Summary of Public Review Comments and Responses:
Draft *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018*

May 2020
U.S. Environmental Protection Agency
Office of Atmospheric Programs
Washington, D.C.

Responses to Comments Received during the Public Review Period on the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018*

Preface

EPA thanks all commenters for their interest and feedback on the annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks*. Per Federal Register Notice 2020-02139 published on February 12, 2020, EPA announced document availability and request for comments on the draft "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018" report. The EPA requested recommendations for improving the overall quality of the inventory report to be finalized in April 2020 and submitted to the United Nations Framework Convention on Climate Change (UNFCCC), as well as subsequent inventory reports.

During the 30-day public comment period which ended March 13, 2020, EPA received 17 sets of comments, including 34 unique comments in response to the notice. This document provides EPA's responses to technical comments on methods and data used in developing the annual greenhouse gas inventory. The verbatim text of each comment extracted from the original comment letters is included in this document, organized by commenter. Full comments can be found in the public docket here: https://www.regulations.gov/docket?D=EPA-HQ-OAR-2019-0706. EPA's responses to comments are provided immediately following each comment excerpt.

Commenter: American Fuel and Petrochemical Manufacturers (AFPM)

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0009

David Friedman

Comment 1: Re: Percent of CO_2 from refining that results from flaring

This comment is in respect to the Energy chapter of the report, specifically on the section describing GHGs from the refining sector. On page 3-68, the report states, "Almost all (about 98 percent) of the CO_2 from refining is from flaring."[1] Based on previous reports issued by EPA, AFPM believes that this statement is inaccurate and contradicts determinations made in these previous reports.

In both the 2015[2] and 2019[3] Industrial Profile reports, EPA includes charts that summarize petroleum refinery sector GHG emissions by source (see Appendix below). The refinery GHG emissions by source include: Combustion of Fuel, (percentage share of 63 and 73 respectively), Catalytic Cracking/Reforming (approx. 23%), Flaring (approx. 2.5%), and other sources (such as Hydrogen Plant, Sulfur Removal Plant, etc.). The sum of the published 2015 and 2019 percentage shares of Combustion of Fuel, Catalytic Cracking/Reforming, and sources other than flaring total more than 97 percent.

As written, the 2020 report implies that the numbers are now transposed and that flaring now accounts for 98 percent of a refinery's GHG emissions. The calculations in the 2015 and 2019 reports are also more consistent with the refining industry's own determinations on the contribution of flaring to the overall GHG emissions in a refinery.

AFPM recommends that EPA reevaluate the refinery GHG summary and apply from the earlier reports the determination that flaring contributes a very small portion (less than 2.5%) to a refinery's overall GHG emissions.

---

[1] Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018, 3-68.

[2] Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Petroleum Refining Industry. (2010). Retrieved 10 March 2020, from https://www.epa.gov/sites/production/files/2015-12/documents/refineries.pdf.

[3] Greenhouse Gas Reporting Program Industrial Profile: Petroleum Refineries Sector (2019). Retrieved 10 March 2020, from https://www.epa.gov/sites/production/files/2019-10/documents/petroleum_refineries_industrial_profile_9_25_2019.pdf.

APPENDIX

2015 Industrial Report

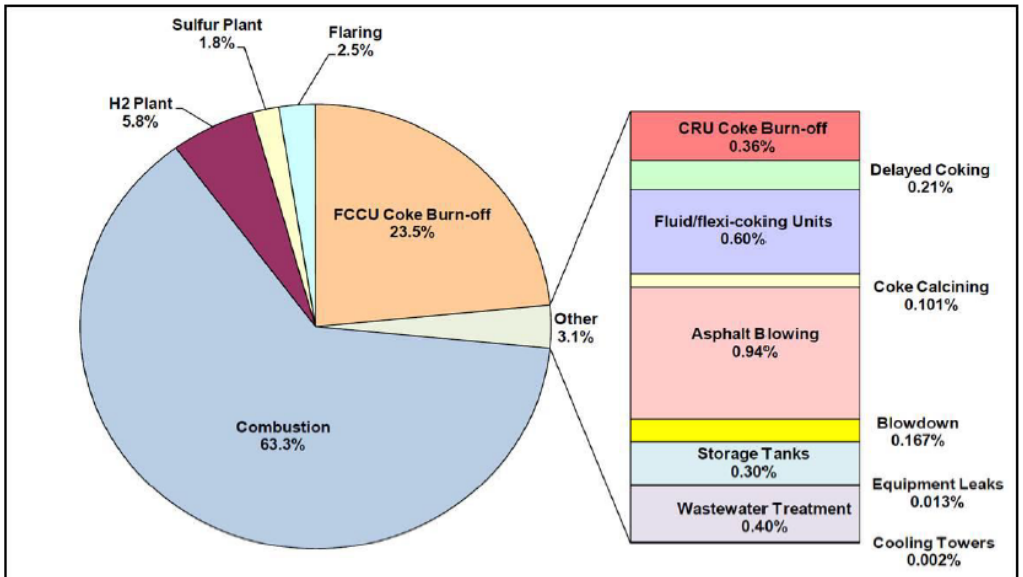
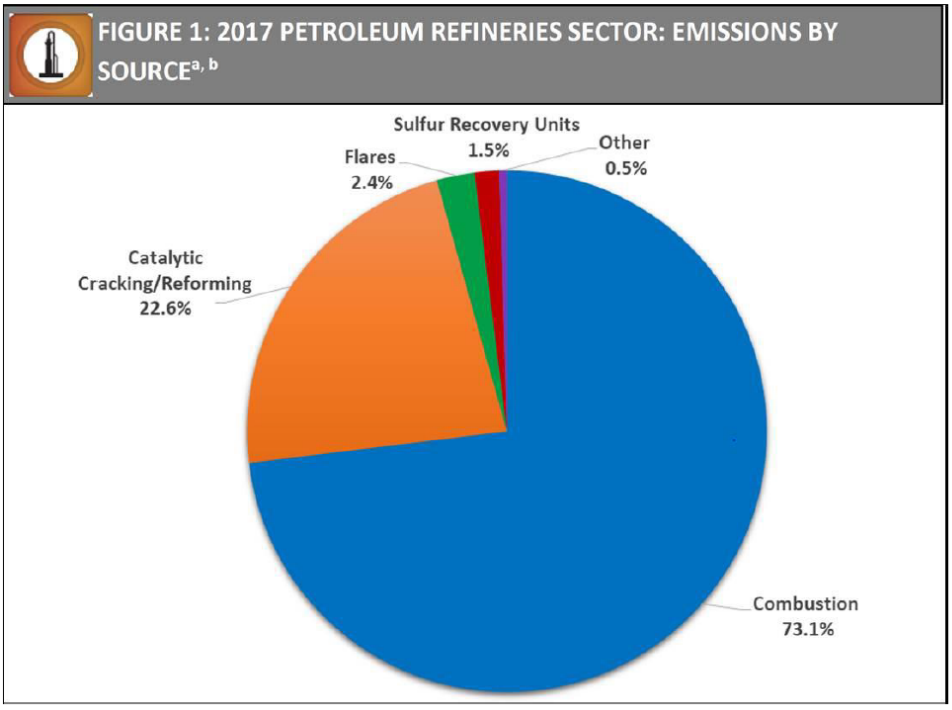


Figure 2. Contribution of different emission sources to the nationwide CO_2 equivalent GHG emissions from petroleum refineries.

2019 Industrial Report



Response: The Inventory text in Section 3.6 on Petroleum Systems has been edited to clarify that the emissions discussed in this section are fugitives (leaks, venting, and flaring), not combustion sources. See pp. 3-68 to 3-70 in Section 3.6 of the report.

Commenter: American Gas Association

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0010

Pamela Lacey

Comment 2: Re: Emission estimates for Natural Gas Systems

The GHGI directly affects AGA and its members because it provides the best available estimate of national average GHG emissions from our members' operations – including natural gas local distribution, transmission, and storage. In addition, the GHGI also provides the best available estimate of the national average methane intensity of the product our members deliver to customers, measured from wellhead to the customer. As demonstrated by previous Inventories, the methane intensity of delivered natural gas in the U.S. already falls well below even the most stringent thresholds for immediate climate benefits achieved through coal to natural gas switching.[4]

As the 2020 Draft GHGI shows, natural gas emissions from distribution systems have declined by 73 percent from 1990 through 2018, including an almost 1% additional reduction between 2017 and 2018. This emissions reduction has been achieved largely through replacing cast iron and unprotected steel distribution mains with modern medium and high-density polyethylene (MDPE or HDPE) or cathodically protected steel pipe and upgrading metering and pressure regulating stations to replace high bleed pneumatic devices. Increasingly, our members are also seeking additional opportunities to reduce emissions, for example through their commitments in the EPA Methane Challenge program to reduce emissions from pipeline blowdowns or to enhance programs for reducing pipeline dig-ins (third party damage). We look forward to seeing how these emission reduction efforts can be reflected in future GHGIs.

AGA appreciates EPA's ongoing efforts to improve emission estimates based on new research. While the 2020 Draft GHGI contains no proposed changes in methodology for estimating emissions from natural gas distribution, transmission or storage,[5] AGA appreciates and supports EPA's proposals to update emission estimates for upstream and midstream segments of the natural gas supply chain to incorporate data from recent studies and from reporting under EPA's GHG Reporting Program (GHGRP). For example, AGA supports the use of updated GHGRP reported data in the exploration segment well completions with and without reduced emissions completions (RECs), demonstrating a 72% decrease in exploration emissions from 1990 through 2018 and an 8.3% reduction from 2017 to 2018.[6] AGA also supports EPA's use of updated methodology using GHGRP data and the Zimmerle et al. 2019 study to improve the estimate of emissions from gathering and boosting compressor stations in the production segment.[7]

---

[4] See AGA's Analysis of EPA's 2019 GHGI (May 23, 2019) at https://www.aga.org/research/reports/epa-updates-to-inventory-ghg-may-2019/.

[5] See 2020 Draft GHGI at page 3-98.

[6] See 2020 Draft GHGI at page 3-83.

[7] See 2020 Draft GHGI at pages 3-83 and 3-91.

Response: EPA appreciates the comment and has noted potential use of data from the Methane Challenge program in the planned improvements text for Natural Gas Systems. See page 3-101 of the report.

Commenter: American Petroleum Institute (API)

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0012

Karin C. Ritter

Comment 3: Delayed Cokers in Refining

API has advocated the use of GHGRP data for the refining sector (Subpart Y) since all U.S. refineries have been required to report CH_4, CO_2, and N_2O emissions for all major activities starting with emissions that occurred in the year 2010.

