

Summary of Public Review Comments and Responses: Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021

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Responses to Comments Received during the Public Review Period on the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021

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Preface

EPA thanks all commenters for their interest and feedback on the annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks*. Per <u>Federal Register Notice 2023-01575</u> published on February 15, 2023, EPA announced document availability and request for comments on the draft "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021" report. The EPA requested recommendations for improving the overall quality of the inventory report to be finalized in April 2023 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 25, 2023, EPA received 13 sets of comments, including 25 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/EPA-HQ-OAR-2023-0001. EPA's responses to comments are provided immediately following each comment excerpt.

Commenter: National Association of Clean Water Agencies (NACWA)

EPA Docket ID No.: EPA-HQ-OAR-2023-0001-0012

Cynthia A. Finley, Ph.D. | Director, Regulatory Affairs

Comment 1: Planned Improvements for the Wastewater Treatment section. Similar comments as previous reports, recommend developing U.S. specific and/or treatment specific emission factors.

The National Association of Clean Water Agencies (NACWA) appreciates this opportunity to comment on the U.S. Environmental Protection Agency's (EPA) draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 (Inventory), and specifically Section 7.2, Wastewater Treatment and Discharge (CRF Source Category 5D), as part of the public review process. NACWA represents the interests of 350 publicly owned wastewater treatment agencies nationwide, serving the majority of the sewered population in the US. NACWA members want to ensure that greenhouse gas (GHG) emissions from wastewater treatment facilities are characterized correctly in the Inventory, since the Inventory is a frequently cited reference for GHG information. 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. NACWA agrees with the Planned Improvements described in the Inventory, many of which the Association has recommended in past comments. NACWA's comments below provide further explanation for why these improvements should be made.

To reflect US GHG emissions from POTWs more accurately, NACWA recommends that development of US- and treatment-specific methodologies and emission factors be prioritized, particularly for nitrous oxide. EPA uses guidelines published by the Intergovernmental Panel on Climate Change (IPCC) in 2019 to calculate emissions for the Inventory. Previous IPCC guidance used different emissions factors depending on whether plants use nitrification/denitrification (N/DN) processes, with lower emissions resulting from plants without N/DN. These previous guidelines more accurately characterized the emissions of nitrous oxide from POTWs. If the IPCC calculations for nitrous oxide are not updated, EPA should use US-specific factors to account for the presence or absence of N/DN processes at different treatment plants. Actual nitrous oxide emissions are process-specific, with factors such as consistency of dissolved oxygen levels, system upsets, and supplemental carbon addition sources potentially playing a large role in the quantity of nitrous oxide formed. Further refinements are needed with respect to treatment process type to reflect actual conditions.

NACWA also recommends that EPA focus on where wastewater discharges occur in the aquatic environment and how this affects GHG emissions. The current emissions factors apply to "estuaries," but further details describe "slow moving" aquatic systems. A large portion of wastewater discharges go to aquatic systems that are not "slow moving," since discharge points for POTWs are usually selected to meet water quality objectives and to target dilution and movement of the receiving water – conditions that are not conducive for producing GHG emissions. A better understanding of how emissions depend on the discharge points would produce more accurate emissions estimates.

The continued success of water conservation efforts in many parts of the US means that the standard 100 gallons/capita/day wastewater generation factor should be updated in the Inventory as soon as possible.

Thank you for your consideration of these comments. Please contact me at 202-533-1836 or cfinley@nacwa.org if you have any questions.

Response: As stated by the commenter, there are many factors affecting nitrous oxide emissions from wastewater treatment systems such as the temperature and dissolved oxygen concentration of the wastewater, and the specific operational conditions. EPA agrees that development of more specific emission factors based on type of system would be an improvement and will continue to evaluate available data. EPA is unlikely to develop emission factors that vary based on specific operating parameters at the more than 16,000 centralized treatment plants in the U.S. as we lack activity data to appropriately apply such factors. See also response to comment 56 on pp. 20-21 in https://www.epa.gov/system/files/documents/2021-07/us-ghg-inventory-1990-2019-expert-review-comment-log.pdf and response to comment 35 on page 33 in previous response https://www.epa.gov/system/files/documents/2021-07/us-ghg-inventory-1990-2019-expert-review-comment-log.pdf and response to comment 35 on page 33 in previous response https://www.epa.gov/system/files/documents/2022-06/us-ghg-inventory-1990-2020-public-review-comment-log.pdf

EPA notes the request to consider emissions associated with discharge to the aquatic environment. For nitrous oxide emissions, the IPCC Tier 3 emission factor is applied to discharges to waterbodies that are impacted for nutrients. The IPCC Tier 1 emission factor is applied to all other wastewater discharges. For methane emissions, the two IPCC Tier 2 emission factors are used for discharges to reservoirs, lakes, and estuaries (0.114 kg CH4/kg BOD) and all other discharges (0.021 kg CH4/kg BOD). EPA acknowledges that the approach used to determine the approximate percent of waterbodies that are reservoirs, lakes, or estuaries was a high-level investigation and based on limited data and data sources. If the commenter is aware of a source that provides a quantitative estimation of POTW wastewater effluent discharged to the various waterbody types to provide context to a "large portion of wastewater" discharged to "not slow moving" aquatic system, EPA encourages the commenter and all other stakeholders to provide that source to further improve methane emissions estimates. See also response to comment #57 on p. 21 in response to previous comments: https://www.epa.gov/system/files/documents/2021-07/us-ghg-inventory-1990-2019-expert-reviewcomment-log.pdf and response to comment 35 on page 33-34 in previous response https://www.epa.gov/system/files/documents/2022-06/us-ghg-inventory-1990-2020-public-reviewcomment-log.pdf

Commenter: American Petroleum Institute (API)

EPA Docket ID No.: EPA -HQ-OAR-2023-0001-0010

Jose Godoy, Jennifer Stewart

Comment 2: Support for use of GHGRP data, but request to clarify upfront the separate impacts on the estimated GHG emissions due to changing the GWP vs updating the calculation methodology.

The American Petroleum Institute (API) appreciates the opportunity to review and provide comments on the Public Review Draft of the U.S. EPA 2023 Greenhouse Gas Inventory (GHGI).

API represents all segments of America's oil and natural gas industry. API was formed in 1919 as a standards-setting organization. In our first 100 years, API has developed more than 700 standards to enhance operational and environmental safety, efficiency, and sustainability. Our members produce,

process, and distribute most of the nation's energy. Most of our members will be directly impacted by how GHG emissions from their operations are presented in the national GHGI.

API supports timely and accurate reporting and transparency by the oil and natural gas industry – and all other emitting sectors of GHG emissions – through the EPA GHG Inventory (GHGI). API seeks to ensure that GHGI emission estimates used are based on the best and most current data available, reflect actual industry practices and activities, and are technically correct. To assist EPA, API has consistently participated in EPA's stakeholders' process and expert review phases of the GHGI development process, providing comments and recommendations on the agency's proposed methodologies. API appreciates continued opportunities to engage with EPA.

API's comments below are designed to provide feedback on the changes presented in the public review draft and on information EPA is seeking from industry along with additional input to inform the proposed updated methodologies. API's comments consist of several overarching concerns and are limited by the short time period provided for the review of updates under consideration for the 2023 public review draft.

Overarching Comments

• The current Inventory updates the global warming potentials (GWPs) for calculating CO2equivalent emission estimates of non-CO2 gases (CH4, N2O, HFCs, PFCs, SF6, and NF3) to reflect updated science in accordance with new reporting requirements that will be implemented in national reporting by countries by the end of 2024.

API agrees with the revisions to the GWPs included in various sections of the Draft 2023 GHGI report. Nonetheless, API requests EPA clarify upfront (in the Executive Summary and in the introduction to the various chapters) the separate impacts on the estimated GHG emissions due to, respectively, i) changing the GWP vs. ii) updating the calculation methodology. By additionally addressing the separate impacts in each of the Recalculation sections, EPA will better inform GHGI stakeholders. The detailed discussion of the decoupled impacts of the revised GWPs from any other updated methodology will ensure that the GHGI properly reflects the causes for the changes in the recalculated emissions.

• EPA posted a technical memorandum in October 2022 to start the stakeholder's discussion of geographically disaggregating the GHG emissions estimates. EPA states that it did not receive any comments from stakeholders, however API did provide written comments in its correspondence of January 3, 2023 (See Appendix A).

EPA issued a second memorandum in conjunction with the public review draft of the 2023 GHGI, discussing updates under consideration for the 2023 GHGI emission estimates for certain emissions sources in the Production segments of the Petroleum and Natural Gas Systems. It addresses the quantification of emissions at the basin level and aggregating those estimates to the national level.

EPA originally addressed these updates under consideration in the November 2022 stakeholders' webinar, but the memo was not posted for independent review during the expert review phase. As a result, API did not have sufficient time to review the updated methodologies described in the memo since it was issued in conjunction with the Draft GHGI. API seeks

clarifications on whether the recalculations are still "updates under consideration" rather than revised estimates.

3.6 Petroleum Systems

API supports the continued use of the Greenhouse Gas Reporting Program (GHGRP) submitted data to revise emission and activity factors associated with petroleum systems. EPA has used additional basinlevel data from Subpart W of the GHGRP to calculate basin specific emission factors and activity factors for several emission sources in the onshore production segment. The updated methodology pertains to pneumatic controllers, equipment leaks, chemical injection pumps, and storage tanks.

If allowed more time for stakeholder review, API may be able to support using disaggregated emission estimation when the available basin-specific data represents over 50% coverage for such calculations and recommends that further discussion of this topic should be part of the forthcoming stakeholders' process for the 2024 GHGI.

