

Summary Report for the Fourth Stakeholder Webinar on Updates to Methodology Improvements for MSW Landfills (December 13, 2017)

EPA develops an annual report called the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (Inventory).¹ This report tracks total annual U.S. emissions and removals by source, economic sector, and greenhouse gas (GHG) going back to 1990. One sector in the annual report is the waste sector, which includes municipal solid waste (MSW) landfills, industrial landfills, composting, and wastewater. With each Inventory report, EPA strives to improve the data inputs and calculations used. The national GHG Inventory is submitted to the United Nations in accordance with the United Nations Framework Convention on Climate Change (UNFCCC). Additional information about the GHG inventory reporting requirements can be found on the UNFCCC GHG Inventories Reporting Requirements page at the following link:

http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/2759.php.

On December 13, 2017, EPA held a stakeholder webinar on the Inventory data and methodology for the waste sector, with a focus on MSW landfills to discuss the methodological changes made to the 1990-2015 Inventory and considerations for methodological improvements to future inventories.

1. Purpose of the Targeted Waste Sector Stakeholder Outreach

The December 13, 2017 webinar provided an overview of the methodological changes to the solid waste section of the 1990-2015 Inventory while also providing detail into review of the data supporting the new methodological changes that had occurred since the previous August 17, 2017 webinar. The following items were discussed:

- a. Improvements to the scale-up factor applied to the Inventory to account for landfills not reporting to Subpart HH (MSW Landfills) of the Greenhouse Gas Reporting Program (GHGRP), including an overview of Reviewer input on the non-reporting landfill dataset supporting the scale-up factor
- b. Re-assessment of the current oxidation factor (10%) used by the Inventory for the years 1990-2004 based on an analysis of GHGRP Subpart HH data
- c. Re-assessment of the current degradable organic carbon (DOC) value of 0.20 used by the Inventory for the years 1990-2004 based on a comprehensive review of waste characterization studies.

The slides from the webinars are posted on the [EPA Website](#) at:

<https://www.epa.gov/ghgemissions/stakeholder-webinar-waste-sector-data-and-methodology-us-greenhouse-gas-inventory>. The remainder of this report summarizes the August 16, 2017 webinar content.

2. Summary of the Webinar

The EPA opened the webinar with a summary on three major methodological updates made to the 1990-2016 Inventory. These three updates were:

¹ The latest GHG Inventory report is available at <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015>.

- Evaluation of data on landfills that do not report to the EPA’s Greenhouse Gas Reporting Program
- Development, implementation, and updating of the scale-up factor to account for emissions from MSW landfills that are not required to report under Subpart HH
- Oxidation factor

Non-reporting Landfills and the Scale-up Factor

In the 1990-2015 Inventory year, the EPA first used methane emissions as directly reported to the Greenhouse Gas Reporting Program. The Greenhouse Gas Reporting Program emissions data accounts for facility-specific methane recovery (where applicable), a variety of oxidation factors, a variety of degradable organic carbon values, and facility-reported annual waste disposal quantities 50 years prior to first acceptance. While this data provides the EPA a more precise and accurate measure of landfills emissions, the EPA also noted that there is a gap that exists in accounting for all landfill emissions which stems from the facilities that do not report to the Greenhouse Gas Reporting Program.

This gap is sought to be solved by implementing a scale-up factor to account for emissions from municipal solid waste landfills that are not required to report to the Greenhouse Gas Reporting Program, but still contribute to U.S. emissions. In the 1990-2015 Inventory, this scale-up factor was roughly estimated to be 12.5%. In order to revise the scale-up factor to a more representative percentage, the EPA needed to create a master list of MSW landfills that have never reported to the Greenhouse Gas Reporting Program.

The EPA developed the scale-up factor based on total waste-in-place from all non-reporting landfills within their dataset. This dataset consisted of non-reporting landfills gleaned from the Landfill Methane Outreach Program’s (LMOP) database, the 2016 Waste Business Journal Directory, and the EPA/OAQPS landfill dataset. About 60% of the landfills within EPA’s non-reporting landfill dataset had all data needed to estimate waste-in-place, but the remaining 40% were missing 1 or 2 data elements needed to estimate the value. EPA used forced assumptions for landfills with 1 missing data element.

In an attempt to address these data gaps, the EPA posed several charge questions to Inventory expert reviewers:

1. What are the best approaches to estimate a scale-up factor to account for landfills that do not report to the GHGRP?
2. What additional datasets can the EPA use to generate a list of non-reporting landfills with waste-in-place data, and start/closure years to develop a scale-up factor for landfills that do not report to the GHGRP?
3. How should the EPA consider landfills that off-ramp from the GHGRP going forward with respect to the scale-up factor?
4. What is the best approach for applying the scale-up factor (apply same scale-up factor for 2005 and later years, or apply a variable scale-up factor in blocks of time)?