For delayed cokers, an updated calculation method was promulgated by the U.S. EPA in December 2016, which became mandatory starting with reporting year 2018. The update to the calculation methodology resulted in higher reported methane emissions from delayed cokers in 2018 compared to previous years of reporting. API recognizes that the update did not impact all facilities reporting under Subpart Y equally, since some facilities had adopted the updated methodology earlier.

API concurs with EPA's approach to update the time series estimate for 1990-2018 using a ratio of reported delayed cokers and GHGRP emissions from 2017 to 2018 in order to ensure continued consistency of emissions estimated between the GHGI and GHGRP for the refining sector.

Response: EPA appreciates the comment.

Comment 4: Offshore Petroleum and Natural Gas Production

In previous discussions with EPA, API supported the continued use of updated Gulfwide Emission Inventory (GEI) data to ensure the utilization of the most current representation of activities and emissions for offshore operations. EPA has implemented this approach in the GHGI by calculating vent and leak EFs for offshore facilities in GOM federal waters for major complexes and minor complexes using Bureau of Ocean Energy Management (BOEM) GEI emissions data from the 2005, 2008, 2011, and 2014. EPA acknowledged that this approach addresses only production in the federal waters of the Gulf of Mexico (GOM). Notably, EPA considered a 4-step process of assigning production type for each complex. The approach potentially counts the same complex up to four times across the GEI's for 2005, 2008, 2011, and 2014.[8] It is unclear as to how the number of complexes counted were reconciled with the BOEM GEI Inventory and which number of complexes were used in order to achieve the results in the Draft GHGI 2020 update (Table 3-48 of Draft GHGI). The complex counts and approach should be reconciled with BOEM and explained as to how the total complex counts were used.

Additionally, BOEM GEI had a step-change in their reporting process which incorporated more minor sources from 2005 to 2008. EPA should note if that step-change or other main factors were the driver(s) for the increase in the number of complexes. EPA should further note that the "increase" in CO_2 emissions between 2005 and 2018 was the result of more comprehensive reporting and changes in

[8] U.S.EPA (2019), "Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018: Updates Under Consideration for Offshore Production Emissions", September 2019 (Table 4, page 8).

emission factors. Lastly, it would be beneficial to understand whether EPA's emissions trends over this period accounted for a 50% reduction in platforms and an 80+% reduction in well starts.

API contends that using source specific emission factors may be preferable to the approach taken by EPA of defining major and minor 'complexes' along with major or minor 'structures', and assigning average emissions to each type of complex. This approach is not fully transparent regarding the process used for assigning the emission sources to the complex categories and calculating the respective emission factors.

Concurrently, EPA calculated GOM federal waters flaring emissions using flaring volumes reported in Oil and Gas Operations Reports (OGOR), Part B (OGOR-B). EPA's approach used the EF basis of kg/MMBtu (with year-specific heat content), applying it to OGOR-B flared gas volumes. The other option was to use BOEM's GEI emission factors however, according to the EPA, this was not chosen because OGOR-B flared gas volume data are available each year, versus the GEI data that is available only during publication years, However, BOEM already collects and assesses emissions based on OGOR-Data. BOEM completed an in-depth QA/QC of GOADS-2011 data submittals for volumes vented and flared with the values reported to the Office of Natural Resources Revenue (ONRR) through Oil and Gas Operations Report (OGOR) forms. Additionally, BOEM contacted operators and reconciled flare/vent estimates. Given this extensive review, it is appropriate to use BOEM emission factors and not duplicate an existing effort. Furthermore, BOEM is in the process of developing a new web-based emissions reporting tool. BOEM anticipates collecting emissions data using the new web-based reporting tool for CY2021 and for those emissions to be reported annually.

API welcomes EPA's discussion of the fact that the previous Inventory allocated all GOM federal waters flaring emissions to offshore gas production facilities, which explains the shifting of estimated emissions between the petroleum and natural gas systems in the GHGI. Moreover, in order to combine its GHGI and OGOR-B datasets, EPA assumed that the 2011 OGOR values, which indicate that 80% of flared gas is from oil complexes and 20% of flared gas is from gas complexes, is broadly representative and applied it to all prior years (1990-2010) that were originally attributed to all gas flaring. This is due to the fact that separate volumes of gas flared and gas vented were not available prior to 2011 and EPA relied on data provided by the Minerals Management Service (MMS) Staff from 1990-2008. API contends that it is appropriate and more representative to allocate flaring to both offshore oil and gas complexes, however the methodology of percent (%) allocation of flared gas from oil vs gas complexes should be reviewed versus BOEM and their historical MMS data to assess EPA's selection of the 80%/20% assignment.

API is also noting that new data is becoming publicly available on oil and gas venting and flaring. Clearly the trend favors flaring (vs. venting) because most gas is now produced at modern deepwater facilities. A 2017 Bureau of Safety and Environmental Enforcement (BSEE) report[9] (Tables 1 and 2) confirms that oil-well gas is primarily flared (in those instances when not captured and exported to market) and that nearly all the gas released from floating deep-water structures is flared. Given the much higher GHG effect of methane (vs. CO_2), this is a very important distinction and highly favorable trend.

The U.S.EPA included in the current GHGI calculations of production based EFs for offshore facilities in the Pacific and Alaska regions, using data from the GHGRP. API understands that under 40CFR 98.233 (s)(2)(i), production facilities in GOM State Waters, Pacific and Alaska Regions reporting to the GHGRP adjust previously calculated emissions using the duration of operations for calendar years that do not overlap with the most recent GEI. API concurs that the increase in CH_4 emission estimates from offshore oil production are due in part to the inclusion of emissions from facilities located in GOM state waters

[9] https://www.bsee.gov/sites/bsee.gov/files/5007aa.pdf

and the Pacific and Alaska regions. API also notes that the increase in offshore emissions attributable to oil production is due to the fact that a much higher percentage of offshore facilities in the current Inventory are classified as oil rather than gas.

API requests further information for the EPA calculated GHGRP production-based emission factors in non-GEI years. The GHGRP methodology for non-GEI years requires the leaks, flaring, and fugitive emissions reported to be scaled based solely on operating hours. Subsequent scaling of operating hour based emissions by production volume might not be representative of actual emissions. Additionally, API is concerned that the use of production data from all sites in conjunction with emission factors that are limited to the largest emitting sites (those reporting to the GHGRP) might skew the emission estimate for the specific region.

API recognizes that the implementation of EPA's updated methodology results in decreases in CH_4 and CO_2 emissions from natural gas systems, due to the reallocation of venting and flaring emissions between the Petroleum and Natural Gas segments. Most notably, in previous GHGIs all CO_2 emissions from flaring were reported under Natural Gas Systems.

API notes that the major factors affecting the lower CH_4 and CO_2 emissions from offshore production include:

- Reductions in methane emissions from offshore operations can be directly related to more stringent limitations imposed by BSEE related to venting and flaring. Venting and flaring is limited by 30 CFR 250 Subpart K which often required the installation of separate flare and vent meters (after May 2010) and limits the amount of flaring/venting allowed. In addition, in 2012, BSEE issued guidance for requesting departure approval to flaring or venting beyond allowable. No flaring or venting without permission is allowed except in limited circumstances, permitted on a case-by-case basis at BSEE's discretion. When considering requests to approve flaring or venting, BSEE does not consider the avoidance of lost revenue to be a justifiable reason.
- Industry as a whole is utilizing more VRU equipment to capture releases and moving away from venting and toward the safer alternative of flaring which results in overall lower methane emissions. As a consequence of this important development over the past 10 years less gas is being vented. Even though oil-well gas production (for which there may be a greater incentive to flare) now (since 2016) exceeds gas-well gas production, the volume of gas flared or vented has declined. While total gas production has also declined, total flaring/venting volumes have remained relatively stable at around 1% of total gas production.
- Removal of older platforms, mainly in shallow water and nearer to shore, and installation of new, state of the art platforms in deep water much further from shore.

Response: Additional documentation was provided in the memo, "Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018: Updates for Offshore Production Emissions," clarifying how complex counts were developed.[10] Additional text was provided in the GHG inventory and the memo to clarify the data sources for complexes. The trends over time are due to the underlying trends in the complex counts and emissions as reported to BOEM. Emissions estimates were calculated using complex-level factors for offshore operations in GOM federal waters and using production-based emission factors for offshore operations in state waters. An estimate of emissions source-level emissions was developed using the fraction of emissions in each category in the GOM federal waters data set, applied to GOM federal and state water total emission estimates, and using the fraction of emissions in each category

[10] https://www.epa.gov/sites/production/files/2020-04/documents/2020_ghgi_update_-_offshore_production_final.pdf

in GHGRP for Pacific and Alaska offshore production, and applied to the total estimates for Pacific and Alaska offshore production. The emission source-level estimates are available in the supplementary excel annex files for Petroleum and Natural Gas Systems.[11]

Regarding the use of emission factors calculated from data from the from the GHGRP reporting population for Pacific and Alaska offshore production, alternative data sources are unavailable.

Regarding the use of the GEI versus OGOR-B data, the emissions estimates were calculated using OGOR-B. GEI data is currently available for the years 2005, 2008, 2011, 2014, and 2017. The OGOR-B dataset can be used to calculate flaring emissions for the full 1990 to 2018 time series. EPA applied the OGOR-B data because it is more readily available across the full time series. EPA is aware the BOEM GEI studies may be updated more frequently in the future and will assess the data as it becomes available. Regarding upcoming availability of emissions data for offshore production, this feedback has been noted in the Planned Improvements section of the GHGI. See pages 3-82 and 3-101 of the report.

Comment 5: Gathering and Boosting Operations

API supports separating the GHGI emission estimate for G&B from the estimate for onshore production and natural gas processing. EPA updated the gathering and boosting (G&B) station emission estimation methodology based on CH_4 measurements at G&B stations and from data provided since 2016 under the GHGRP. EPA applied the national average ratio of compressors per station and the national-level scaling factor, both based on year 2017 data, from the Zimmerle et al. study and did not re-evaluate the ratio or scaling factor for other years in the public review draft of the Inventory.

API finds that using GHGRP developed equipment level emission factors for sources not included in the Zimmerle et al. field study is the best available data at this time. The U.S.EPA approach for scaling GHGRP emissions to the national level closely matches the Zimmerle et al. approach of scaling the Production sector data (1.07 compared to 1.075) for 2017. However, API contends that the Zimmerle et al. approach is the more conservative and preferred approach. The GHGRP Gathering and Boosting volume of gas received can be reflective of gas transported from one gathering station to another instead of new production from well sites. For example, the 2017 quantity of gas received for the G&B segment (44,187,605,033mscf) exceeds the total produced gas volume in DI desktop (33,755,773,191mcf based on 2017 DI Desktop data pulled in June2018).