API agrees with EPA's assertion that in cases with limited data in certain areas, disaggregated approaches might substantially increase the uncertainty of estimates and basin-specific calculations and would not be an improvement over use of a national average.

As indicated above, API is requesting that in the final GHGI EPA clarify the separate impact of the contribution of these changes to the recalculated emissions as compared to the impact of the revised GWPs used for presenting data in terms of CO2-equivalent.

3.7 Natural Gas Systems

API supports the continued use of GHGRP submitted data to revise emission and activity factors associated with natural gas systems. EPA has implemented updates that incorporate additional basin level data from GHGRP Subpart W for several emission sources in the onshore natural gas production segment, including for pneumatic controllers, equipment leaks, chemical injection pumps, storage tanks, and liquids unloading. For each of these emission sources, EPA modified the calculation methodology to use GHGRP data to develop basin-specific activity factors and/or emission factors.

API has previously provided comments to EPA supporting the use of basin specific factors for liquids unloading with emphasis on developing basin specific factors when the GHGRP data provides coverage of at least 50% of the production. The use of disaggregated data for the sources listed above does not seem to have a significant impact on the overall GHG emissions estimate.

As indicated above, API is requesting that in the final GHGI EPA clarify the separate impact of the contribution of these changes to the recalculated emissions as compared to the impact of the revised GWP used for presenting data in terms of CO2-equivalent.

3.8 Abandoned Oil and Gas Wells

In our comment letter dated March 17, 2022,1 API stated the count of abandoned wells developed by EPA is an overestimate and that EPA should review and incorporate data provided by the Interstate Oil and Gas Compact Commission (IOGCC) in 2021 to establish a more accurate count of idle and orphan wells in the US.2 API also continues to recommend that this IOGCC resource can help to inform EPA on the regulatory structures in place to ensure proper plugging and maintenance of idle and orphan wells.

EPA updated the Inventory methodology to estimate abandoned well emissions at the state level as an intermediate step to calculating national emissions. EPA states that in the current Inventory (2023), EPA used abandoned well counts and plugged and unplugged fractions at the state level to estimate GHG emissions; however, EPA continues to reference their state level annual counts of abandoned wells for 1990 through 2020, which are derived by summing together an annual estimate of abandoned wells in the Enverus data set (Enverus 2021), and includes an estimate of total abandoned wells not shown in the Enverus dataset. As such, it is unclear how consistent the estimation methodology for emissions from abandoned oil and gas wells EPA is as applied to the 2023 current Inventory.

API notes that the designation of "Dry Wells" in the Enverus database indicates a production type rather than a status type. Hence, EPA's approach of considering all wells with no cumulative production as abandoned wells is likely leading to double counting of dry wells in the abandoned well category since they are embedded in the well status counts. Furthermore, EPA's assumption that dry wells are unplugged is neither consistent with the Enverus data nor state plugging requirements, in fact, even EPA's current Enverus data shows that 93% of dry wells are plugged.3

EPA states that the emission factors from the previous Inventory were retained and used to estimate state-level emissions, with Appalachia-specific factors applied to states in Appalachia. API continues to recommend the use of the "western US" emission factor from the Townsend-Small et al. (2016) study4 for areas outside the Appalachian region, rather than the national average which would include the Appalachian region in the development of the emission factor.

Conclusion

Due to the simultaneous release of the methodology update memo and the public review draft of the 2023 GHGI, API needs more time to provide detailed comments on the updates under consideration. As stated above, API may be able to support using basin specific factors for sources for which the GHGRP data used represents basins with over 50% coverage, while combining data for all basins below this threshold to estimate emissions. The stakeholders' feedback requested by EPA would be good topics for continued discussion towards the next (2024) GHGI.

API welcomes EPA's willingness to work with industry to improve the data used for the national inventory. API encourages EPA to continue these collaborative discussions including making progress in addressing CCS and updating methodology based on industry data collected by the GHGRP.

As indicated before, API is available to work with EPA to make best use of the information available under the GHGRP, or other appropriate sources of information/data, to improve the national greenhouse gas emission inventory. We look forward to earning about the next steps regarding incorporating revisions to the GHGRP.

Response: EPA added text to the natural gas and petroleum systems chapter noting the comment received (see pages 3-90 and 3-110). EPA anticipates continued discussions on updates to the Inventory in the 2024 GHGI stakeholder process.

Impacts from the updating GWPs from AR4 to AR5 for recalculating CO₂ equivalent emissions are discussed in the in the following sections of the final Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021: executive summary (p. ES-7), introductions to the sectoral chapters and in <u>Chapter 9</u>, <u>Recalculations and Improvements</u> (provides quantitative impacts from recalculations due to

methodological updates including and excluding the impact of GWP updates, see Tables 9-1 through 9-4).

Comment 3: API seeks clarifications on whether the recalculations are still "updates under consideration" rather than revised estimates.

EPA posted a technical memorandum in October 2022 to start the stakeholder's discussion of geographically disaggregating the GHG emissions estimates. EPA states that it did not receive any comments from stakeholders, however API did provide written comments in its correspondence of January 3, 2023 (See Appendix A).

EPA issued a second memorandum in conjunction with the public review draft of the 2023 GHGI, discussing updates under consideration for the 2023 GHGI emission estimates for certain emissions sources in the Production segments of the Petroleum and Natural Gas Systems. It addresses the quantification of emissions at the basin level and aggregating those estimates to the national level.

EPA originally addressed these updates under consideration in the November 2022 stakeholders' webinar, but the memo was not posted for independent review during the expert review phase. As a result, API did not have sufficient time to review the updated methodologies described in the memo since it was issued in conjunction with the Draft GHGI. API seeks clarifications on whether the recalculations are still "updates under consideration" rather than revised estimates.

Response: At the time of the public review draft, the updates were still not final and were therefore "updates under consideration." With the publication of the 2023 GHG Inventory, the revisions are revised estimates. An updated memo documents the revised approach. See <u>https://www.epa.gov/system/files/documents/2023-</u>04/2023_ghgi_update_disaggregated_production_data.pdf.

Comment 4: Using basin-level geographically disaggregated data from the GHG reporting program can improve the relative accuracy of estimated emissions when applied appropriately

The American Petroleum Institute (API) appreciates the opportunity to review and provide comments on the proposed update the U.S. EPA is considering for using additional geographically disaggregated data to estimate greenhouse gas (GHG) emissions for the 2023 GHG Inventory (GHGI).

API represents all segments of America's natural gas and oil industry. API was formed in 1919 as a standards-setting organization. In our first 100 years, API has developed more than 700 standards to enhance operational and environmental safety, efficiency, and sustainability. Our approximately 600 members produce, process, and distribute most of the nation's energy. Most of our members will be directly impacted by the way emissions from their operations are depicted in the national GHGI.

API's aim is to make sure that the GHGI emission estimates used are based on the best and most current data available, reflect actual industry practices and activities, and are technically correct. To assist EPA in the endeavor API has participated in EPA's stakeholders' process and expert review phases of the GHGI development process, providing comments and recommendations on the agency's proposed

methodologies. API appreciates the continued engagement with EPA through the multi-stakeholder process.

API's comments below are designed to provide feedback on the information the Agency is seeking from industry regarding the use of additional geographically disaggregated data to improve the accuracy of emission estimates for certain portions of the oil and natural gas production value chain.

Using basin-level geographically disaggregated data from the GHG reporting program can improve the relative accuracy of estimated emissions when applied appropriately. As noted in the October 2022 memo, use of national-level average emission and activity factors may not properly reflect differences in operations, gas compositions, or other characteristics that may contribute to distinctly different emission profiles from different producing regions. API generally supports the use of facility reported emission data collected by EPA under 40 CFR part 98 (the GHG Reporting Program, "GHGRP") to inform EPA's emission and activity factor estimates for petroleum and natural gas systems. GHGRP data represents the most reliable and consistent set of GHG emission estimates for petroleum and natural gas systems used to generate the national inventory. Further, the accuracy of emissions estimates reported to EPA under the GHGRP should continue to improve with the inclusion of important updates and revisions in the upcoming years. EPA should not consider the use of other State oriented data sources to develop state profiles. EPA may continue to use GHGRP data, as able, to inform the State Inventory, but should avoid any incentive for states to create additional reporting programs that may differ from the EPA program.

Because production facilities that report under the GHGRP are already geographically defined by sub basin, this data can provide insight into regional emission profiles that may emerge based on operational or production characteristics that are common to producers in a specific region. As noted by EPA, when significant variations are found relating to the activity or emission profiles of a specific region relative to another, application of a national-level average may not be the most accurate approach. Using data that can be disaggregated by region to increase the granularity of GHG emission and activity factors that are considered in the development of EPA's national GHG emission estimates can improve the relative accuracy of the GHG emission estimate for a given source.

Response: EPA has applied basin-level data to quantify emissions for several sources in onshore production. See more details in the Recalculations Discussions for Petroleum Systems starting on pg. 3-83 and for Natural Gas Systems pg. 3-101 available at

https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Chapter-3-Energy.pdf.

Comment 5: API supports the continued use of geographically disaggregated data to estimate GHG emissions from associated gas venting and flaring and miscellaneous onshore production flaring.

As noted in API's 2018 comments on the Public Review draft of the 1990-2016 Greenhouse Gas Inventory, API provided EPA with a basin-level analysis of 2015 GHGRP data for associated gas venting and flaring and miscellaneous flare stack data under both a well count and a production volume basis. At that time, API recommended that EPA develop emission estimates for both sources based on production volume and basin. As indicated in the October 2022 memo, EPA has since adopted such an approach, improving the relative accuracy of emission estimates from those two sources. API supports the continued use of this approach for these two emission sources. Response: EPA has continued the use of geographically disaggregated data for associated gas venting and flaring and miscellaneous onshore production flaring.