Reviewers provided the following feedback with respect to the EPA’s charge questions:

- There are no other datasets to use
- 12.5% is too high for a scale-up factor, it should be no greater than 5% based on removed waste-in-place from matches to the GHGRP facilities

- Use waste-in-place and not first order decay estimated emissions
- It isn't necessary to make special account of off-ramped facilities from the GHGRP
- Do not overcomplicate the scale-up factor by applying different scale-up factors for different years or blocks of years in the time series

In conjunction with the Expert Review process, the EPA also shared their initial list of non-reporting landfills with some industry stakeholders and LMOP staff to help verify the waste-in-place information, identify duplicate landfills across the datasets, and any matches in the non-reporting list that may be reporting to the GHGRP but that the EPA couldn't readily identify because of naming variations. The EPA asked stakeholders to provide waste-in-place data, the years of landfill operation, and geographical coordinates for known landfills. Reviewers looked at the data from different angles. Landfills within the non-reporting list with high waste-in-place estimations were looked at most closely, and many were matched to a GHGRP facility. A state level review was also performed, starting with CA, TX, and other states with many landfills.

As a result of the Expert Review, 229 of the 1,207 landfills reviewed were removed from the non-reporting landfill list because they were either matches to GHGRP facilities, were non-MSW landfills, or were identified as duplicates to an entry from another database. The revised number of MSW landfills contains approximately 1,544 landfills, although this number should not be deemed as final since there are still 29 GHGRP reporting facilities with no matches to landfills in either the LMOP, WBJ, or OAQPS databases. 566 landfills were not reviewed as a part of this process because of time constraints.

Waste-in-place data for 403 landfills were identified, with 54 of these landfills having new waste-in-place data as part of the review; the remainder of the landfills' waste-in-place was either confirmed or revised as part of the review. It is important to note that data for 134 of these landfills are for a single year only, which requires the EPA to make broad assumptions to estimate waste-in-place if the EPA is to use the reviewer-provided values.

The Expert Review process resulted in a 3% increase of non-reporting landfills with all data available (63% versus 60%); however, even with this additional data, there are several gaps that the EPA cannot currently fill using this data collection methodology.

Reviewer input contributed to approximately 50% of the estimated waste-in-place data that was not forced; the remainder of unforced data are from the LMOP or WBJ databases. The EPA used several assumptions to force the data to estimate the total amount of waste-in-place at non-reporting landfills. If a landfill had a closure year but no start year and a total waste-in-place value was not provided, the start year was forced back 30 years from closure. For landfills that had a start year but no closure year and was still open, a closure year of 2016 was used to estimate waste-in-place. If only one year of waste disposal data was provided and the EPA could estimate a start and closure year (or if this data was reported outright), the EPA assumed the same quantity of waste was disposed in each year to estimate total waste-in-place. The EPA noted that these assumptions are broad and would like stakeholders' opinions on feasible assumptions given the limited data received from web-based reviews of these landfills.

Considering the revised information the EPA gleaned from reviewers, the scale-up factor is now estimated to be 9%. The EPA re-calculated the total annual waste disposed across all facilities reporting to the GHGRP for the year 2016, including those that have off-ramped and are not included in the list of

non-reporting landfills. The revised scale-up factor of 9% appears to be a better graphical continuation of Solid Waste Inventory estimates from 1990-2004 years than the previous default of 12.5%.

Oxidation Factor Review

The IPCC 2006 Guidelines recommends a 10% oxidation value at landfills, however, the literature provides evidence for higher oxidation rates. Currently, the Inventory uses 10% oxidation for the years 1990-2004 and an average of 19.5% for 2005-2015 due to the incorporation of GHGRP data. The EPA noted that the average oxidation values from RY2015 of the GHGRP data can vary based on how the data is viewed: it is 19.5% for all facilities (for whatever equation the each facility has chosen to use as its facility total); 18.2% for older, smaller landfills across all equations; 15.3% for facilities with a gas collection system; and 20-25% for the facilities that have off-ramped.

The EPA wanted to review whether the oxidation factor for the years 1990-2004 in the time series should be revised. The focus for this review was on older, smaller landfills that would not typically report to the GHGRP because the literature already provides enough evidence for the larger landfills that are reporting to the GHGRP.

In a first step, EPA reviewed literature published after 2012 and also revisited the literature reviews previously completed in 2011 and 2012 when working on technical corrections to the GHG Reporting Rule. During this review, the EPA specifically looked for data from landfills that may not report to the GHGRP, which are assumed to be older and smaller.

In a second step, EPA reviewed the GHGRP data to determine the extent to which older, smaller GHGRP-reporting facilities use an oxidation rate based on their calculated methane flux.