The Zimmerle et al study found great variability in the compressor counts per station and in the fraction of produced gas reported under GHGRP to Drilling Info production data at the basin level. API notes that simplifying the approach would potentially result in a lower appearance of GHGRP coverage and an increased emission estimate.

API suggested during the expert review phase of the proposed methodology updates that,

- Data quality filters are applied in order to avoid including production data scaling where less than 6% of the gas is sold and for basins where the reported produced gas is >200% of the Drilling Info production.
- A sensitivity analysis is performed to document the impact of using a national-level approach vs.

[11] https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems-ghg-inventory-additional-information-1990-2018-ghg

a basin-level approach to scale up national emissions.

It is not clear that such an analysis or data quality checks were undertaken by EPA and incorporated in the data that is presented in the public review draft GHGI. EPA should also confirm that for the current GHGI it applied the most recent GHGRP data (October 2019 GHGRP data release). For example, in the November 2019 methodology update memo for the dehydrator category does not appear to include desiccant dehydrators emissions.

Response: Additional text clarifying the development of the scale-up factor and the use of national-level versus basin-level approaches has been added to the Inventory and the memo, "Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018: Updates to Natural Gas Gathering & Boosting Station Emissions***."[12] In the final Inventory, the most recent GHGRP data were used to calculate emissions, and an estimate for desiccant dehydrator emissions was added.***

Commenter: Colorado State University

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0018

Dan Zimmerle

Comment 6: Re: Page 3-91, lines 18-25

I recommend an explicit mention of the 'compressors/station' assumption in our methodology; since the GHGRP does not report station counts, that factor should be noted, and if possible confirmed & updated over time.

Response: Additional text was added to the Inventory to document the compressors/station assumption (see page 3-93) and to note that if data are available, this assumption will be assessed over time (see page 3-101).

Comment 7: Re: Gathering infrastructure outside of compressor station boundaries may not be included in the methodology

There is some amount of additional gathering infrastructure that is outside of compressor station boundaries, but not specifically on well pads. These sources are not included in our study, and it is uncertain if these sources were estimated in your methodology section. This should be clarified.

Response: Additional text was added to the Inventory make this clarification. See pages 3-93 to 3-95 of the report.

Comment 8: Re: Scaling factor

As in the first comment, the scaling factor (cell C75, sheet 3.6-8) of 1.075 was valid for the 2017 ratio of GHGRP gas production to DrililngInfo™ production data, but should be confirmed & updated over time.

Response: Additional text was added to the Inventory to note that the scaling factor will be updated over time if possible. See page 3-101 of the report.

[12] https://www.epa.gov/sites/production/files/2020-04/documents/2020_ghgi_update_-_gb_stations_final.pdf

Comment 9: Re: Statement that the second largest methane source at G&B stations is "compressor venting and flaring" on page 3-83

If this is reference to our report, it should be "venting and fugitive." Perhaps our abbreviation of F&V was misunderstood. We counted flaring as a separate category, and that also appears to be consistent with the annex tables.

Response: The text in the Inventory was corrected based on the information provided by the commenter (see pages 3-93 to 3-95).

Commenter: Environmental Defense Fund, Clean Air Task Force, Apogee Economics and Policy, and The Wilderness Society

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0014

David Lyon, David McCabe, and Laura Zachary

Comment 10: Re: Natural Gas and Petroleum Systems estimates

We are concerned that the draft 2020 GHGI would deepen the Inventory's existing underestimate of natural gas and petroleum systems methane emissions, exacerbating the existing problem already present in previous editions of the inventory. While we appreciate EPA's hard work to improve the Inventory and we recognize the value in research into up-to-date emission factors for equipment used in the gathering and boosting segment of the natural gas sector, EPA should not move from emission estimates for the segment based on Marchese et al's site-wide measurements to emissions estimates based solely on Zimmerle et al's bottom-up surveys. As numerous studies have demonstrated [Alvarez et al 2018, Brandt et al 2014, and references therein], bottom-up equipment-based inventories consistently underestimate emissions from natural gas facilities for a variety of reasons.

Furthermore, the appropriateness of site-level measurements as a measure of true facility emissions was recently validated by Alvarez et al 2018, who compared site-level measurement and basin-wide measurements for 9 basins, showing excellent agreement for 7 of the 9 basins and agreement within uncertainty for all basins. In contrast, the disagreement between equipment-based survey approaches and facility-level emissions measurements has been demonstrated, as mentioned above. As described by Brandt et al 2014, there are a number of systematic reasons why equipment surveys underestimate emissions.

The impacts of the proposed changes are substantial. The recalculations to the natural gas system methods, dominated by changes to the G&B segment, resulted in an average decrease in total natural gas system methane emission estimates of 14.1 MMT CO_2 Eq., or 8 percent, across the 1990 through 2017 time series. Annual G&B station methane emission estimates decreased by an average of 36 percent in the current Inventory for the 1990 to 2017 time series, compared to the previous Inventory.

Looking specifically at methane emission estimates for 2017 further illustrates the dramatic decrease due to the proposed revisions. The combined impact of GHGI 2020 methane emissions revisions across the natural gas system to 2017, compared to the previous Inventory, is a decrease from 165.5 to 139.1 MMT CO_2 Eq. (26.5 MMT CO_2 Eq., or 16 percent). A substantial portion of that change, the revisions to the G&B segment resulted in a decrease from 55.5 to 32.0 MMT CO_2 Eq. (23.5 MMT CO_2 Eq., or 42 percent). Revisions to the G&B segment accounted for 23.5 of the 26.5 MMT CO_2 Eq. (or 88 percent) of the total decrease from the natural gas system methane emissions estimates for 2017.

For the reasons described above, EPA should not move forward with the changes to the methodology for estimating emissions from gathering and boosting outlined in the Draft Inventory.

Alvarez et al 2018 estimated that U.S. Petroleum and Natural Gas System methane emissions in 2015 were 13±2 million metric tons, approximately 60 percent higher than 2017 EPA Greenhouse Gas Inventory estimate. The study relied primarily on site-level measurement data to extrapolate emissions, which were then validated with independent, basin-level top-down estimates. For gathering stations, Alvarez et al 2018 estimated emissions based on data from Marchese et al 2015, which were based on around 100 site-level measurements and adjusted upward by around 10 percent to account for emissions from facilities above the sampled range of the log-normal distribution. EPA's proposed change to gathering station emissions would widen the discrepancy between Alvarez et al 2018 and the GHGI to around 80 percent, which is inconsistent with numerous peer-reviewed papers that have determined basin-level emission estimates are substantially higher than regional estimates derived from GHGI data or methods.

The main cause of this 80 percent discrepancy likely is large, anomalous emission rates caused by malfunctions or other abnormal events that are difficult to both quantify with component-level approaches or categorize within a traditional, source-based emission inventory - even a high-quality bottom-up inventory such as Zimmerle et al 2019. Therefore, the proposed approach would inadequately account for super-emitter emissions in the G&B sector and cause EPA's estimate to deviate further from empirically-based estimates.

We therefore do not support EPA's decision to move away from using empirical, site-level data from Marchese et al (2015) to estimate methane emissions from gathering and boosting stations. For future considerations of updates to this source, we suggest that EPA consults the EDF and CATF stakeholder feedback on the 2018 GHGI memos, describing an alternative method that uses data from both GHGRP and Marchese et al to most accurately estimate total emissions with a best approximation of source-specific emissions.

Component emission factors for 2016/2017 should not be used for historic emission years. In the proposed revisions, EPA uses Zimmerle et al 2019 calculated emission factors for compressors, tanks, acid gas removal units, combustion slip, dehydrators, yard piping, and separators across all years in the inventory time series (1990-2018). Above we suggest that EPA should not proceed with using the updated methodology as discussed in the Draft Inventory. If EPA chooses to nevertheless use this methodology, given that Zimmerle et al state that the lower nationwide emissions that result from their component emission factors (based on a 2017 survey), compared to the nationwide results from Marchese et al, may be in part due to improved technologies and industry practices implemented in the past few years, what assumptions does EPA make in applying the Zimmerle et al 2019 emission factors to revise Inventory emission estimates for 1990-2016? On what basis does EPA conclude that Zimmerle et al emission factors are representative of earlier years?

For the remaining G&B station components (station blowdowns, dehydrator vents, pneumatic devices, flare stacks, and pneumatic pumps), EPA calculates emission factors for 2016-2018 using year-specific GHGRP subpart W data. However, for 1990-2015 for those GHGRP-based components, EPA uses 2016 emission factors. Why does EPA believe that GHGRP-based emission factors for 2016 are representative of earlier years?

Response: In their paper, Zimmerle et al. discussed differences between the Zimmerle et al. study (current Inventory data source for gathering stations) and the Marchese et al. study (previous Inventory data source for gathering stations). The differences noted in Zimmerle et al. are: (1) the Zimmerle et al. study uses an updated and likely more representative mix of stations in terms of

throughput and complexity, (2) the Zimmerle et al. study accessed component level activity and emissions data from the GHGRP, which were not available at the time of the Marchese et al. study, and which represented data from a large set of operators for the entire U.S., (3) the two studies utilized different measurement methods, and (4) there may have been operational improvements to G&B stations and/or construction of new lower-emitting stations during the intervening years between studies due to increased attention to CH4 emissions across the natural gas value chain.

The Zimmerle et al. study detected a number of large emitters. For example, the study noted that "For most leaker factors, 50% or more of emissions are due to the largest 5% of emitters." The set of emission factors developed in the Zimmerle et al. study which were used to calculate emissions in the GHG Inventory include estimates for all emissions detected in the field campaign, including estimates for large emitters, and the study notes that these "Large emitter emissions have substantial impact on major equipment emission factors, adding 70% - 83% to the impacted major equipment factors."

EPA considered an approach using the Zimmerle et al. (measurements conducted in 2017) and GHGRP (data available starting in 2016) data in recent years and using from Marchese et al. (measurements from 2013 and 2014) in earlier years but did not implement it in the Inventory due to incongruencies between the studies noted above. If the Marchese et al. study in emissions and activity data were used for early years of the time series (e.g., 1990-2014) and the Zimmerle et al. and GHGRP data were used in more recent years (e.g. 2016-2017), there would be a large decrease in emissions over a short period of time due to this transition. Some fraction of the decrease would likely be attributable to improvements in technologies and industry practices. However, as noted above there are other differences between the studies such as study representativeness and the difference between the two is likely not entirely due to changes in technologies (or any other single factor). For this reason, EPA did not implement an approach that uses data from both of the studies in different parts of the time series.

Commenter: National Association of Clean Water Agencies (NACWA)

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0016

Cynthia A. Finley, Ph.D.

Comment 11: Re: wastewater treatment emissions from publicly owned treatment works (POTWs)

The wastewater treatment category includes publicly owned treatment works (POTWs), septic systems, and industrial wastewater treatment systems. NACWA's review focused on emissions from POTWs.