Comment 6: API previously recommended the use of basin-level data for liquids unloading and would likely support the use of geographically disaggregated data to improve the accuracy of emission estimates from this source.

In addition to recommending that EPA develop emission estimates for associated gas venting and flaring and miscellaneous flaring at the basin level on a production volume basis in 2017, API also recommended that EPA develop emission estimates for liquids unloading at the basin-level on a wellcount basis. API's March 2018 comments on the Public Review draft of the 1990-2016 Greenhouse Gas Inventory included summary information regarding API's analysis of the 2015 GHGRP data for liquids unloading. In this memo, API recommended that EPA extrapolate emissions from liquids unloading at the basin level for those basins with the most significant contribution to emissions. API further recommended that these emission estimates should be performed on a well count basis, as emissions from liquids unloading are related to the number of liquids unloading events and were not directly or inversely related to the gas production rate. API further recommended that the emission estimates should be evaluated annually. Barring significant changes in reported GHG emission data since 2015, API would likely continue to support the incorporation of such an approach at this time. Similar to other sources indicated above, API would prefer to have the opportunity to review more recent data and EPA's assessment before such an approach is incorporated into the Inventory.

API welcomes EPA's willingness to work with industry to improve the data used for the national inventory. API encourages EPA to continue these collaborative discussions. API is available to work with EPA to make best use of the information available under the GHGRP, or other appropriate sources of information/data, to improve the national greenhouse gas emission inventory. To that end we await hearing the agency's next steps for incorporating such revisions.

Response: In this year's Inventory, EPA has incorporated basin-level data for liquids unloading. See Recalculations Discussion for Natural Gas Systems starting on page 3-101 of Chapter 3 (Energy) available at <u>https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-</u> <u>Chapter-3-Energy.pdf</u>.

Commenter: National Wildlife Federation (NWF)

EPA Docket ID No.: EPA- HQ-OAR-2023-0001-0009

Comment 7: NWF appreciate the inclusion of harvested wood products but suggest providing further information on the relative contributions by product category or type to C/CO2 fluxes and storage in HWP in Tables A-191 through A-198. More disaggregated information on HWP; Reflect more policy relevant information on fluxes, stocks and drivers

The National Wildlife Federation appreciates the opportunity to comment on the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. We thank the authors for their work on this important document.

Our comments pertain to Chapter 6 (Forest Land Remaining Forest Land) and to Annex 3 (Section 3.13) and the opportunities for subsequent inventory reports in those sections. We appreciate the continued

inclusion and reporting of a suite of harvested wood products (HWP) accounting approaches outlined in the 2006 IPCC Guidelines. This is useful to understand the implications of international trade of HWP, as not all countries rely on the commonly used production approach.

In future reports, we believe that it would be helpful to provide further information on the relative contributions by product category or type to C/CO2 fluxes and storage in HWP in Tables A-191 through A-198.

Through advancements in USDA Forest Service's Research & Development arm as well as in technology for carbon measurement and monitoring, data continue to become available. Including such information in the Inventory could help policymakers to better understand the net impacts of policies and investments in forest restoration and climate-informed management, forest preservation, and wood product use and substitution.

Overall, we encourage EPA to continue to strive to provide policy-relevant information throughout the inventory pertaining to the Land Use, Land-Use Change, and Forestry Sector on ecosystem fluxes and stocks and their drivers, to support evidence-informed climate mitigation and forest stewardship. As interest in these strategies as climate mitigation options continues to grow and as other Parties to the UNFCCC look to the U.S. for leadership, it is essential that policymakers can understand their net impacts on carbon sequestration and storage, both in Forest Land Remaining Forest Land and in HWP, both domestically and internationally.

Thank you for your consideration.

Response: Please see Annex 3.13 which shows a comparison of different IPCC approaches for the calculation of net annual change associated with HWP. Tables in Annex 3.13 also currently show the relative breakdown of different categories of HWPs from products in use and those in solid waste disposal sites. EPA can explore, in collaboration with USFS, and dependent upon available data, opportunities to provide additional information on the relative contributions by product category or type.

Commenter: Earth Engineering Center, Columbia University in the City of New York

EPA Docket ID No.: EPA-HQ-OAR-2023-0001-0004

Prof. Nickolas J. Themelis

Comment 8: underestimate of landfill methane emissions based on top-down data.

Another reason for underestimate of landfill methane emissions in Draft of GHG Inventory (please read my earlier comment) is that in Table 7-4 the amount of CH4 captured in LMOP landfills is stated to be 7.195 million metric tons of methane. On the basis of the EPA-LMOP spreadsheet of the 396 LMOP landfills with biogas capturing projects, and assuming 365-day and 24-hour operation of the daily data provided in EPA spreadsheet (Attachment 1), the total CH4 capture is 4.636 million metric tons of methane. This difference of 2.559 million metric tons also explains the discrepancy between the EPA estimate of lsndfill methane emissions to atmosphere and the detailed Columbia study (Attachment 2).

Response: EPA will review the study in depth but it appears the commenter has missed the additional destruction of methane that occurs at landfills without an energy project (thru flaring only).

Commenter: Mass Comment Campaign sponsored by Dogwood Alliance. (web)

EPA Docket ID No.: EPA-HQ- OAR-2023-0001-0005

Sam Davis, Ph.D.

Comment 9: EPA should account for and report on forest emissions associated with industrial logging and forest clearing.

The undersigned organizations and scientists appreciate all that the EPA does to ensure sound and robust carbon accounting and reporting within the US Annual Greenhouse Gas Emission Inventory. We appreciate the opportunity to comment on improvements necessary to ensure accurate reporting of information vital to understanding the U.S. carbon footprint. The greenhouse gas inventory is a vital document policy makers rely on in developing sound climate policy.

We are writing to urge you to transparently account for and report on forest emissions associated with industrial logging. Forests are vital to our ability to solve the climate crisis. We must have more detailed analysis of the drivers of forest emissions in order to develop sound strategies related to emissions reductions.

Emissions From Logging

We believe that while it is good that EPA is now counting emissions from forest fires separately, the agency should also separate out emissions from logging, as logging represents a larger share of forest carbon loss/emissions. The work on these calculations is well established in the scientific literature and should be incorporated into this or into future Greenhouse Gas Inventories. The two papers below are specific examples of how the EPA may incorporate a more holistic understanding of the impacts of logging on carbon flux in forests.

• Harris NL, Hagen SC, Saatchi SS, Pearson TRH, Woodall CW, Domke GM, et al. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance Manag. 2016;11: 24.

• Curtis PG, Slay CM, Harris NL, Tyukavina A, Hansen MC. Classifying drivers of global forest loss. Science. 2018;361: 1108–1111.

Logging, which includes logging for wood pellets, is the primary cause of carbon loss, tree cover loss, and forested wetland loss in the US. In the South, forest carbon losses are overwhelmingly due to the impacts of increased extraction from Southern forests. The Harris et al. (2016) paper found that a full 85% of carbon emissions from US forests was attributed to silvicultural activities like clearcutting, more than fire, insect, drought, and wind damage combined. The Curtis et al. (2018) study found that around half of tree cover loss in North America was driven by forestry activities, and that particular type of tree cover loss was predominant in the United States, not Canada.

Disaggregating natural and anthropogenic causes of carbon fluxes in forestland –such as logging – as per the Harris et.al report referenced above was recommended by the US Forest Service in The U.S. Forest

Carbon Accounting Framework: Stocks and Stock Change, 1990-2016 at p 41. In this report, the US Forest Service states:

"The framework and accompanying results from this research represent a step towards enabling the disaggregation of natural and anthropogenic causes of carbon fluxes in forest land of the United States. The results also allow U.S. policy makers and negotiators to better understand the drivers of forest carbon fluxes more completely so that they can participate more effectively in domestic policy discussions about forest management and monitoring as well as in the upcoming international negotiations. For example, the team found that timber harvesting, and not land use change or fire, was the largest source of gross emissions from U.S. forests between 2006 and 2010." [emphasis added]

Our Proposed Solution

The ideal Greenhouse Gas Inventory would include the sector of Forestry alongside other sectors like Agriculture and Waste Management. This sector's analysis would include:

• The amount of CO2e emitted from forest clearing, displayed in the Forest Land Remaining Forest Land category.

• The amount of CO2e stored in each wood product type (e.g., lumber, paper, pellets) alongside expected time to complete emission into the atmosphere (1-5 years, 5-10 years, 50+ years, etc).

Transparently accounting for forest emissions associated with logging is essential to meeting climate goals. Understanding the major drivers of forest carbon losses/emissions is necessary to inform policy decisions related to forest emission reductions that are based on current, verifiable and accurate data.

If you have any questions, please don't hesitate to reach out.

Response: Data and information on emissions associated with logging and forest clearing are currently accounted for in the estimates of forest land net carbon stock change, found in Chapter 6 and Annex 3.13. These chapters and annexes within the report are available at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021. EPA acknowledges that these drivers are important but a breakdown of these drivers and their influence on all carbon stock changes is beyond the scope of the national GHG Inventory. We will explore opportunities to link to other studies, databases, etc. that focus on this type of analysis given the relevance of the information.

Commenter: Save The Colorado, Patagonia, Stoecker Ecological, and Independent Consultant

EPA Docket ID No.: EPA-HQ- OAR-2023-0001-0008

Gary Wockner, Hans Cole, Matt Stoecker, and Mark Easter

Comment 10: concerned that EPA's current methodology significantly understates these emissions. Include in GHGRP, use peer-reviewed literature surface emission rates, adjust for trophic status/class, inclusion of unaccounted for decommissioned dams To Whom It May Concern,

Thank you for the opportunity to comment on the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. 88 Fed. Reg. 9881 (Feb. 15, 2023). We respectfully request that you consider the comments below on the inventory approach for "Draft Chapter 6: Land Use, Land Use Change, and Forestry", land use category of "Flooded Land Remaining Flooded Land" beginning on page 6-120.