The EPA found that literature tends to focus on landfills that would report to the GHGRP and measurements of oxidation for location-specific facilities and/or gas management and cover systems employed. Several recent studies (e.g. Chanton and Abichou, 2011; Bogner et al., 2014; SWICS, 2012) provide evidence for higher oxidation rates at specific facilities. Some of these studies do support a 10% oxidation value when accounting for a wide range of facilities, such as those that make up the nationwide Inventory.

The EPA posed additional charge questions to reviewers pertaining to the oxidation data:

1. What should the oxidation value be for landfills from 1990-2004 with and without gas collection systems? Are there data sources on trends?
2. What should the oxidation value be if the EPA uses one value for all of the 1990-2004 time series?
3. Comment on methane leakage (e.g. from cracks and fissures in the landfill cover) with respect to the oxidation value. If the EPA applies a higher oxidation factor, should we also apply a higher oxidation factor to waste disposed at landfills with gas collection and control, or all landfills in general?

In response to the questions, the EPA received the following feedback:

- If the EPA uses one value for oxidation for all U.S. landfills for 1990-2004, 10% is biased low, but there is no clear alternative value to use
- To calculate oxidation...

- EPA should assign different values for landfills with gas collection (although this ignores all other variables that impact oxidation)
- EPA should calculate the methane flux by landfill and bin them appropriately, similar to the GHGRP
- EPA should not apply a leakage factor to an oxidation factor. There is too much uncertainty in the oxidation factor already and more uncertainty with the addition of a leakage factor will not improve emissions estimates.

Due to the lack of certainty in whether to change the oxidation value used in the Inventory for the years 1990-2004 in the time series, both within the literature reviewed and in the stakeholder comments received, the EPA decided to retain the value of 10% currently used. EPA will continue to examine this issue and may make changes to the oxidation value as appropriate in future years.

Additional Expert Review Feedback

As part of the Expert Review, EPA also received comments pertaining to the Inventory DOC value of 0.20. Commenters specifically stated that the Inventory DOC value of 0.20 is too high, and that the GHGRP values for MSW waste of 0.20 and 0.31 are also too high. The commenters also stated that using a single value for DOC for all U.S. landfills assumes that waste composition does not change over time, instead, DOC should vary annually or in 5-year increments. Commenters cited evidence from an EREF assessment of recent state-level waste characterization studies which identified the average DOC for MSW only waste being 0.184, with values ranging from 0.142 to 0.209.

EPA reviewed the annual waste disposal data for the 1990-2004 time frame and excluded non-MSW material from the annual amount of waste disposed. Because the Inventory is currently using directly reported net emission values from the GHGRP for 2005 – 2016 and those emission values already incorporate the rule’s DOC values, EPA did not apply any sort of DOC value or emission factor. Under the Inventory, EPA cannot change the DOC values included in the GHGRP because it is a regulation; however, EPA is investigating waste composition studies that have been completed in the U.S. and may make revisions to the DOC value for 1990-2004 based on this information.

The EPA also received comments on the decay rate values and the uncertainty associated with those values as documented in EPA’s draft AP-42 section on MSW landfills. The Inventory and the GHGRP both use similar decay rate values, which are mainly derived from the 1998 version of EPA’s AP-42, not the draft version from 2008. The EPA acknowledges the range of uncertainty in the decay rate values indicated in the 2008 draft AP-42; however, EPA cannot, at this time, conduct the field or laboratory research needed to investigate decay rate values under the Inventory program. The EPA is not aware of any efforts underway to finalize the 2008 draft AP-42.

5. Next Steps

General Next Steps

The EPA will address Expert Review comments and update the Inventory for the Public Review draft. EPA anticipates that the Public Review draft will be made public in early February 2018 with comments due in early March. The Public Review draft will be the full Inventory report.

After Public Review, the EPA will address any additional comments and update the Inventory for the Final Inventory Report due to the UNFCCC on April 15, 2018. EPA plans to submit the Final Report on April 12, 2018.

Non-reporting Landfills and Scale-up Factor

The EPA will use the 9% scale-up factor in the Public Review draft of the Solid Waste Inventory. If no additional comments or data are received during Public Review, the EPA will use the 9% value moving forward. The EPA is currently drafting a technical memorandum on how the scale-up factor was developed for technical records and Inventory references, which will be ready when the Public Review draft is available.

Oxidation Factor Review

EPA will continue to use the 10% oxidation value for the 1990-2004 time series to be consistent with IPCC 2006 Guidelines, and will continue to incorporate an average of 19.5% oxidation for 2005 to date in the Inventory by incorporating the GHGRP data. The IPCC is currently refining the Guidelines and may recommend an alternative default in the future. The EPA will likely revisit this issue once the new Guidelines are finalized.

For more information and to send any feedback, please contact Rachel Schmeltz of the EPA at Schmeltz.Rachel@epa.gov.