NACWA has submitted comments on the wastewater treatment section since the 2005 Inventory, and we appreciate the clarifications that EPA has made over the years for the emissions calculations and the factors that are used in the calculations. Several references were updated in the 2017 Inventory to better reflect current characteristics of the sector. However, more work needs to be done on updating data sources. For example, the outdated 2004 Clean Watershed Needs Survey (CWNS) was still used as the basis for the percent of wastewater flow to aerobic and anaerobic systems, the percent of utilities that do and do not employ primary treatment, and the wastewater flow to POTWs that have anaerobic digesters. The forecasts made using the 2004 CWNS and previous editions of the CWNS may not accurately reflect recent trends and practices for wastewater utilities.

Another factor that should be updated is the wastewater flow of 100 gal/person/day, which was taken from a 2004 document published by the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. Due to droughts and effective water conservation

measures, many areas of the US now have wastewater flows significantly less than this value. NACWA recommends that EPA consider updated wastewater flow references that represent current wastewater flow in other regions of the country.

NACWA agrees with EPA's planned improvements for the Inventory and encourages development of US-specific methodologies and emission factors when appropriate. As NACWA has explained in comments on the Inventory in previous years, the Association believes that the nitrogen loading rates for $N_2O_{EFFLUENT}$ are sourced incorrectly and that using information from the existing National Pollutant Discharge Elimination System (NPDES) database will yield more accurate and justifiable loading rates.

The NPDES permitting program represents long-term, nationwide facility performance that would allow emissions estimate projections over the time series represented in the Inventory. EPA should also investigate additional references for nitrogen loading rates.

NACWA also asks that EPA consider reformatting the explanations of the variables used to calculate methane and nitrous oxide emissions. Both the value used in the calculation and the source should be clearly stated, preferably in bullet or table form. The current paragraph format, which generally does not include the value used in calculation, increases the difficulty of reproducing the emissions calculations.

Response: EPA appreciates the commenter's feedback on the emissions estimates for POTW, and the encouragement to develop U.S.-specific methodologies and emission factors as described in the Planned Improvements within Section 7.2. Each year in compiling estimates, EPA looks for updated wastewater activity data sources and we appreciate any future suggestions provided by the commenter or others on specific data sources for wastewater flow and sources to replace the CWNS. We are aware of a voluntary survey of POTWs that is currently being administered by EPA's Office of Water that could provide valuable updated activity data depending on response rate and representativeness of facilities that reply. We ask the commenter to encourage its members to complete the survey to ensure the resulting data may be used for future Inventories.

EPA has considered the suggestion to estimate nitrogen effluent loads based on data reported under EPA's National Pollutant Discharge Elimination System (NPDES) Program. Unfortunately, very few POTWs are required to report their effluent nitrogen concentration or load, and those that do are typically required to meet more stringent limits than the average POTW. At this time, EPA is unable to confirm that these data would be representative of the entire industry. In addition, this would represent a departure from the IPCC accepted methodology and would require substantiation that it results in a more robust estimation of these nitrous oxide emissions.

EPA also appreciates the formatting suggestion and will explore ways to improve the clarity of the explanation of the variables in the emission equations and the sources for those variables in future reports.

Commenter: National Cattlemen's Beef Association

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0004

Scott Yager, Mary-Thomas Hart

Comment 12: Global Warming Potential Methodology

The Draft Inventory notes that, in 2018, enteric fermentation emissions from cattle accounted for 1.92% of all United States GHG emissions. To complete this calculation (in addition to other contribution percentage calculations in the Draft Inventory), EPA utilized the GWP100 methodology. As EPA seeks to improve its inventory, NCBA urges the Agency to forgo the GWP100 methodology, instead adopting the GWP* methodology – specifically with regard to methane emissions. Under the United Nations Framework Convention on Climate Change (UNFCCC), reporting of GHG emissions has been standardized in terms of CO_2-equivalent (CO_2-e) emissions using Global Warming Potentials (GWP) over 100 years, but the conventional GWP100 methodology does not adequately capture the different behaviors of long-lived climate pollutants (LLCPs) and short-lived climate pollutants (SLCPs). The atmospheric lifetime and radiative impacts of different GHGs differ dramatically. Acknowledgement of this reality led to the widescale adoption of the GWP100 methodology. GWP100 equates emissions using a scaling factor – CO_2-e. GHGs are assigned a GHG equivalency, then that number is used to determine the emissions' potential impact. Following GWP100, a pound of methane equates to 25 pounds of CO_2. Thus, methane is calculated as $25CO_2e$. However, this simplified scaling factor fails to recognize the amount of time emissions remain in the atmosphere – an equally important factor in determining potential atmospheric impact. The GWP* methodology seeks to remedy this oversight.[13]

Anthropogenic warming estimations are largely determined by the cumulative total emissions of LLCPs and the emission rates of SLCPs. GWP* equates an increase in the emissions rate of an SLCP with a single "pulse" emission of CO_2, and thus considers not only the initial intensity of GHGs, but also the amount of time that they remain in the atmosphere. This approach is a significant improvement on the conventional GWP100 methodology. Further, the GWP* methodology modifies the conventional GWP definition to consider CO_2 warming equivalents (CO_2-we) rather than CO_2-e. Following GWP*, SLCPs can be incorporated directly into carbon budgets consistent with long-term temperature goals, because every unit of CO_2-we emitted generates approximately the same amount of warming, whether it is emitted as a SLCP or a LLCP. This is not the case for conventionally derived CO_2-e measurements.

Response: As noted by the commenter, EPA uses 100-year Global Warming Potentials (GWP) from IPCC's Fourth Assessment Report as required in reporting annual inventories to the UNFCCC. This is required to ensure that national GHG Inventories reported by all nations are comparable. The Inventory presents estimates on a gas by gas basis to allow users to understand relative contribution across all sources of methane, see Table 2-1. The report also includes unweighted estimates in kilotons (see Table 2-2 of the Trends chapter on p. 2-4) and stakeholder/researchers can and have used these values to apply other metrics. We are also tracking the ongoing work of the IPCC in this area related to the development of their Sixth Assessment Report. EPA takes note of the supplemental materials submitted with the comments.

Comment 13: Greater Recognition of Grassland Carbon Sinks

NCBA is pleased with the Agency's effort to recognize existing GHG emission offsets. As the Agency noted in the Draft Inventory, carbon sinks account for a 20% offset of agricultural GHG emissions – significantly reducing the net impact of the industry. NCBA encourages the bolstering of this section generally, so that regulated stakeholders and consumers alike can assess the net impact of GHG emitters. Going forward, NCBA urges EPA to specifically consider the environmental benefit of managed grazing, a conservation practice implemented by ranchers across the country. It is well-known that

[13] Cain, M., Lynch, J., Allen, M.R. et al., Improved calculation of warming-equivalent emissions for short-lived climate pollutants, Clim Atmos Sci 2, 29 (2019). https://doi.org/10.1038/s41612-019-0086-4.

rotational grazing leads to increased carbon sequestration.[14] Globally, if soil organic carbon in agricultural lands and grasslands increase 10% over the course of the 21st century, carbon dioxide concentrations in the atmosphere could be reduced by 110 ppm.[15]

Response: Improved grazing management such as rotational grazing is an activity that EPA would like to capture better within the GHG inventory but has proved to be challenging due to lack of a consistent time-series of national activity data for these alternative grazing management approaches. EPA would appreciate information on activity data sources that NCBA is aware of so these practices can be better reflected in the methods currently used to estimate emissions and removals from livestock management on grasslands.

EPA also notes that the offset percentage or "relative" sink cited by NCBA in their comments is not presented in the report. We were unable to replicate this value based on estimates in the Inventory report.

Commenter: National Lime Association

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0003

William C. Herz

Comment 14: Re: The IPCC factor used to account for lime kiln dust (LKD) CO_2 emissions

NLA notes that, as in previous years, the Draft U.S. Inventory of Greenhouse Gases and Sinks 1990 – 2018, published on February 11, 2020, still relies on the inaccurate IPCC factor of 1.02 to account for lime kiln dust (LKD) CO_2 emissions, and CO_2 emissions accounting for off-spec lime and other wastes are absent.

NLA previously submitted comments in 2013 and 2015 concerning inaccuracies on the U.S. Inventory of GHG Emissions and Sinks that recommended EPA should discontinue using the IPCC emission factors to account for LKD emissions, and also take into account CO_2 emissions from off-spec lime, scrubber sludge, and other wastes (NLA prior comments are included as an Attachment). This issue is important to NLA members not only to ensure data accuracy, but to EPA's stated goal of agreement and alignment with the GHG mandatory reporting system. Currently, EPA calcination emission calculations rely on output-based emission factors from the relatively outdated IPCC 2006 GHG Guidelines.

NLA's recommendations to adopt accurate calcination emissions calculation methodology for LKD and off-spec lime, scrubber sludge and other wastes are based not on modelled data but rather on analysis of actual production data, including accurate measurement of CaO and MgO oxide contents of lime and LKD provided to NLA from its member companies (see NLA comments 2013). These comments and supporting data should be sufficient to provide EPA with the basis to generate more accurate emissions estimates for LKD, off-spec lime and scrubber sludge.

In summary, NLA comments concluded that the IPCC's output-based approach for estimating calcination emissions from U.S. lime products is highly accurate, but **it understates emissions from LKD and other byproducts/wastes generated in the United States**. The NLA recommended that lime calcination

[14] Wang, T.; Teague, W.R.; Park, S.C.; Bevers, S. GHG Mitigation Potential of Different Grazing Strategies in the United States Southern Great Plains. Sustainability, 7 (2015), pp. 13500-13521.

[15] Lal, R., *Sequestering carbon in soils of agro-ecosystems*. Food Policy. 36 (2011), (Suppl. 1): S33-S39.

emissions should be multiplied a factor of 1.06 (not 1.02) to account for LKD, and by 1.02 to account for wastes generated at lime plants (which are currently not accounted for).

However, in the "Uncertainty and Time-Series Consistency" section of the Draft Inventory, EPA acknowledges NLA's concern using the erroneous factor to account for LKD emissions. EPA also notes the sharing of historical emissions data and calculation methodologies between NLA and EPA, but adds it is still reviewing the information.

EPA also adds other caveats, such as uncertainty regarding the availability of data across time series needed to generate a representative country-specific LKD factor, and uncertainty associated with the reliability and completeness of voluntarily reported plant-level production data, and the need for further research and data to improve understanding of additional calcination emissions to consider revising the current assumptions that are based on IPCC guidelines.

Further, in the "Planned Improvements" section, EPA cites limited resources and the need for additional QA for not incorporating NLA's recommendations into the current inventory report.