Save the Colorado is a grassroots, non-profit 501(c)(3) environmental organization dedicated to the protection and restoration of the Colorado River and its tributaries. Save the Colorado has approximately 25,000 members, supporters, and followers throughout the Colorado River Basin who live, work, and recreate on the Colorado River and other rivers that are impacted by dams and reservoirs. Save the Colorado's mission is to promote the conservation of the Colorado River and its tributaries through science, public education, advocacy, and litigation.

Founded by Yvon Chouinard in 1973, Patagonia is an outdoor apparel company based in Ventura, California. As a Certified B Corporation, the company is in business to save our home planet. Patagonia's grant making, advocacy, communications, and activism have long prioritized the health of America's freshwater ecosystems. Patagonia has advocated for the removal of dams to support the protection of wild, native fish populations and the communities that depend on them. This has included more than \$4 million in grants to nonprofit groups since 2000, as well as numerous films and campaigns, including three award-winning documentaries: DamNation, Blue Heart, and Artifishal.

Save the Colorado, Patagonia, Stoecker Ecological, and Mark Easter are concerned that policymakers, regulators, and other stakeholders frequently overlook the greenhouse gas (GHG) emissions from dams and reservoirs, and they often mistakenly assume that hydropower facilities generate clean, carbon-free electricity. The U.S. Environmental Protection Agency's (EPA) decision last year to begin including reservoir emissions in the GHG Inventory is an important first step in measuring and reporting these emissions. Relatedly, Save the Colorado, Patagonia, Stoecker Ecological, and over 140 other organizations submitted a rulemaking petition to EPA last year that requests the agency add dams and reservoirs to the GHG Reporting Program.1 The facility-specific reporting requirements of the GHG Reporting Program complement the broader scope of the GHG Inventory, and adding dams and reservoirs to the GHG Reporting Program will provide useful information on the scope of individual facilities' GHG emissions.

While we strongly support EPA reporting GHG emissions from reservoirs in the GHG Inventory, we are concerned that EPA's current methodology significantly understates these emissions. Accordingly, we recommend EPA improve the reporting methodology in several ways, which are detailed below.

Reservoir Surface Emissions

Recent peer-reviewed literature reports estimated and measured surface emissions from reservoirs to be 1.5x to 49.7x higher than the emission factors the IPCC guidelines used. The emission factors implemented in this inventory are among the lowest reported emissions factors for reservoir surfaces in the scientific literature (Deemer et al. 2016, Rosentreter et al. 2021).

It does not appear that the trophic status adjustment (α i in the IPCC guidelines, equations 7.10 and 7.11) was utilized in the inventory process, which used the Tier 1 calculation adjustment factor of 1.0. In

contrast, the IPCC guidelines recommended adjustment factor (Table 7.11) is as high as 25, with an upper range of 39. There is no reference to trophic status or use of the factor in the inventory calculations. Ample survey information is available from EPA's National Lakes Assessments and other sources to estimate the proportion of water bodies in different trophic states, by climate region, which likely would result in a much higher emissions estimate (USEPA 2009, 2016, 2022). The U.S. National Lakes Assessment has shown that the proportion of reservoirs classed as eutrophic or hypereutrophic has climbed steadily over the assessment period (50% in 2007, 54% in 2012, 69% in 2017). Considering the seriousness of this trend and the importance it has for the climate, and the significant influence trophic status has on the variability of model simulations, trophic status should be accounted for in the inventory.

Based on the proportion of reservoirs described as oligotrophic, mesotrophic, eutrophic, and hypereutrophic in 2017, and utilizing the trophic class adjustment factor to weight emissions by trophic class, the total inventory surface emissions estimate based on the IPCC good practice guidance would be approximately 2.9x higher than the estimate included in the 2022 inventory. Though such a correction would produce an estimate for surface emissions closer to reports in some scientific literature, it would still likely be lower than other more recent scientific literature as well as an estimate based on recent global inventories.

Reservoir Surface Emissions Uncertainty

The reported uncertainty for reservoir surface and downstream emissions are the smallest of any national-scale inventory source category in the "Land Use, Land Use Change, and Forestry" (LULUCF) sector, and are an order of magnitude lower than the variation reported in multiple other studies of global emissions from reservoirs. Emissions from reservoir systems are extremely variable (Rosentreter et al. 2021, Deemer et al. 2016). The uncertainty estimate provided in the inventory does not account for site-level variation or site-by-year variation inherent in how weather and watershed-scale weather influence the trophic status of reservoirs.

The trophic status adjustment factor recommended for use in the IPCC guidance, but which was not used in this inventory, accounts for some of that variation. It provides a range of adjustment factors by trophic status. If the trophic status adjustment factor were incorporated into the inventory, as the IPCC guidance recommends as good practice, the range of values incorporated into the Monte Carlo simulation method would lead the distribution of the Monte Carlo simulations to a mean and variance estimate more representative of other models simulating microbially-mediated processes.

Water Body Downstream Emissions

This inventory estimates downstream emissions based on an emission factor (Rd) of 9% multiplied by surface emissions. The use of a uniform factor for all reservoirs contrasts with the IPCC guidance language, which specifically notes that waters drawn from below the hypolimnion (which is common in hydropower reservoirs and some other types of dams) have methane concentrations much higher than near the surface. For example, Delwiche et al. (2022) suggest a minimum downstream methane emission rate of 80% of surface emissions from dams that release water from depths well below the water's surface, rather than from a spillway near the reservoir surface. Estimates of downstream

emissions should be stratified by dam by deep (sub-hypolimnion) and shallow (super-hypolimnion) releases, to account more accurately for downstream emissions.

Unaccounted for Land Use Change Categories

The inventory notes that a small number of new reservoirs are added to the inventory of dams in the United States each year, documenting these reservoirs under the category of "Land Converted to Wetlands". However, an approximately equal number of dams are being decommissioned each year as are being constructed. For example, consider dams in the Klamath River watershed in Northern California, and multiple watersheds draining into the Gulf of Maine scheduled for demolition in the next several years. Additionally, the U.S. Bureau of Reclamation is currently evaluating methods to decommission and/or modify the hydropower facility at Glen Canyon Dam on the Colorado River.

Pacca (2007) simulated significant trace gas emissions from stored lake sediments in the years immediately following dam decommissioning. Additionally, the decommissioning of large dams in major watersheds, and the possibility of significant biogenic and anthropogenic emissions from those activities, calls for accounting for emissions from land use change in the source categories of Flooded Land Converted to Forestland, and Flooded Land Converted to Grassland. Further, not only will decommissioning cause emissions to occur, the restoration of flooded lands to vegetated lands will cause a consequential amount of sequestration to occur due to that revegetation and reforestation.

Other comments

• Considering recent, alarming evidence that short-lived climate pollutants (including methane, nonmethane tropospheric ozone precursors, chlorofluorocarbons, and other ozone-depleting substances covered in the Montreal Protocol) appear to amplify biogenic methane feedback loops, the role of these gases in the U.S. national inventory must be accounted for in ways other than the standard 100 yr global warming potential. Additional metrics must begin to be reported alongside those embodied in the UNFCCC reporting guidelines, in order to provide greater context and more accurate accounting of the climate risks that short-lived climate pollutants incur on the ecosystems that must remain healthy and functioning for human civilization to thrive (Dreyfus et al. 2022). • The change from last year's inventory to this year's method of sourcing reservoir attributes and activity data from the National Wetlands Inventory is well-supported by the literature and appears to be a positive move to improve the accuracy of the inventory.

• EPA's continued effort to develop a country-specific inventory method for surface emissions is warranted and also appears to be a positive move to improve the accuracy of the inventory. Until such a method is available, however, EPA should pivot to approaches that utilize more realistic emissions rates, which do not undercount emissions, and which account for variation introduced by reservoir tropic state.

• Greenhouse Gas Emissions from dam and reservoir systems involve some of the most complex interconnected mixes of emissions sectors over the period of a century or more, including Energy (fuel use and electricity), Industrial Processes (cement and construction equipment manufacturing), Land Use and Forestry, and Agriculture. The emissions begin with construction of dam and reservoir/energy (if

applicable) infrastructure, and then continue with biogenic emissions sources from the disturbed ecosystem, ending with a combination of emissions from dam deconstruction including a pulse of biogenic emissions as reservoir sediments erode and the previously inundated ecosystem stabilizes into a new forest or grassland ecosystem. The only other interconnected system of emissions from land use that appears to involve so many emissions classes is in the Agriculture sector. The inventory language in the Agriculture sector acknowledges this complex web of interacting emissions in the beginning section, stating the following on page 5-1:

"Additional CO2, CH4 and N2O fluxes from 7 agriculture-related land-use and land-use conversion activities, such as cultivation of cropland, management on 8 grasslands, grassland fires, aquaculture, and conversion of forest land to cropland, are presented in the Land Use, 9 Land-Use Change, and Forestry (LULUCF) chapter. Carbon dioxide emissions from stationary and mobile on-farm 10 energy use and CH4 and N2O emissions from stationary on-farm energy use are reported in the Energy chapter 11 under the Industrial sector emissions. Methane and N2O emissions from mobile on-farm energy use are reported 12 in the Energy chapter under mobile fossil fuel combustion emissions."

