOP

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>2010</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EREF</td>
<td>GHG</td>
</tr>
<tr>
<td>Open, receiving waste</td>
<td>1,577</td>
<td>1,141</td>
</tr>
<tr>
<td>Closed</td>
<td>-</td>
<td>122</td>
</tr>
<tr>
<td>Total</td>
<td>1,577</td>
<td>1,263</td>
</tr>
</tbody>
</table>
LFG Management
*(based on tonnage)*

Roughly ~80 million more tons goes to private vs public LFs
LFG Management
*(based on gas collected)*

- Majority of LFG collected occurs at facilities with beneficial use
- Does not account for gas flared at beneficial use facility
LFG Management
*(based on gas collected)*

- 18% is flared at BU facility as a result of downtime, excess generation, supply/demand imbalance, etc.
LFG Management - Reporting Coverage
(based on number of facilities)

GHGRP Open Landfills  \( n=848 \)

- 39% In Progress
- 35% No Collection
- 26% Flare
- 8% Beneficial Use

Non-Reporting Open Landfills  \( n=623 \)

- 7% In Progress
- 8% No Collection
- 52% Flare
- 34% Beneficial Use

- Landfills not covered in the GHGRP framework and reporting requirements are less likely to have gas capture and control
- Data collection ongoing to assess coverage of GHG database
Future Work: Impact of Organics Diversion on LFG
Case Study in LFG Trends:
Aggressive (Altamont) vs. Typical (Scholl Canyon)
Comparison of Policies

San Francisco – Aggressive Policy (Altamont Landfill)

2001:
- Must meet 75% diversion by 2010 to send waste to Alameda County’s Altamont Landfill.
- 3 bin system to collect organics

2009:
- San Francisco Mandatory Recycling and Composting Ordinance
- All residents must divert organics

CA State – Typical Policy (Scholl Canyon Landfill)

2012: AB 341- 75% recycling and composting rate by 2020

2014: AB 1826- Mandatory commercial organics recycling, beginning 2016
Altamont/Scholl Canyon

Waste in Place

- Altamont Landfill
- Scholl Canyon Landfill

Graph showing the waste in place, tons, from 2010 to 2014.
Altamont/Scholl Canyon
Collected LFG per Ton

Gas collected from Altamont is nearly 1/3 of Scholl Canyon even though waste in place is over 2X higher at Altamont.

2010 – 2014 Reduction in LFG Collected
Altamont: 16.8 %
Scholl Canyon: 3.3 %
Preliminary Thoughts on Methodological Improvements for Consideration
Context

• Did not receive much input on . . .
  – Non-reporting landfills
  – Data for years prior to implementation of the GHGRP (pre-2010)

• Following options are concepts and touch upon pros/cons, but are not complete
Option 1: Use current method

- Use State of Garbage and EREF (2016) data on MSW generation and apply a disposal factor to estimate nationwide MSW landfilled
- Use GHGRP methane recovery data and supplement with other 3 databases
- Could modify the Inventory bulk MSW DOC value (through waste characterization studies, updated Lo)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal changes required</td>
<td>Unsure when updated MSW generation data will be available</td>
</tr>
<tr>
<td>Allows for facility-specific CH4 recovery values to be used</td>
<td>Does not reduce uncertainty</td>
</tr>
<tr>
<td></td>
<td>Unable to use facility-specific OX</td>
</tr>
</tbody>
</table>
Option 2: Use CH₄ Generation from GHGRP

- Use subpart HH reported methane generation values
- Augment with waste disposal amount for landfills that do not report using a modified Inventory DOC value (waste characterization studies, Lo)
- What method to use for pre-2010?
- Use GHGRP methane recovery data and supplement with other 3 databases
- Use default methane oxidation value of 10% for all landfills

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH data are facility-specific, EPA-verified, higher quality</td>
<td>Unable to use facility-specific OX</td>
</tr>
<tr>
<td></td>
<td>Different method for non-reporting facilities and years pre-2010</td>
</tr>
</tbody>
</table>
Option 3: Use net CH4 emissions from GHGRP

- Use directly-reported CH4 emissions by facility from Subpart HH of the GHGRP for years 2010+ for reporting facilities
- What method to use for pre-2010?
- How to consider the ~300 non-reporting landfills?
  - 2010: 1,572 (EREF) - 1,235 (HH) = 337
  - 2013: 1,540 (EREF) - 1,237 (HH) = 303

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH data are facility-specific, EPA-verified, higher quality</td>
<td>Different method for non-reporting facilities and years pre-2010</td>
</tr>
<tr>
<td>For HH facilities, using facility-specific waste disposal data, OX, CE, R</td>
<td>Fluctuating dataset; some GHGRP facilities will off-ramp; technical modifications may impact cross-year net emissions</td>
</tr>
</tbody>
</table>
Q&A; Discussion
More Information

Rachel Schmeltz
Schmeltz.Rachel@epa.gov

Kate Bronstein
kbronstein@rti.org