As previously stated, the NLA conclusions and recommendations were based on accurate NLA member data. Because EPA continues to use inaccurate IPCC's LKD generation rates, calcination emissions continue to be understated and we urge EPA to take our recommendations into consideration. Further, if as indicated, there are other supporting data we can provide that would add weight to our argument, please let us know.

In addition, we know that EPA has a strong interest in having both the GHG Inventory and the Mandatory GHG Reporting system be in agreement as much as possible. This is important not only for EPA's creditability but also for the public's and stakeholders' understanding of these issues as well.

The on-going differences NLA has outlined are significant and should be corrected.

Response: EPA appreciates NLA's comment and interest in improving emissions associated with lime kiln dust generation (LKD) and has reached out to the commenter to discuss available data to advance efforts to address this potential update.

Commenter: National Waste & Recycling Association, SCS Engineers, Solid Waste Association of North America, Republic Services, Waste Managment, Weaver Consulting Group

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0005

Jesse Maxwell

Comment 15: Degradable Organic Carbon (DOC)
We are pleased that EPA has evaluated stakeholder input regarding DOC and k values, and is developing an analysis to update default values for both DOC and k in its Greenhouse Gas Reporting Program (GHGRP) that then would be applied to the emissions estimates for MSW landfills in the GHG Inventory data for years 2005 to the present. We previously submitted comments recognizing that the default DOC value used in the GHGRP does not reflect recent trends in the composition of waste disposed in MSW landfills. Notably, in 2019, the Environmental Research and Education Foundation (EREF) published a white paper updating the DOC values for MSW landfills and revised its DOC estimate in 2020 with additional technical data to further substantiate representative DOC values for MSW. We encourage EPA to account for this recent data in its planned improvements to the GHGRP Subpart HH

methodology to present more accurate emissions data from MSW landfills in the 2005 and later years of the GHG Inventory. We also offer our expertise in assisting EPA in preparing the anticipated multivariate analysis that attempts to optimize DOC and k values across our sector.

We also are encouraged by EPA's efforts to identify potential improvements to the DOC and k values for MSW landfills in the GHG Inventory for years 1990 to 2004. EREF has assembled a comprehensive list of waste characterization studies, including those evaluated by EPA, for this Inventory time series. EREF used the reliable data from those studies to reevaluate the DOC values for the years 1990 onward and in February 2020 provided EPA with its new findings to supplement EREF's 2016 white paper and its January 2019 updates. The additional data reinforces the need for updating the DOC values and should be used to inform EPA's process for updating the GHGRP as well as the GHG Inventory.

Chapter 7 of the GHG Inventory explains that EPA uses one DOC value of 0.20 to calculate emissions for the years 1990 through 2004. The GHGRP allows landfills to use 0.20 for bulk MSW or allows a landfill to further delineate waste streams by accounting for separate shipments of construction and demolition (C&D) waste, which uses a DOC of 0.08, and separate shipments of inert wastes, which may use a DOC of 0.0. If a landfill delineates in this way, it must use a DOC of 0.31 for its MSW volumes, which applies an artificially high DOC to MSW, and inappropriately overestimates emissions. The required DOC value of 0.31 fails to account for the significant volumes of C&D and inert wastes that are incorporated in MSW, and which cannot be separated from the MSW or accounted for distinctly, as can discrete shipments of inert wastes from industrial or C&D recycling facilities. Please let us know how we can assist the agency in providing additional data on DOC and k values for this Inventory time series.

As stated previously, in 2016, EREF undertook a state-based study of DOC values for both landfills receiving only MSW (MSW Only Landfills) and for Non-MSW Material going to MSW Landfills. EREF updated the 2016 paper in January 2019 and February 2020 with additional information based on new waste characterization information. The DOC guideline recommended by EPA for MSW Only Landfills is 0.31 and the recommended guideline for bulk material (combined MSW, C&D and inert waste streams) going to MSW landfills is 0.20. EREF concluded both guidelines over-estimate the amount of organic waste deposited in landfills, which results in inaccurate estimates of landfill gas generation and methane emissions. Furthermore, neither of the EPA-recommended DOC values have been reviewed in many years. It is time EPA update the DOC values for MSW and Bulk waste and we believe that the most valuable focus would be to reassess the DOC values incorporated in the GHGRP used for inventory years 2005 forward.

EREF reviewed 17 recent waste composition studies for MSW Only Landfills conducted by 13 states and confirmed that waste composition has, and continues to, change over time, as fewer organic materials are sent to MSW landfills. Since EPA cites the EREF research as a rationale for reassessing DOC values for 1990-2004, the following quotes from EREF clearly suggest that the data strongly suggest reevaluating DOC values used in the GHGRP for years 2005 and later:

> All characterization studies had DOCMSW values significantly less than the default value of 0.31, which suggests this value is not representative of real-world conditions for MSW (Table 3; Figure 4). Analysis of U.S. EPA data … also results in a significantly lower DOCMSW value compared to the U.S. EPA guideline of 0.31, with DOCMSW values ranging from 0.218 in 1994 to a minimum of 0.160 in 2015 (Figure 4; Appendix B). Both the state characterization studies and U.S. EPA Facts and Figures data independently suggest that a DOC guideline value of 0.31 for MSW is not representative of the landfilled MSW stream….
>
> The use of a single DOC value as a guideline for all U.S. landfills makes the implicit assumption that waste composition does not change over time or due to location. The results presented

> here suggest these are not valid assumptions and that, collectively, the use of a static DOC value of 0.31 may lead to inaccurate estimates of landfill gas emissions for landfills that only accept MSW. Because this specific analysis is focused only on MSW materials, one would expect the inclusion of non-MSW materials going to a landfill to impact DOC estimates even more.[16]

With respect to Non-MSW going to MSW Landfills, EREF finds "a common assumption is that all waste materials entering MSW landfills consist only of MSW materials. As noted previously, MSW Landfills rarely accept MSW exclusively. Rather, most MSW Landfills (landfills in 45 states) are authorized to accept other Subtitle D wastes in addition to MSW,"[17] and often non-MSW materials comprise a significant percentage of MSW landfills. In addition, EREF notes:

> Given that a third of incoming waste to MSW Landfills consists of non-MSW materials, there is significant potential for non-MSW materials to impact the relative fraction of organics and degradable organic carbon (DOC) of the MSW Landfill waste stream.[18]
>
> The amount and types of non-MSW Subtitle D organic wastes impact the DOC value for the landfilled waste since it consists of both MSW and non-MSW streams. This combined DOC value (DOCSubD) incorporates degradable organic carbon from all Subtitle D wastes accepted at MSW Landfills (both MSW and non-MSW) …. State waste characterization studies were used to estimate the relative fraction of each organic constituent for C&D and industrial waste … and DOC for each waste type was calculated using Equation 1b. Based on this analysis the DOCSubD value of landfilled waste is 0.167 (Table 7).[19]

EREF also highlights that the DOCSubD value:

> … is lower than the guideline value of 0.20 for bulk waste. It is also lower than the average DOCMSW value of 0.191 computed in the prior section, indicating the inclusion of non-MSW decreases overall DOC. Using the same approach as for the DOCMSW analysis, state-specific organics content and DOCSubD values for all fourteen states with sufficient data were determined and presented in Table 8, below. … The results, all for 2013, highlight differences in DOCSubD based on locale and suggest the use of a static 0.20 guideline for bulk waste may lead to inaccurate estimates of methane generation and emissions, especially in some areas.[20]

Thus, EREF concludes as follows:

> The average computed DOC value for MSW using state data was 0.191, or roughly three-fifths of the MSW guideline value. The average computed DOC value for bulk waste using state data was 0.167, or roughly four-fifths of the bulk waste guideline. This analysis suggests that the U.S. EPA's guideline DOC values of 0.31 for MSW-only landfills and 0.20 for facilities accepting non-MSW Subtitle D wastes overestimate DOC at these landfills and may result in inaccurate estimates of landfill gas generation and methane emissions.[21]

Based on this review of the DOC values for MSW landfills, the waste sector concludes that the long-standing DOC values developed in the past over-estimate both landfill gas generation and methane

---

[16] The Environmental Research & Education Foundation (2019). Analysis of Waste Streams Entering MSW Landfills: Estimating DOC Values & the Impact of Non-MSW Materials., pp 8 – 9. Retrieved from www.erefdn.org

[17] Ibid., p. 10.

[18] Ibid., p. 11.

[19] Ibid., p. 13.

[20] Ibid., p. 14.

[21] Ibid., p. 15.

emissions. The data provided by EREF confirms that two trends are driving the changes in waste composition at MSW Landfills. First, many MSW landfills are handling less organic matter now, and we anticipate this trend will continue due to state and local organics diversion goals. Second, the increase of Subtitle D non-MSW waste disposed of in MSW landfills has altered the DOC for all waste deposited in MSW Landfills. EPA validates these trends in the GHG Inventory's Chapter 6 discussion of carbon sequestration of harvested wood products, yard waste and food waste, as Table 6-85 shows a significant reduction in sequestered carbon since 1990 due to reduced volumes of organic wastes disposed in landfills.

Based on EREF's research, we urge EPA to update the DOC values to reflect significant changes in the amounts and types of organic materials being landfilled over the past 20 years. The values now in use are inaccurate and should not be used going forward. We recommend that EPA review and update the DOC values for the entire 1990-2018 time series of the GHG Inventory and prioritize updates of the DOC values used in calculating GHG emissions under Subpart HH of the GHGRP.

Response: EPA appreciates the commenter's feedback on the DOC as applied to estimating methane generation and emissions from MSW landfills. We also appreciate the information provided about the most recent Environmental Research and Education Foundation (EREF) white paper. As stated in the Planned Improvements section of Section 7.1 of the U.S. Greenhouse Gas Inventory of Emissions and Sinks, EPA is developing a multivariate analysis solving for optimized DOC and k- across the more than 1,100 landfills that report under subpart HH of the GHGRP. This analysis uses publicly available data directly reported to the GHGRP. The results of this analysis could inform updates to the default DOC and k-values used by landfills subject to reporting under subpart HH of the GHGRP in calculating their facility-level emissions. For updates to the DOC to be reflected in the Inventory, the updates also need to be incorporated in Subpart HH of the GHGRP given its direct use in estimating national-level emissions from MSW landfills.

Comment 16: The Scale-Up Factor for MSW Landfills

We find the explanation of the methodology EPA employed to arrive at the scale-up factor to be clear. We also are encouraged that EPA intends to periodically assess and revise the scale-up factor based on reasonable expectations that landfills that do not report under the GHGRP are likely to be smaller, closed sites with declining GHG emissions and that reporting landfills will continue to represent a larger proportion of waste-in-place. For example, starting in 2010, every year fewer landfills have reported more than the 25,000 $MTCO_2e$. Yet, every year, more landfills are included in the GHGRP. This means that more of the waste is covered by reporting facilities on an annual basis.