Similar language exists in the inventory sections describing interconnections between forest management activities and biogenic emissions from forest systems. The inventory language for "Land Converted to Wetlands" and "Wetlands Remaining as Wetlands" describe in detail the biogenic emissions from dam and reservoir systems once the infrastructure has been manufactured, but does not identify where readers may find related, interconnected emissions sources. Per the convention established for other emissions source categories described above, the inventory document should identify these related emissions sources from dam construction, operations, and decommissioning, and direct the reader to the corresponding sections where they are quantified. These include:

o Cement manufacturing (Industrial Processes)

o Energy used in construction, dam and reservoir operations, and dam decommissioning (Energy)

o Emissions from manufacturing construction, infrastructure, and decommissioning equipment (Industrial Processes and Energy)

o Biogenic CO2, CH4, and N2O from downstream wetlands and riparian forests impacted by disturbed hydrographs (Land Use Change)

• Finally, we bring to your attention that we are developing a modeling tool, "All-Res"2 which estimates the total carbon footprint over the lifecycle of a dam and reservoir system. This tool brings together all of the source categories attributable to a dam and reservoir system (noted above) and intends to better inform the public, media, and decision-makers about the lifecycle carbon footprint of dams and reservoirs. Further, "All-Res" will also be able to report facility-specific emissions corresponding to the EPA's GHG Reporting Program requirements. In recent comments to the White House CEQ3, we have recommended that All-Res be added to NEPA.gov website, "GHG Tools and Resources"4.

We would be happy to discuss this modeling tool with EPA as well. We appreciate the opportunity to comment on the EPA's draft inventory. We are happy to answer any questions about our comments or provide any clarification if needed. Feel free to contact us.

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Response: All flooded land inventory estimates are derived from IPCC default emission factors. The IPCC default emission factors are derived from application of the GRes model to all reservoirs contained in the GRAND database. Predicted emission rates were averaged by climate zone. Although the default emission rates are lower than the arithmetic mean of the literature data (as reported in Deemer et al. 2016, Rosentreter et al. 2021), those same literature data were used to calibrate the GRes model. The IPCC approach assumes that predicting emission rates based on reservoir characteristics (which the GRes model does), is more accurate than simply using a mean of all published data, particularly given the relative sparseness of published data for the US. Nevertheless, the accuracy of the default emission factors for US reservoirs is not well known and the US EPA is in the final year of a nationwide survey of GHG emission rates from US reservoirs. Beginning in the 1990-2023 Inventory cycle, these country specific emission factors will be used in lieu of the IPCC default value.

Flooded land emissions were estimated using the Tier 1 methodology, which includes an α_i of 1. Values greater or lesser than 1, as allowed in the Tier 2 and 3 methodologies, require knowledge of the surface area of waterbodies by trophic status. The U.S. National Lakes Assessment (NLA) can be used to derive the proportion of waterbodies in different trophic status, by ecoregion or state, but this estimate falls short of linking trophic status to waterbody surface area. The NLA data could, however, be used to estimate trophic status for the individual waterbodies that are included in the survey. The EPA expects that patterns in emission rates that are linked to productivity will be captured in the ongoing national-scale survey. It is anticipated that results from the survey will allow for a more accurate assessment of flooded land emissions than implantation of the trophic adjustment factor.

The reported uncertainty follows from the uncertainty in the default emission factors, which is defined as the 95% confidence interval of the G-Res modeled emission rates, by climate zone. The 95% CI is quite constrained, relative to literature reports, possibly because of the large number of predicted values by climate zone. While incorporating a Tier 2 trophic factor adjustment may add uncertainty to the estimate (as suggested by the commentors), this approach is problematic for the reasons discussed above. The EPA expects that the use of country specific emission factors derived from the ongoing national-scale survey will result in uncertainty more similar to that of other LULUCF categories.

The EPA agrees that accounting for water withdrawal depth would improve the accuracy of flooded land emission estimate; however, this information is difficult to obtain and the agency is unaware of any national-scale database that includes water withdrawal depth. If the commenter is aware of such a database, EPA would appreciate this information.

The Inventory captures dam decommissioning through the National Inventory of Dams, which is updated to reflect dam removals. The IPCC guidance does not provide a methodology for estimating emissions associated with decommissioning.

The referenced petition to include flooded lands in the GHGRP falls out of scope of the U.S. GHG Inventory development and reporting process and is under review by EPA's Greenhouse Gas Reporting Program.

Commenter: Blue Sky Maritime Coalition

EPA Docket ID No.: EPA-HQ-OAR- 2023-0001-0006

David H. Cummins

Comment 11: Recommends that EPA should engage with Blue Sky to identify pathways to achieve EPA's stated goal of improving GHG emissions reporting in the "ships and boats" category of the Draft Inventory.

Blue Sky members have unique insight, relevant industry experience, and data that is critical to better understanding U.S. maritime shipping GHG emissions. Directly measuring emissions, rather than calculating emissions, is a more consistent and accurate way to understand emissions. Measuring these emissions with precision and accuracy is becoming ever more critical to achieving the U.S. Paris Agreement commitments, and Blue Sky is uniquely positioned to work with EPA to improve this reporting. The perspective of individual Blue Sky member sectors (such as U.S. ports, vessel operators, fuel providers, and engine manufacturer) should also be included in EPA's efforts to improve measurement of the U.S. maritime emissions. Blue Sky has also been working closely on evaluating emissions reporting approaches. Two reports prepared by Blue Sky directly addressing emissions reporting are set forth at Appendix B (Scope 1 Greenhouse Gas Emissions Calculation Methodology Recommendations, June 2022 (Updated)) and Appendix C (North American Waterborne Transportation Carbon Footprint, July 2022). We recommend that EPA evaluate these reports in preparing its Draft Inventory.

About Blue Sky and our work addressing greenhouse gas accounting methods in the maritime shipping sector.

Blue Sky is a U.S. non-profit, member-based organization with a mission to accelerate the transition of waterborne transportation in the United States and Canada to net-zero greenhouse gas (GHG) emissions. Formed in 2021 and now with over 100 members that represent the entire value chain of the U.S. maritime shipping industry (from ship owners and operators to classification societies, fuel providers, engine manufacturers and many more)1, Blue Sky is a first-of-its kind coalition in North America. Blue Sky directly facilitates collaboration among industry stakeholders regionally and globally to identify, evaluate, encourage and engage in commercial and technical pathways and projects that deliver significant near-term reductions in GHG emissions and that will lead to commercially viable net-zero emissions.

Accurate accounting of the GHG emissions attributable to the U.S. maritime shipping sector is foundational to measuring progress toward any decarbonization efforts, and to drive needed investment and prioritize actions. Stakeholders across the value chain must therefore have confidence in the methodologies used to assess GHG emissions and trust in the accounting results. We understand this is a challenging task, especially because within maritime shipping there are wide varieties in vessel types and energy needs, approaches to tracking fuel use, and unique difficulties in distinguishing an "international" voyage (or portion thereof) from a "domestic" voyage and the fuel use (and associated GHG emissions) for each portion of such a voyage. We also appreciate that for several years EPA has expressly recognized the particular challenge of accurate emissions accounting within the ships and boats category. Again, this year, the Draft Inventory states EPA's "ongoing planned improvement . . . to develop improved estimates of domestic waterborne fuel consumption." Draft Inventory at p. 3-43:1-6; see also p.3-51:12-22. We agree there is a critical need for these improvements and invite EPA to work directly with Blue Sky and its members in identifying and developing such improvements. We also submit these comments to make EPA aware of the work Blue Sky has completed that may inform EPA's

planned improvements to GHG emissions accounting in the ships and boats category of the Draft Inventory.

Because of the importance of accurate emissions data to achieving the decarbonization goals at the heart of Blue Sky's mission, our members have spent considerable effort examining existing methodologies and approaches to assessing GHG emissions attributable to the U.S. maritime shipping sector. Two of our members, Vanderbilt University and the American Bureau of Shipping ("ABS") (an American maritime classification society recognized by the U.S. Coast Guard) developed a study on decarbonizing the U.S. inland river shipping sector.2 That report included an analysis of the GHG emissions attributable to the U.S. inland waterway sector.

Subsequently, in 2022, the Measurements & Operational Efficiency Workstream of Blue Sky undertook an analysis of existing efforts to inventory the GHG emissions from the U.S. and Canadian maritime shipping sectors. After research to identify, assess, and compare existing GHG inventories and their methodologies—which included a detailed presentation from a consultant that has conducted numerous GHG inventories for U.S. ports (Starcrest Consulting Group, LLC)— Blue Sky determined that there is considerable misalignment among approaches utilized and consequently, considerable variability in the total GHG emissions reported by differing groups. Standardization is needed, and EPA can play a key role in advancing critically needed improvements to accounting for GHG emissions in the "ships and boats" category.

Standardization is needed to assess GHG emission in the U.S. maritime shipping sector.

Our work identified six separate resources that have assessed and reported on GHG emissions associated with the North American marine shipping sector. Five of these reports focus on U.S. emissions and one focusses on Canadian emissions. Of the U.S. focused reports, two come from the EPA and include the current Draft Inventory on which we are today providing these comments. One report was prepared by the University Maritime Advisory Services ("UMAS"), one was prepared by the Chartering, Finance, and Commercial Workstream of Blue Sky, and one was prepared by Blue Sky members Vanderbilt University and ABS. The six reports are:

1. UMAS – Future Maritime Fuels in the USA: Options and their Potential Pathways, January 2022.

2. U.S. Environmental Protection Agency (EPA) – Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2020. EPA 430-R-22-003, April 14, 2022.

3. U.S. Environmental Protection Agency (EPA) – EPA National Emissions Inventory, report prepared for EPA by ERG (Eastern Research Group), Draft 2020 Report (May 2022).

4. American Bureau of Shipping (ABS): Decarbonization of the Inland Waterway Sector in the United States, September 2021

5. Blue Sky Maritime Coalition – Chartering, Finance, and Commercial workstream: Report – Carbon Footprint of the North American Waterborne Fleet

6. Environment and Climate Change Canada – Marine Emission Inventory Tool

Table 1 below summarizes, for each report, the total emissions, the boundary the report identified to calculate total emissions, and a brief description of the data or methodology applied by that report. Note that none of these reports solely rely on actual emissions measurements, which are more accurate than calculated or simulated emissions data. A more detailed discussion of the methodologies for each report appears in Appendix A.

Report/Study	Total GHG emissions	Boundary	Methods		
UMAS	13.3 MtCO ₂ (2018)	Total calculated from	UMAS Fuel Use Statistics and		
		"domestic shipping" (Jones	Emissions (FUSE) model based		
		Act vessels connecting ports	on AIS data and vessel		
		within U.S. waters)	information to calculate fuel use.		
EPA - Inventory of	**23.3 MtCO2 (2018)	U.S. domestic "ships and	Data from distillate fuel oil sales		
Sources and Sinks		boats" category.	and residual fuel oil sales,		
			**excluding recreational boats		
			and international bunker fuels;		
			total "ships and boats" category		
			for 2018 is 41.1 MtCO ₂ .		
EPA – National	38.6 MtCO2 (2020)	Category 1, 2, and 3 vessel	Emissions were calculated using		
Emissions Inventory		engines operating in the U.S.	AIS vessel data based on location		
		Exclusive Economic Zone	and engine information and		
		(EEZ)	activity duration, which translates		
			to fuel burn.		
ABS – Decarbonization	5.6 MtCO ₂ (2018)	U.S. Inland waterways only	Estimate based on Inland		
of the Inland Waterway		 vessels reported in the 	Waterways Trust Fund tax		
		Inland River Record	receipts, and confirmed using		
			company data.		
Blue Sky Maritime	47 MtCO ₂ (45.3-US /	U.S. offshore support,	Estimates based on industry		
Coalition-Chartering,	1.7-CA) (2018)	inland, coastal, ferry,	knowledge and total vessel		
Finance, and		tankers/containerships/RoRo,	inventory of various classes and		
Commercial	Additional:	and Canadian flagged.	owner/operator feedback for fuel		
Workstream: North	Ports—19 MtCO2		usage and ranges by vessel type.		
American Waterborne			Inland sector estimation methods		
Transportation Carbon			are similar to those used by		
Footprint			ABS/Vanderbilt (with notable		
			difference in estimated percent of		
			total inland fuel use that is <u>not</u>		
			subject to Inland Waterways		
			Trust Fund Fee (20%		
			ABS/Vanderbilt vs. 50%		
	0.714/00 (2010)		BSMU.		
Canada – Environment	8.7 MtCO ₂ (2019)	All vessels that entered the	AIS data, vessel characteristics,		
and Climate Change		Canadian EEZ from 2015 to	and emission factors along with		
tool		2020	other information such as course		
			correction based on bathymetry		
			or engine load based on currents		

Table 1. Summa	arv of GHG emissions r	eporting for U.S	S. and Canadian	maritime shi	pping	sector
able 1. Summa	if y of OffO chilissions i	eporting for U.	5. and Canadian	i mai iunic sin	pping	accioi

As noted above, our review of these existing reports revealed a lack of consensus and coordination regarding approaches, data sets, and reference points (boundaries) for these emission calculations. The primary data sources relied on across the six studies were (i) AIS data coupled with vessel operating information and (ii) fuel sales data. However, different approaches (methodology, models, emission factors, etc.) resulted in a variety of total emission calculations. The lack of standardization makes comparability among the reports difficult. While there are some entities that are required to report their GHG emissions under federal or state rules (such as the EPA GHG Reporting Rule or pursuant to the California Air Resources Board regulations), the majority of emissions associated with marine shipping is not required to be reported under any standardized structure, so difference in approaches to voluntary

reporting is also an issue. The reports that are focused on U.S. emissions also did not have consistency regarding the emission boundary used. The precise number of gallons of fuel a marine shipping company uses in a given year also tends to be highly confidential business information. Fuel is often the single largest expense for any shipping company. Accordingly, costs related to fuel use are important to competitive advantage. Fuel-burn data is therefore not easily obtainable from individual operators due to legitimate business concerns.

Conclusion

The maritime value chain is critical to the U.S. and global economy and decarbonization is the key challenge the industry faces in the coming years. As the entire world takes on the global challenges of climate change, the maritime industry is both a very important, and very difficult sector to abate. Maritime is already the most sustainable, and lowest-emission mode by which to transport goods but, absent efforts to decarbonize, the industry's total emissions are likely to increase as customers seek to reduce emissions and switch to water-borne transportation where feasible.

Accurate measurement of domestic GHG emissions from maritime shipping is the foundation on which achievement of decarbonization goals depend. We appreciate EPA's continued effort to improve its reporting of GHG emissions from the "ships and boats" category of the EPA Inventory. Blue Sky's comments are intended to assist EPA in this effort and we are available to answer any questions.

Response: EPA has identified the need to refine the methodology for estimating GHG emissions from ships and non-recreational boats as a planned improvement (already in the draft report). The challenge of measuring, monitoring, and estimating emissions from this sector is significant. These challenges are further compounded by UNFCCC reporting guidelines that require EPA to distinguish between domestic and international bunker fuel emissions. EPA intends to review information submitted and consider ways to improve and standardize the methodology for estimating emissions from this sector. Additionally, EPA intends to engage with relevant stakeholders (e.g., in the Expert Review phase of the annual report cycle) in the development of a refined methodology.

Comment 13: Evaluate alternative methodologies for assessing GHG emissions in the "ships and boats" category.

As demonstrated in the methodologies described in Table 1, emissions can be calculated using AIS3 vessel data based on location and engine information, advanced computational or proprietary methodologies, fuel tax records, company-specific data, or other approaches. We recommend that EPA evaluate the costs and benefits of using these approaches, taking into account factors such as the importance of obtaining accurate, verifiable emissions data that can be compared over time. This is especially important because EPA has acknowledged the need for improvement in calculating emissions from the "ships and boats" category of the Inventory yet there have been few changes to EPA's methodological approach for this category over the years.

Response: See response to comment 11.

Comment 14: Include in the report a review of prior studies (such as those identified in Table 1, but at minimum include a discussion of the EPA's National Emission Inventory).

Having two EPA reports that assess maritime shipping GHG emissions, and reach different results, can be confusing to the public, the industry, policy makers, and other stakeholders. We recommend that each annual Inventory include a review of these prior reports, and some discussion of why the boundaries, standards, or methodologies are or are not followed in the current report. Include some discussion of selected emissions factors and why EPA has confidence in those selected (e.g., IMO v. IPCC emission factors).

Response: See response to comment 11. Clarification on scope of data was included in the National Emission's Inventory Technical Support Documents (TSDs), e.g. see pg. 11-2 of the TSD for Commerical Marine Vessels, page https://www.epa.gov/system/files/documents/2023-03/NEI2020_TSD_Section11_CMV.pdf

Comment 15: Develop a standard approach to GHG emission reporting that can be easily adopted on an industry-wide scale and mandatory reporting process.

Any standard should allow for flexibility to incorporate the continued evolution of emissions methodologies and approaches.

Response: The development of a standardized GHG mandatory reporting process from the shipping industry is out of the scope of the Inventory of U.S. Greenhouse Emissions and Sinks development and reporting processes. This comment was shared with EPA's Greenhouse Gas Reporting Program. EPA continues to engage with stakeholders on ways to improve the national estimates.

Comment 16: EPA should collaborate with the U.S. Coast Guard and the U.S. DOT's Maritime Administration (MARAD) on developing the emissions inventory for the "ships and boats" category

The U.S. Coast Guard collects and maintains substantial data on vessels operating on U.S. waters, and is developing regulations that will impact vessel energy efficiency measures aimed at reducing carbon emissions. The Coast Guard has also developed a methodology to quantify GHG emissions from the U.S. Coast Guard vessel fleet that could provide important information to EPA as EPA works to improve GHG emissions reporting for the "ships and boats" category of the Draft Inventory.

Response: See response to comment 11.

Comment 17: EPA should collaborate with U.S. Coast Guard and Blue Sky to provide additional data on the drivers in year-over-year changes in "ships and boats" category emissions

Table 2-13 in the Draft Inventory identifies a substantial increase in 2021 emissions data that appears inconsistent with prior years' growth (even taking into account the impact of COVID and potential

rebound). Further information on what drove these changes will be useful for emitters to modify operational behaviors, and/or technologies to continue to reduce their GHG emissions.

Response: See response to comment 11.

Comment 18: EPA should establish grant programs that are specifically focused on the broader implementation and use of real-time measurements of GHG emissions.

Real-time assessment of vessel emissions is more accurate, and therefore more useful than estimated calculations based on fuel consumption factors such as engine manufacturer data.

Response: Development of grant programs is out of the scope of the Inventory of U.S. Greenhouse Emissions and Sinks development and reporting processes. See also response to comment 15.

Comment 19: EPA should develop a tool similar to Canada's Marine Emissions Inventory Tool.

This tool displays marine emissions from commercial vessels operating in Canadian waters4. The tool allows users to view and marine emissions data in a variety of ways and can hone in on particular data sets such as years, regions, etc. A similar tool for American marine emissions would be useful for operators and local communities to identify trends and sources. This data could then better inform vessel operations, and community and port planning.