Year	# of landfills reporting	# of landfills >25k $MTCO_2e$	Total $MTCO_2e$ reported
2010	1235	975	101,920,033
2011	1240	965	93,830,839
2012	1252	961	94,375,699
2013	1278	946	91,159,615
2014	1290	941	90,817,217
2015	1294	935	89,746,871
2016	1300	914	86,905,137
2017	1304	898	86,464,158

2018	1313	896	89,215,401

Again, most landfills that are exempt from the GHGRP requirements are old, small, closed landfills. The potential methane emissions from these sites decrease year over year by approximately 3 percent, on average. Therefore, the emissions contribution from these sites will continue to decrease compared to the sites that report via the GHGRP. The scaling factor must be adjusted to reflect the declining contribution of the exempt sites.

Response: EPA appreciates the commenter's feedback on the clarity of the methodology used to develop the scale-up factor to account for landfills that do not report to the GHGRP. EPA also agrees with the commenter's feedback that the scale-up factor should be evaluated on a routine basis. There is a large amount of uncertainty associated with the number of non-reporting landfills and their total waste-in-place and the scale-up factor is our best estimate given the available information. EPA plans to reexamine the scale-up factor for the 1990-2019 Inventory cycle to determine if there are additional landfills reporting to the GHGRP such that the waste-in-place amounts for those landfills can be removed from the scale-up factor assumptions. At the same time, EPA will also account for those landfills that have stopped reporting to the program because they were able to exercise the off-ramp. Any additional information from commenters on landfills that do not report to the GHGRP that could help refine the scale-up factor assumptions are always welcome and appreciated.

Comment 17: Methane Oxidation Factor

Our previous years' comments on the methane oxidation factor used for the 1990 to 2004 Inventory time series remain unchanged and are repeated below. EPA calculates a national estimate of methane generation and emissions using a combination of secondary data sources that detail the annual quantity of waste landfilled and the annual quantity of methane recovered from facilities with landfill gas collection and control systems. EPA applies a 10% oxidation factor to all facilities for the years 1990 to 2004. This 10 percent default factor contrasts significantly with the average methane oxidation factor of 19.5 percent applied through use of GHGRP data, to the later years of the time series (2005 to 2018). Importantly, the 19.5 percent average oxidation rate incorporated in the GHGRP, subpart HH, emissions data is premised on a more detailed and up-to-date estimation approach than is the default value of 10 percent. It is also a conservative average value, as the GHGRP methodology restricted the maximum oxidation rate to 35 percent.

In its work to review and revise the method for calculating methane oxidation under subpart HH of the GHGRP, EPA acknowledged the need to update the default 10 percent oxidation value. The default value was based on only one field study, at a landfill without gas collection and control, and did not reflect the much higher oxidation values found in numerous subsequent, peer-reviewed field studies. Given the plethora of scientific studies showing methane oxidation to be several times higher than the EPA and IPCC default value,[22] we strongly recommend EPA apply a revised value (perhaps the average oxidation value from the GHGRP) to the earlier years of the time series.

Response: EPA appreciates the commenter's feedback on the oxidation factor as applied to estimating emissions from MSW landfills. EPA regularly reviews new literature related to landfill methane oxidation and investigated options to adjust the oxidation factor from the 10 percent currently used for 1990 to 2004 to another value or approach such as the binned approach used in the GHGRP (e.g., 10 percent, 25 percent, or 35 percent based on methane flux) or the average oxidation factor across

[22] Solid Waste Industry for Climate Solutions, 2.2 Methane Oxidation Addendum 2012, November 19, 2012.

facilities reporting to the GHGRP (approximately 19.5 percent). At this time EPA has decided not to revise the methane oxidation factor for the 1990-2004 time series since such a change will likely result in a noticeable discontinuity in the emissions between 2004 and 2005-2010 (i.e., a jump in emissions between 2004 and 2005) that would need to be investigated and resolved to ensure methodological consistency over the time series and to accurately reflect trends. We continue to advance efforts to improve the methane generation calculations in the landfills section of the Waste Chapter by focusing on improvements to the DOC and k-value per responses to other comments submitted by this commenter, in order to make best use of the available resources across the Inventory compilation process.

Comment 18: The k Factor (Methane Generation Rate Constant)

As discussed above, we are encouraged that EPA is evaluating stakeholder input on k value for both the 1990 to 2004 Inventory series and for 2005 to the present. We also are pleased that EPA is investigating k values for different climate types against new data and other landfill gas models, as well as assessing the uncertainty factor applied to these k values in the Waste Model, and we offer our support to EPA in collecting and evaluating this information. As noted in previous years' submissions, the waste sector is concerned that these k-values are outdated and rife with uncertainty, as confirmed by the *Draft AP 42.2.4 Municipal Solid Waste Landfills*, which states:

> There is a significant level of uncertainty in Equation 2 and its recommended default values for k and Lo. The recommended defaults k and Lo for conventional landfills, based upon the best fit to 40 different landfills, yielded predicted CH_4 emissions that ranged from ~30 to 400% of measured values and had a relative standard deviation of 0.73 (Table 2-2). The default values for wet landfills were based on a more limited set of data and are expected to contain even greater uncertainty.[23]

The waste sector has previously highlighted the significant issues with the k values used in the *Draft AP-42 Section 2.4: Municipal Solid Waste Landfills*. In fact, EPA has never finalized AP-42 for MSW landfills, despite the k-value issues identified by EPA in both AP-42 and the Background Information Document. With uncertainties in CH_4 emissions ranging from -30% to 400% under EPA's assessment of the LandGEM model, it is difficult to rely on these data. For this reason, we support EPA's plan to review and resolve the significant problems in the k value data set. However, we also suggest that the agency review L0 value. Although an independent variable, L0 should be considered in conjunction with k value modifications because it is related to fitting the curve, where the results will be dependent on the assumptions used for the L0/DOC.

Response: EPA appreciates the commenter's feedback on the k-value as applied to estimating methane generation and emissions from MSW landfills. As stated in the Planned Improvements section of Section 7.1 of the U.S. Greenhouse Gas Inventory of Emissions and Sinks, EPA is developing a multivariate analysis solving for optimized DOC and k-values across the more than 1,100 landfills that report under subpart HH of the GHGRP. This analysis uses publicly available data directly reported to the GHGRP. The results of this analysis could inform updates to the default DOC and k-values used by landfills subject to reporting under Subpart HH of the GHGRP in calculating their facility level emissions. As the commenter already acknowledged for updating DOC, in order for updates to the k-value to be reflected in the Inventory, the updates also need to be incorporated in Subpart HH of the GHGRP given its direct use in estimating national-level emissions from MSW landfills.

[23] U.S. EPA, Draft AP 42.2.4: Municipal Solid Waste Landfills, October 2008, p. 2.4-6.

Comment 19: Compost Emission Factor

Our previous years' comments on compost emission factor remain unchanged and are repeated below. In ideal conditions, the composting process occurs at a moisture content of between 50 and 60%, but the moisture content of feedstocks received at composting sites varies and can range from 20% to 80%. It is common for moisture to be added to dry feedstocks prior to the start of composting to optimize the biological process. In the calculation of emissions from composting in the draft chapter, it appears that all incoming wastes were assumed to have a moisture content of 60%. If 60% is not reflective of the actual weighted average of all feedstocks, this will introduce errors in the inventory calculation that could be significant.

We recommend that the calculations be based on waste subcategories (i.e., leaves, grass and garden debris, food waste) and category-specific moisture contents, or ask that further information is provided on the rationale for assuming 60% as the average moisture content of all inbound materials.

Response: EPA notes the commenter's feedback on the moisture content levels used in the calculation of emissions from composting. The calculations for composting are based on IPCC Tier 1 methodology defaults. Under this methodology, the emission factors for CH_4 and N_2O assume a moisture content of 60% in the wet waste. (IPCC 2006) EPA has included this detail to the Methodology section of Section 7.3 of the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018, as was done in the previous year's inventory report, so that the source of the moisture content is more transparent. In addition, EPA continues to include in the Planned Improvements section of Section 7.3 that EPA is looking into the possibility of incorporating more specific waste subcategories and category-specific moisture contents into the emissions estimates for composting in the United Stated to improve accuracy. However, to date the EPA has not been able to locate substantial information on the composition of waste at U.S. composting facilities to do so. As additional data becomes available on the composition of waste at these facilities, EPA will consider using this information to create a more detailed calculation of U.S. composting emissions.

Comment 20: Chapter 6: Land Use, Land-Use Change, and Forestry - Carbon Stocks

In Chapter 6: Land Use, Land-Use Change, and Forestry of the GHG Inventory, carbon stocks from yard trimming and food scrap in landfills are discussed starting on page 6-128. The carbon stocks are calculated according to Equation 1 on page 6-131. However, Equation 1 reduces the persistent carbon by the carbon content twice, effectively reducing the carbon storage value. The formula calculates C stock (LFC), which is the incoming weight (W) reduced by moisture content (MC), reduced by initial carbon content (ICC), reduced by degradation of the non-persistent carbon. The formula reduces stored carbon by the initial carbon content within the braces even though it had previously been accounted for. Rather the formula shown, it should be:

$$LFC = W \times (1-MC) \times ICC \times \{CS + (1-CS) \times e^{-k(t-n)}\}$$

Additionally, Table 6-87 shows that the decay rates for grass, leaves, branches and food scraps were 0.323, 0.185, 0.016, and 0.156, respectively. Last year's report shows the values on Table 6-81 as 0.313, 0.179, 0.015, and 0.151, respectively. It appears that the decay value for each material increased from the values shown in last year's report without any explanation. The discussion on the values references using the 2000 U.S. Census for the latest year's calculation, but the 2010 U.S. Census for the previous year's calculation. It is unclear why EPA would use the earlier census data instead of the most recent. We recommend that EPA elaborate on the changed decay rates.

The waste sector also has questions regarding Table 6-88, which shows the remaining carbon stock in landfills. Although grass has the highest decay rate and the highest moisture content, it is shown as having the highest stock in the landfill of all yard trimmings and food scraps. C stocks should represent the total carbon stored in landfills minus the amount lost from decomposition. By weight, grass should be 30 percent of yard waste, but because it is composed of 70 percent moisture, the weight is reduced by that amount. Then, only 53 percent is persistent and it has the highest decay rate and the lowest initial carbon content. Therefore, grass should have the lowest amount of C in the landfill, not the highest. It is probable that the figures for grass and branches were inadvertently switched. We recommend that EPA review the values shown in Table 6-88 to determine their accuracy.