Response: See response to comment 15. While beyond the scope of the Inventory of GHG Emissions and Sinks as noted in the response to comment 15, EPA's Office of Transportation and Air Quality has posted a beta version of a Marine Emissions Tool (https://www.epa.gov/moves/emissions-modelsand-other-methods-produce-emission-inventories). This tool is used by EPA to develop AIS-based CMV inventories for the NEI and Emissions Modeling Platforms, for all US waterways, out to 200 nautical miles from the coast. Emissions resulting from the combustion of fuels used for international transport activities, termed international bunker fuels under the UNFCCC, are not included in national emissions totals but are reported separately as a memo item based on the location of fuel sales. Therefore, the scope of emissions and how data are reported in the NEI and the US GHGI (both at the national and state level) for CMVs are different.

Commenter: American Gas Association (AGA)

EPA Docket ID No.: EPA- HQ-OAR-2023-0001-0011

Pamela A. Lacey

Comment 20: concern about studies used to estimate post meter emissions. Seek removal of estimate for residential post-meter leaks (which was included for the first time in 2022 GHGI), until more data become available.

We are pleased to see the Draft Inventory shows methane emissions from natural gas local distribution systems across the country declined by 70 percent from 1990 to 2021. The data reflect the work AGA member gas utilities have been doing to modernize their systems and implement best practices. This

work has been enhanced by voluntary initiatives, including sharing best practices for methane detection, quantification and reduction in AGA workshops and EPA's voluntary Gas STAR program, and more recently through commitments made and implemented under EPA's Methane Challenge program.

However, we continue to be concerned about EPA's use of a few studies with significant limitations to provide an estimate of post meter emissions. For the reasons stated in our comments last year on the Public Review Draft of the 2022 GHG Inventory, attached as Appendix A to this letter, AGA urges EPA to remove the estimate of residential post-meter emissions and revisit the estimate in a future Inventory once data gaps and uncertainties can be more reliably addressed. We also urge EPA to work with the Department of Energy (DOE) to fund the necessary research to fill these data gaps. Funds recently made available to DOE and EPA by Congress in the Inflation Reduction Act could be used for this purpose. We make this request for the following reasons.

1. There are no consensus standard test methods or standard practices for measuring and determining the flow rate or volume of methane emissions from end-use natural gas appliances. Differences in the types of measurement equipment used, performance related attributes of the equipment, and standardization of the measurement protocols themselves should be addressed first before utilizing any individual study on these types of methane emissions. The standards development for testing protocols would be time intensive work but essential to establish the credibility for estimating post-meter methane emissions.

2. The use of a limited set of studies conducted on a small sample of homes is unlikely to be representative of a national U.S. estimate. It is especially inappropriate to rely on a small sample size in a data set known to have a fat tail distribution.

3. There are considerable data gaps, large uncertainties, and orders of magnitude difference among the available studies EPA reviewed for these post meter methane emissions estimates.

4. There were no repeated tests to determine the reproducibility of the methods referenced or to determine whether emissions vary with time or environmental conditions.

AGA appreciates the opportunity to comment. If you have any questions, please contact me at placey@aga.org or Tim Parr, AGA Deputy General Counsel, tparr@aga.org.

Response: EPA added text to the natural gas chapter (page 3.111) noting the comment received and noting that we will review new data as it becomes available. See also EPA's response to similar comments on last year's Inventory (page 42, <u>https://www.epa.gov/system/files/documents/2022-</u>06/us-ghg-inventory-1990-2020-public-review-comment-log.pdf): "Default emission factors became available to quantify emissions for this source in the 2019 Refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC 2019 refinements). EPA reviewed available data and for residential appliance fugitive emissions relied on data from Fischer et al. 2018 instead of international default values available from IPCC. For more information, please see the memo Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020: Updates for Post-Meter Emissions, available athttps://www.epa.gov/system/files/documents/2022-04/2022_ghgi_update_-_meter.pdf. EPA will continue to review data as it becomes available for potential updates to its post-meter estimates. EPA notes that due to timing of its publication, EPA did not review the Lebel 2022 study in the development of this inventory."

Commenter: The State of Alaska Department of Environmental Conservation

EPA Docket ID No.: EPA-HQ- OAR-2023-0001

Gary Mendivil

Comment 21: address use of CO2 injection and geologic storage in regulatory structure of greenhouse gas inventory, specifically in Alaska.

The Alaska Department of Environmental Conservation (DEC) appreciates the opportunity to comment on the U.S. Environmental Protection Agency's (EPA) Inventory of U.S. Greenhouse Gas Emissions and Sinks published in the Federal Register on February 15, 2023. We noted specifically that the EPA is also exploring the approach used to account for CO2 transport, injection, and geologic storage. This is an area where Alaska has a very specific interest.

The Alaska oil and gas industry has been reinjecting natural gas into reservoirs to enhance oil recovery, but are being penalized for doing so. Unfortunately, the EPA's current determination appears to be that this natural gas is being emitted rather than being sequestered. This determination is outdated and characterizing Alaska's greenhouse gas emissions in the EPA's Greenhouse Gas Inventory in this way is a disservice to Alaska and to the general public. This conclusion appears to be based on an outdated EPA regulatory classification system.

This regulatory discrepancy was recently noted in the BLM's Final supplemental EIS for the Willow Development Project on the North Slope of Alaska.1 In this same document the BLM also cites to information provided by the U.S. Geological Survey which notes that industrial injection of GHG into the subsurface for enhanced hydrocarbon production or for GHG storage are forms of geologic sequestration.2 This was also recognized and discussed in substantial detail in the Department of Energy's Supplemental Environmental Impact Statement (EIS) for the Alaska LNG Project issued on January 6, 2023.3 As the EPA explores approaches to account for CO2 injection and geologic storage we encourage you to address this beneficial use in the regulatory structure of the greenhouse gas inventory.

At present, produced gas is being reinjected into the Prudhoe Bay field at a rate of about 8.7 billion cubic feet per day. This injection has had a positive impact on oil recovery efficiency in the Prudhoe Bay Unit and the reality is that this natural gas is being geologically sequestered and not being emitted into the atmosphere. As noted in detail below, the regulatory structure of the existing rules addressing greenhouse gas sequestration does not match with reality on Alaska's North Slope.

The GHGRP regulations require oil and gas facilities to report two types of GHG emissions: (1) combustion emissions resulting from burning fossil fuels and (2) emissions from industrial processes. Unfortunately, the way EPA currently characterizes reinjection of natural gas into the reservoirs is to treat it as an emission from an industrial process rather than as sequestration. While this reinjection method is inherently different from carbon sequestration which removes nature gas, methane, or CO2 from the waste stream of a manufacturing process, it is still sequestering the methane.

Wells in Alaska's North Slope fields produce a mixture of oil, natural gas, and water – these three streams need to be separated before the crude oil can enter the Trans-Alaska Pipeline System. Once the natural gas has been separated it is reinjected into oil reservoirs for enhanced oil recovery.

The current EPA regulations that govern carbon capture and storage (CCS) projects typically assume that the project was designed from the beginning on the basis of site selection criteria that emphasizes permanence in underground CO2 retention. The reinjection of natural gas on the North Slope for enhance oil recovery (EOR) occurs for different reasons: (1) Alaska's statutory rules against waste of oil and natural gas resources and (2) the location of an existing oil and gas producing formation. Because Alaska North Slope greenhouse gas sequestration does not fit the EPA's currently regulatory framework, the default is to treat the reinjection as emissions.

Despite not fitting into the current regulatory framework, the natural gas and specifically the methane and CO2 components in Alaska are being geologically sequestered and should be treated as such. The EPA regulatory requirements for injection control can be found at 40 C.F.R. Parts 124, 133, 145 and others. These injection control regulations were designed under the regulatory authority of the Safe Drinking Water Act to protect the quality of drinking water sources in the US. This regulatory model is also mismatched with the geologic stratigraphy found on the North Slope of Alaska. The presence of thick layers of permafrost means that drinking water sources on the North Slope are based on surface water and shallow groundwater. In addition, deeper groundwater that exists below the permafrost is saline and not suitable for drinking water uses.

The requirements for carbon dioxide are found in Subpart RR: Geologic Sequestration of Carbon Dioxide and Subpart UU: Injection of Carbon Dioxide (40 C.F.R. 98.470 – 478). As noted earlier, we believe that the EPA's current approach regarding carbon sequestration and enhanced oil recovery needs to be revised in order to provide comprehensive and logically coherent solutions. The current enhanced oil recovery (EOR) regulations at 40 C.F.R. 98.470 – 478 were not written to cover long-term underground storage of CO2 or methane as a CCS project. The legal and regulatory framework governing EOR assumes that the natural gas injection will end and producing wells will be decommissioned, plugged, and abandoned after EOR has ceased.

Typically, EOR regulations do not account for what happens to the injected natural gas after EOR activities have ceased. An enhanced oil recovery project seeking to be treated as a carbon capture and storage project presents a special case which must satisfy both the oil and gas production rules and the rules for CCS storage sites. It appears abundantly clear that the EPA regulations need to be updated to allow for this important avenue for sequestration and an accurate accounting of GHG emissions versus what is being captured and stored. We request that you proceed quickly to address these updates as the State of Alaska is currently pursuing efforts to sequester carbon and regulatory certainty would certainly enhance these efforts.

If you have any questions or would like additional information, please feel free to contact me at Gary.Mendivil@alaska.gov .

Response: Fugitive emissions from oil and gas operations in the Inventory are based on Subpart W data reported under the GHGRP. Subpart W requires oil and gas producers to report emissions from leaks, venting and flaring operations. Captured methane is not specifically called out under GHGRP reporting but to the extent it does not result in leaks, venting or flaring it would not necessarily be counted as an emissions under GHGRP reporting. Furthermore, EPA is in the process of developing

enhanced data reporting requirements for petroleum and natural gas systems under GHGRP Subpart W. Any updates to reporting and emissions from oil and gas operations will be reflected in future Inventory emission estimates.