Response: EPA thanks SWANA for their review of the Changes in Yard Trimmings and Food Scrap Carbon Stocks in Landfills section of the Inventory. EPA is still evaluating the suggested changes to Equation 1 and will add this evaluation to the list of planned improvements for next year's inventory. EPA agrees with the comments related to Table 6-87 and the Census data and has corrected the table and text. EPA also agrees with the comments on Table 6-88: the table category labels were transcribed incorrectly. EPA corrected these category labels.

Commenter: POET, LLC

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0006

Kyle Gilley

Comment 21: Re: Using ethanol as a strategy to reduce GHG emissions from the transportation sector

We are troubled that over 90 percent of the carbon dioxide emissions in 2018 were associated with fossil fuel combustion, and over 35 percent of total carbon dioxide emissions are associated with the transportation sector, making the transportation sector the largest carbon emitter in the U.S. economy. See Draft Report at ES-11, ES-12. Ethanol is a renewable fuel with significant environmental and economic benefits that is an important, readily-available tool to help combat transportation sector greenhouse gas ("GHG") emissions.[24] Currently, almost all gasoline in the United States contains 10 percent ethanol; however, higher level ethanol blends--such as E15, approved for use in almost all conventional light-duty vehicles on the road today--provide additional benefits beyond E10, and are increasingly available at retail stations across the U.S.

Specifically, ethanol-blended fuels provide, at low cost, substantial GHG emissions benefits. Recent life cycle analyses show that corn starch ethanol reduces GHG emissions by approximately 40% as compared to petroleum, and additional analyses predict that these reductions may increase to 50% or more by 2022 with ongoing innovations in corn cultivation and biorefinery practices.[25] Cellulosic ethanol

[24] As a methodological matter, we support EPA's adherence to the Intergovernmental Panel on Climate Change's guidance and the United Nations Framework Convention on Climate Change's reporting requirements to exclude biofuel estimates

[25] USDA/ICF Study, "A Life-Cycle Analysis of the Greenhouse Gas Emission From Corn-Based Ethanol," (Sep. 2018) https://www.usda.gov/oce/climate_change/mitigation_technologies/LCA_of_Corn_Ethanol_2018_ Report.pdf; Mueller, "Updated Life Cycle Greenhouse Gas Data for Corn Ethanol Production," (Mar. 2016) http://illinoisrfa.org/wp-content/uploads/2017/06/UIC-OIG-3_16_v2-1.pdf ; Michael Wang et al., Argonne National Labs, "Well-to-Wheels Energy Use and Greenhouse Gas Emissions of Ethanol from Corn, Sugarcane, and Cellulosic Biomass for U.S. Use," (Dec. 2012) http://iopscience.iop.org/1748-9326/7/4/045905/pdf/1748-9326_7_4_045905.pdf.

provides even more substantial GHG benefits, essentially eliminating the greenhouse gas impacts of liquid fuel.[26] Ethanol plays a central role in transportation sector GHG reduction programs, such as in the California Low Carbon Fuel Standard program, in which ethanol provides over one-third of all GHG credits.[27] Without ethanol, such programs would not be able to achieve GHG reduction targets and would do so at a higher cost to consumers and regulated parties.

As a methodological matter, POET supports EPA's adherence to the Intergovernmental Panel on Climate Change's guidance and the United Nations Framework Convention on Climate Change's reporting requirements to exclude carbon dioxide emissions associated with combustion of biofuels from the Inventory totals given the biogenic nature of the fuels. See Draft Report at 3-22, n. 21. The Draft Report indicates "[n]et carbon fluxes from changes in biogenic carbon reservoirs in croplands are accounted for in the estimates for Land-Use, Land-Use Change, and Forestry (see Chapter 6)." *Id*. This portion of the report does not identify any land use changes specifically associated with corn production for ethanol, and the scientific literature supports that no such relationship exists. In particular, total land acreage devoted to corn farming has remained constant since the 1930s.[28] Remarkable increases in yield have allowed farmers to meet greater demands for food and fuel using the same amount of land. Specifically, acres planted in corn have remained at or below 1930s levels while corn production has increased seven-fold.[29] Indeed, according to U.S. Department of Agriculture projections, annual corn production is anticipated to surpass 15 billion bushels by 2025 with approximately 2 million fewer acres in production.[30] Further, water usage for corn crop irrigation has decreased over time and fertilizer/pesticide use has plateaued even as corn harvest has increased substantially.[31] These modest and decreasing impacts contrast with the tremendous environmental impacts of petroleum exploration and refining, and the associated GHG emissions impacts of fossil fuel combustion.[32]

Moreover, increased use of biofuels can promote environmental and equity objectives through maximizing co-benefit improvements in local air quality for low income and vulnerable communities that have been plagued by harmful pollutants. Specifically, vehicle pollution is a key culprit of air quality issues for communities of color that breathe, on average, 66 percent more air pollution from vehicles than white residents.[33] Combustion of the fossil fuel component of gasoline and diesel results in harmful particulates and toxic aromatics like benzene and toluene.[34] Increased biofuel-blending can mitigate

---

[26] *Id.*

[27] California Air Resources Board, *Data Dashboard- Figure 2 Alternative Fuels Volume and Credits*, May 15, 2019. https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm.

[28] Ramboll, *The RFS and Ethanol Production: Lack of Proven Impacts to Land and Water* at 11 (Aug. 2019), https://growthenergy.org/wp-content/uploads/2019/09/Ramboll_RFS_Reset_Document_Final_08_18_2019.pdf.

[29] Ramboll at 11-13; K. D. Reitsma, et. al., "Does the U.S. cropland data layer provide an accurate benchmark for land-use change estimates?" AGRONOMY JOURNAL, 108(1), 266–272 (2016), https://dl.sciencesocieties.org /publications /aj/pdfs /108/1/266; J. B. Dunn, et. al., "Measured extent of agricultural expansion depends on analysis technique." BIOFUELS, BIOPROD. BIOREFINING, *11*(2), 247–257 (2017) 10.1002/bbb.1750.

[30] *Id.* at 12.

[31] *Id.* at 32.

[32] E. Parish, et. al., "Comparing Scales of Environmental Effects from Gasoline and Ethanol Production," ENVIRONMENTAL MANAGEMENT (2013) 51:3017-338 https://link.springer.com/journal/267/51/2.

[33] *Inequitable Exposure to Air Pollution from Vehicles in the Northeast and Mid-Atlantic,* UNION OF CONCERNED SCIENTISTS (June 21, 2010), https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles

[34] *See e.g., New Studies Show Ethanol Reduces Emissions and Improves Air Quality*, URBAN AIR INITIATIVE (Apr. 11, 2018), https://fixourfuel.com/2018/04/11/new-studies-show-ethanol-reduces-emissions-and-improves-air-

these emissions. Biofuels' displacement of harmful fuel additives is further illustrated by a recent study conducted by the University of California Riverside (UCR), which found that greater use of ethanol-blended fuels can reduce carbon monoxide, ozone, and particulate matter levels relative to the use of gasoline-only fuels.[35] Thus, biofuel-blended fuel is positioned to ease the pollution burdens low income and vulnerable communities bear, including reducing the toxic constituents in gasoline.

Further, while other means of alternative personal transportation may be relatively expensive or require extensive infrastructure upgrades, higher biofuel blends can be utilized by nearly all consumers, and can be offered at a discounted price relative to higher GHG emitting fuels. Higher biofuel blends are a way to share the economic advantages of a low carbon transportation sector with low income consumers.

In sum, ethanol should be a key tool in the United States' strategy to reduce the GHG emissions associated with the transportation sector identified in the Draft Report.

Response: EPA thanks the commenter for the information and perspective on ethanol production and use. As mentioned, biofuel CO_2 estimates are presented in the Inventory for informational purposes only, in line with IPCC methodological guidance and UNFCCC reporting obligations (See Section 3.11 of the Report). Net carbon fluxes from changes in biogenic carbon reservoirs in croplands are reported in the Land Use, Land-Use Change, and Forestry sector (See Chapter 6). All non-CO_2 emissions associated with combustion for biomass energy are included in the Energy sector (See Chapter 3). Furthermore, the Inventory reports emissions in line with international conventions on country level reporting which lists emissions by source or category and not by product life cycle or fuel type. The inventory is a policy-neutral, technical report providing information on current GHG emissions and sinks and trends prepared per reporting UNFCCC Annex 1 National GHG Reporting Guidelines (see Box ES-1) and as such, it is not well-suited as a document in which to outline mitigation opportunities and goals.

Commenter: Private Citizen

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0013

Bridget Chadwick

Comment 22: Re: spelling out carbon instead of using atomic symbol "C"

Spelling out carbon instead of using the atomic symbol "C" will help readers in a search for discussions about "carbon intensity" and the "carbon content" of fossil fuels consumed.

Response: EPA appreciates the comment on improving the usability and readability of the annual Inventory report. Some instances of the use of the atomic symbol "C" were modified for this report but EPA will continue to look for ways to improve readability in future reports.

Comment 23: Re: Using the unit exajoules to describe the carbon content of petroleum products on page 3-34

For consistency with the discussion of the "carbon content" of fossil fuels and "carbon intensity" of energy, elsewhere in the Inventory, the units: MMT CO_2 eq. / QBtu should be used.

---

quality/; S. Mueller, et. al., *The Impact of Higher Ethanol Blend Levels on Vehicle Emissions in 5 Global Cities*, UNI. OF ILLINOIS AT CHICAGO (Nov. 2018), http://www.erc.uic.edu/assets/pdf/UIC5cities_HEALTH_Nov12_ Final.pdf.

[35] University of California CE-CERT, *Impacts of Aromatics and Ethanol Content on Exhaust Emissions from Gasoline Direct Injection (GDI) Vehicles* (April 2018).

Response: The reference to exajoules was replaced with QBtu in the final report.

Comment 24: Re: Referring readers to Table A-41 in Annex 2.1 for "more detail on the C Content Coefficient of different fossil fuels

Table A-42 should be referenced.

Response: The reference was updated for the final report.

Comment 25: Re: The explanation of how CO_2 emissions are estimated on page 3-32

This explanation should say that the carbon content coefficients are multiplied by the molecular-to-atomic weight ratio of CO_2 to carbon i.e. 44/12, as done in the Annexes on page A-465.

Response: The explanation was updated in the Final Report to reference the molecular-to-atomic weight ratio.

Comment 26: Re: Box 3-5

This box provides a discussion of fossil fuel carbon content "ranging from about 53 MMT CO_2 Eq./QBtu for natural gas to upwards of 95 MMT CO_2/QBtu for coal and petroleum coke". A short description of the energy/CO_2 tables, A-11 to A-39, provided in the Annexes with a table of the average CO_2 emission factors of fossil fuels consumed in 2018 (coal 95.6; oil products 72.4 and natural gas 52.9 $MMTCO_2$/QBtu) would help readers understand the relationship between CO_2 emissions [$MMTCO_2$], energy consumption [QBtu] and the carbon intensity of the fossil fuel energy consumed [$MMTCO_2$/QBtu].

Response: The text box was modified in the Final Report (box 3-4) to include a reference to Tables A-42 and A-43 in Annex 2.1 for carbon contents of all fuels.

Comment 27: Re: Figure 3-16 on page 3-34

The key driver "energy consumption" should be shown in this figure.

Response: Energy consumption was not added to Figure 3-16 but was included on Figure 2-15 in the Final Report to be consistent with information provided in Table 2-14.

Comment 28: Re: Table A-44

In this table, total electricity consumption for 2018 should be corrected to 4004 billion kWh as provided in the reference document, the EIA Monthly Energy Review, November 2019.

Response: The values in Table A-44 are consistent with prior versions of the EIA Monthly Energy Review but will be reviewed for future reports and incorporate any updates to EIA data.

Commenter: Private Citizen

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0015

Jeff Moeller

Comment 29: Re: Section 7.2 Wastewater Treatment:

The calculation does not appear to include emissions that may occur in wastewater collection systems. Wastewater collection systems may be a significant source of emissions, but it may also be quite difficult to estimate these emissions. I'd recommend noting that collection systems may be another source of emissions and that more work may be needed on this topic in the future.

Response: As stated in the Planned Improvements within section 7.2 of the Inventory report, although there are insufficient data to capture emissions from collection systems, EPA plans to update emission factors for centralized aerobic treatment based on the recently published 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories. The revised emission factors account for incoming dissolved methane that is formed in the collection system and liberated during aerobic treatment.

Commenter: Private Citizen

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0002

Oleksandr Stubailo

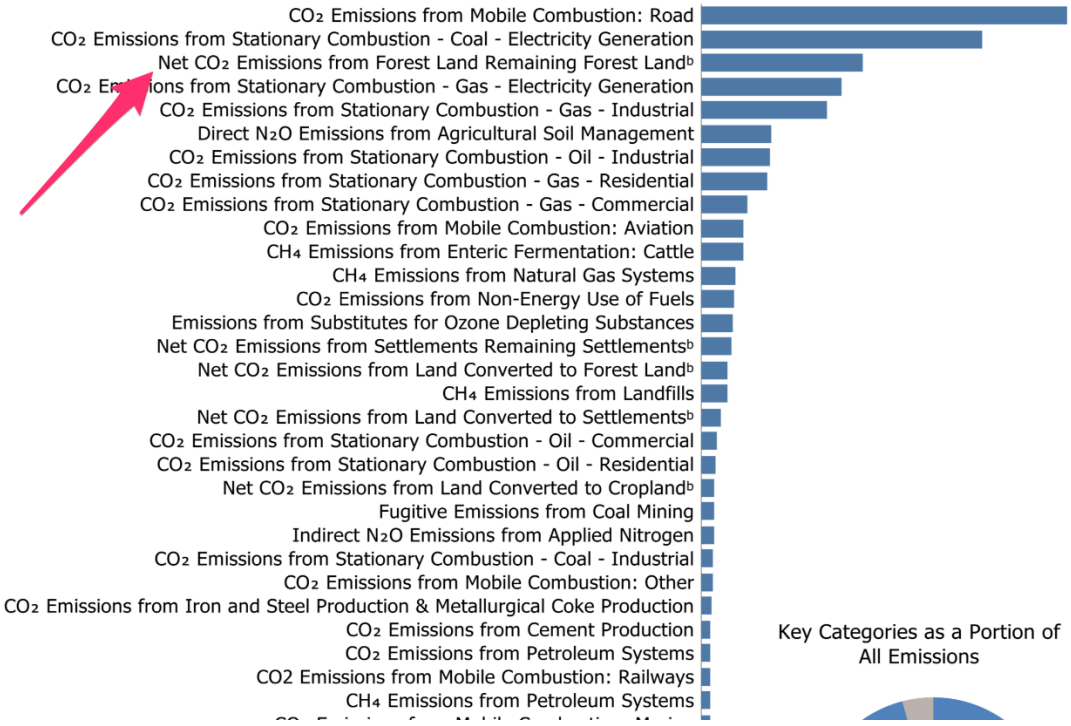
Comment 30: Re: Figures ES-17 on page ES-30 of the Executive Summary

This figure attempts to provide an overview of the key categories of emissions, but combines categories that have net positive and net negative carbon emissions in one chart.

When I was looking at the chart, I didn't initially see that categories like "Net CO_2 Emissions from Forest Land Remaining Forest Land" represented a negative impact on carbon emissions, since they were displayed in a similar way to categories with positive impact.

I'd propose displaying those categories in some other way, perhaps by making the bar in the chart a different color -- maybe green instead of blue.

Figure ES-17: 2018 Key Categories (MMT CO_2 Eq.)[a]



Response: Figure ES-17 has been updated to differentiate key categories from the LULUCF sector that have a net negative emissions. See p. ES-29 of the report.

Commenter: University of Michigan

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0017

Eric Kort, Alan Gorchov Negron

Comment 31: Re: The treatment of emissions from the offshore oil and gas sectors (pg. 3-76 to 3-77 and 3-93 to 3-94)

Regarding the update to activity data (platform counts): This represents a clear and major improvement over the prior inventory, and addresses both the previous gap in accounting for state water platforms and temporal trends.

Regarding the new method for calculating emission factors: We suggest further clarifying differences in both how emission factors are calculated (including the data sources used) and activity data that is used. Specifically noting (perhaps in a table form) this information for the different regions (Federal and State waters in Gulf of Mexico, offshore CA, offshore AK) as well as different categories (major/minor) would be very helpful.

Regarding upcoming relevant data: We have conducted a recent aerial survey of offshore oil and gas platform emissions, and have future surveys planned. In these studies emissions from offshore facilities are characterized and evaluation of different inventory estimates and methods will be provided. As this work appears in the peer-reviewed literature it will provide additional information to assess and improve reported offshore emissions.

Response: Additional information on the calculation of emission factors is included in the memo, *"*Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018: Updates for Offshore Production Emissions***."[36] *The upcoming availability of data relevant to offshore oil and gas emissions was noted in the Planned Improvements text for Petroleum and Natural Gas Systems. See pages 3-82 and 3-101 of the report.***

Commenter: Water Environment Federation

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0008

Patrick Dube

Comment 32: Re: References to sewage sludge

In agreement with the EPA's definition of biosolids, "Biosolids are treated sewage sludge",[37] WEF believes the term "treated" should be included when referencing sewage sludge throughout the document. For reference, this occurs on: Page 5-25, Line 29, Page 5-28, Table 5-18, Page 5-34, Line 4, Page 5-34, Line 22, Page 5-35, Line 16, Page 5-39, Line 24, Page 5-39, Line 26, Page 5-39, Footnote 20, Page 5-40, Line 41, Page 5-40, Line 44, Page 5-42, Line 1, Page 5-43, Table 5-20, Page 6-53, Line 15, Page 6-75, Line 22, Page 6-76, Line 25, Page 6-76, Line 28, Page 6-77, Table 6-40, and Page 6-124, Line 39.

Response: The text has been updated to reflect this clarification.

Other Comments

EPA received two additional anonymous technical public comment as part of the public review of the draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018. The comments can be found on the public docket and is copied below.

Commenter: Anonymous

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0007

Comment 33: Re: Detailed analysis for transportation sector emissions

In Section 2.2 (Emissions by Economic Sector) Table 2-13 and the preceding text provide detail on transportation-related emissions by various modes with electricity-related emissions distributed to the transportation sector. It would be useful to add the same type of detail for the analysis without distribution of electricity-related emissions (i.e., additionally provide the transportation-related detail that would sum to the transportation sector emissions in Table 2-10).

Response: A more detailed break-down of CO_2 emissions from fossil fuel combustion in the Transportation sector is provided by fuel type (including electricity) and transportation mode in Chapter 3 Table 3-13, with additional detail provided in Annex 3.

[36] https://www.epa.gov/sites/production/files/2020-04/documents/2020_ghgi_update_-_offshore_production_final.pdf

[37] https://www.epa.gov/biosolids/frequent-questions-about-biosolids

Commenter: Anonymous

EPA Docket ID No.: EPA-HQ-OAR-2019-0706-0011

Comment 34: Re: Estimated costs for Greenhouse Gas Sinks by cost/MMT reduced for the various types of measures available

There should be estimated costs for Greenhouse Gas Sinks by cost/MMT reduced for the various types of measures available, ranging from additional trees, to electric car conversion, to nuclear power or gas power plants replacing coal, so that prioritized measures to reduce greenhouse gases can be understood and implemented at the lowest marginal cost.

As the 2017 report noted, the decrease in total greenhouse gas emissions between 2016 and 2017 was driven in part by a decrease in CO_2 emissions from fossil fuel combustion. The decrease in CO_2 emissions from fossil fuel combustion was a result of multiple factors, including a continued shift from coal to natural gas and increased use of renewable energy ithe electric power sectors, and milder weather that contributed to less overall electricity use. This is shown in ES-4 Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2017.

It is important, especially where GHG emissions are growing annually, to begin to or accelerate abatement procedures, including replacement of industrial or chemical processes which produce for example Carbon Dioxide or high impact hydrocarbons, by prioritizng those cost measures which produce the most emissions impact reduction per dollar expended.

Moreover, the costs of reducing GHG should be at a minimum the cost of carbon offsets in any carbon offset trading market.

If the highest 75% of GHG abatement techniques cost $50 per ton, or $75 per ton, then that should be the cost of any carbon emissions.

The United States could reduce GHG emissions in 2030 by 3.0 to 4.5 gigatons of CO2e using tested approaches and high-potential emerging technologies. These reductions would involve pursuing a wide array of abatement options with marginal costs less than $50 per ton, with the average net cost to the economy being far lower if the nation can capture sizable gains from energy efficiency. Achieving these reductions at the lowest cost to the economy, however, will require strong, coordinated, economy-wide action that begins in the near future.

Response: The inventory is a policy-neutral, technical report providing information on current GHG emissions and sinks and trends prepared per reporting UNFCCC Annex 1 National GHG Reporting Guidelines (see Box ES-1) and as such, it is not well-suited as a document in which to outline mitigation opportunities and goals. For more information on assessing implications of mitigation measures please see EPA's technical report titled Global Non-CO_2 Greenhouse Gas Emission Projections & Mitigation Potential: 2015-2050 at this link: https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases. ***See also the latest global analysis by IPCC Working Group III report published here:*** https://www.ipcc.ch/report/ar5/wg3//***, noting the development of their Sixth Assessment Report including mitigation is ongoing and anticipated to be published in 2021.***