EPA has also proposed several updates to the GHGRP rules including the proposed addition of a new subpart VV (40 C.F.R. Part 98 Subpart VV). The proposed new subpart VV would create a reporting pathway for EOR operators who use the ISO 27916:2019 standard (ISO standard) to quantify the CO2 sequestered as a result of their operations. The ISO standard has requirements similar to the site-specific monitoring, reporting and verification (MRV) plan required in order to report geologic sequestration under subpart RR. Future reporting from facilities using EOR under subpart VV as proposed will be useful for to updating treatment of CO2 captured for EOR in the Inventory.

Note, these rules are managed by other parts of the EPA and are beyond the scope of the Inventory of U.S. Greenhouse Gas Emissions and Sinks development and reporting. EPA GHG Inventory staff have shared this comment with the GHGRP team and you may also contact them at: ghgreporting@epa.gov.

Commenter: SailPlan Maritime, Inc

EPA Docket ID No.: EPA-HQ- OAR- 2023-0001

Charlotte Runzel

Comment 22: The EPA should consider including or requiring emissions measurements when requesting emissions data from entities and should also disclose the uncertainty with emissions that are reported via calculations, specifically for the maritime sector.

Thank you for the opportunity to comment on the Environmental Protection Agency (EPA)'s Draft Inventory of U.S. Greenhouse Gas (GHG) Emissions and Sinks Report. SailPlan is uniquely positioned to comment, as a clean-tech company provides the maritime industry with emissions monitoring and optimization in real-time. SailPlan's platform uses real-time infrastructure and vessel data feeds (including engine, fuel, speed, and stability data) to measure and reduce greenhouse gasses, as well as advanced weather, mapping, and vessel traffic data to monitor maritime environments. SailPlan's technology is helping vessels and ports realize climate and cost-savings goals.

We commend EPA's efforts to accurately understand the U.S.'s total greenhouse gas emissions by sector, but accurate emissions measurements are necessary for this data. The status quo of emissions tracking is to estimate emissions, but estimation comes with serious flaws. At present, emissions data is generally estimated by input data (such as gallons of gasoline, kilowatt-hours used, volume of natural gas, age of the engine, etc.) and infrequently measured in real-time. Additionally, there are reporting challenges with maritime emissions reporting, due to "the use of legacy systems and outdated maritime software suites that often prove to be unstable and incompatible with new technologies and regulatory requirements." 1 European ships that are required to report their data have to include the monitoring method used, the level of uncertainty, and the subsequent results, but this is not required under the current EPA calculation model. 2 The calculations are self-reported by each individual ship, and many lack the modern software to accurately measure their emissions. This can lead to underreporting and inaccurate reporting, which is becoming a systemic and global issue for countries and cities as well. 3,4

Emission reporting based on estimates or calculations is inherently flawed. In 2021, the Boston Consulting Group performed a study on 1,290 companies and found that only 9% of these companies can quantify their emissions accurately. Out of those surveyed, 40% responded they had estimated errors in their calculations. 5 As countries are beginning to estimate their emissions to align with the Paris Agreement goals, for example, many countries are underreporting and miscalculating certain greenhouse gas emissions and overreporting their carbon sequestration abilities. 6,7 Moreover, U.S. cities underreport their greenhouse gas emissions by 18.3%. 8 The maritime industry, along with companies, countries, and cities are facing a need for new technology to accurately measure emissions. SailPlan's mission is to provide maritime stakeholders with reliable emission data based on actual monitoring of the source that allows an entity to seamlessly report and take action to meet emission reduction goals.

Emission reporting based on estimates or calculations include various judgements - whether or not to include certain data, for example - which present inconsistencies and bias across emissions reporting. 9 These flaws in emissions calculations are troubling – curbing climate change relies on data, but the data can be inaccurate. 10 For methodology to report emissions, the EPA should require or recommend using devices such as CEMS to accurately understand emissions data throughout the U.S.

Emission reporting based on estimates or calculations aggregates emission data in a way that makes it difficult or impossible to take action based on the source cause of increased emissions at any given time. Many times emission calculations provide an estimate of an average emissions over the course of a year, quarter or month. It is impossible to know in a calculation that a particular vessel, crane or truck was emitted an extreme amount of emissions that could impact the workers at a port of the neighboring community. In order to mitigate the impact of emission, real-time data is necessary to identify and address increased emissions in the moment. An emission calculation at the end of the year, quarter or month that your emissions were estimated to have increased instead of decreased provides no opportunity to drive data-driven change to improve the conditions for workers or the neighborhoods near ports.

Inaccurate data results in firms over- or under-reporting emissions, which has consequences. If emissions are underestimated, policymakers would believe climate targets are met, while they would be far below stated goals. If emissions are overestimated, countries would reduce emissions too much and there would be unnecessary economic repercussions. Accurate data in emissions inventories is key to meeting goals and using resources effectively. The EPA should consider including or requiring emissions measurements when requesting emissions data from entities. The EPA should also disclose the uncertainty with emissions that are reported via calculations. Thank you for the opportunity to comment and please don't hesitate to reach out if you have any questions.

Response: See response to comment 15. Development of required reporting at the entity level is beyond the scope of the Inventory of U.S. Greenhouse Gas Emissions and Sinks development and reporting. The comment has been shared with EPA's Greenhouse Gas Reporting Program.

Commenter: Bluefish

EPA Docket ID No.: EPA-HQ- OAR- 2023-0001

Scott Levy

Comment 23: Missing reservoirs in Washington state and use of alternate emission factors

While very pleased to see that reservoirs are now being included in the GHG Inventory, there are two reservoirs that were oddly left out of the inventory. Likely it is nothing more than an oversight -- that will be corrected by inclusion of them in the next inventory.

A decade ago, Pacific Northwest National Laboratory performed the measurements that EPA describes, and reported their findings in PNNL "Evaluating greenhouse gas emissions from hydropower complexes on large rivers in Eastern Washington 2013.pdf" (DOE Contract DE-AC05-76RL01830, available at

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22297.pdf).

Taking this information a bit further, a mechanical engineer from Boise dug deeper and has presented his findings in "The Lower Snake River Reservoirs Generate Significant Amounts of Methane, a Potent Greenhouse Gas" (<u>https://damsense.org/wpcontent/uploads/2014/12/Snake-River-Greenhouse-Gas-2.2.17.pdf</u>). In that report, John Twa documents how he estimates the PNNL studies to be revealing the release of 10 tons of methane per hour, (86,000 metric tons per year).

As point of comparison, news headlines elsewhere in the country alert us of a salt cavern natural gas storage facility that is leaking 5,000 metric tons per year.

Every Hour, This Gas Storage Station Sends Half a Ton of Methane into the Atmosphere (June 19, 2022). "The Petal plant emits the greenhouse gas equivalent of 87,000 automobiles – more than any other gas storage facility in the United States."

The quantity of methane from the Lower Snake River reservoirs, impounded by federal dams that have been a river restoration topic for decades, is not negligible, although the Northwest Power & Conservation Council would have us believe that they can be set aside from further conversation.

"Council finds the region's federal hydro system unlikely to emit high levels of methane gas", March 16, 2017 (<u>https://www.nwcouncil.org/news/columbia-and-snakeriver-reservoirs-not-associated-high-greenhouse-gas-emissions/</u>)

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Walla Walla District of the U.S. Army Corps of Engineers: "Generally, the lower Snake River projects do not release methane gas because oxygen levels are very high, the water does not stratify, and the reservoirs are shallower with water circulating regularly."

Should we trust the Army Corps of Engineers on this topic? I suspect not. Notably, a recent legal victory of Columbia Riverkeepers enables the EPA, for the first time, to set limits on oil and hot water pollution from the four federal dams on the Lower Snake River.

"Dams that pollute will no longer get a free pass," said Brett VandenHeuvel, Executive Director of Columbia Riverkeeper. "The Army Corps' dams spill dirty oil and heat up the rivers to unbearable temperatures for salmon. It's long past time for the Army Corps to correct its illegal pollution problems." (https://www.columbiariverkeeper.org/news/2021/9/victory-army-corps-must-controlpollution) While highly concerned about the existential environmental crisis upon us, pressing for the inclusion of these two PNNL-studied reservoirs in your upcoming analysis would be appropriate and urgent. Please do what you may to properly inform the public at large and include ALL reservoirs to which the federal government has available information.

Response: The commenter reports "...there are two reservoirs that were oddly left out of the inventory.", but s/he fails to report which reservoirs these are. The commenter also cites a report from Pacific Northwest Laboratory (PNNL) on greenhouse gas emissions from the impounded waters behind Priest Rapids and Lower Monumental Dams on the Columbia and Snake Rivers, respectively. Presumably the commenter felt these two dams were missing the Inventory. The EPA can confirm, however, that these systems are included in the Inventory.

The commenter also suggests that the Inventory underestimates GHG emissions from flooded lands along the Lower Snake and Columbia Rivers. As evidence, the commenter cites an unpublished (John Twa, 2016) estimate of methane and carbon dioxide emissions from the flooded lands associated with four dams along the Lower Snake River, including Lower Monumental Dam. The estimate was constructed by scaling the mean ebullition rate reported by PNNL for Lower Monumental Dam to the four Snake River Dams based on 1) the fraction of the impoundments with suitable habitat for ebullition and 2) number of days per year likely to support ebullition. The upscaled ebullition estimate for the lower Snake River flooded lands is 103 kg CH₄ ha-1 year-1, which is lower than the default emission factor (150.9 kg CH₄ ha-1 year-1) for the warm temperate dry climate zone where the lower Snake River resides. Twa (2016) includes estimates of CO₂, but the Snake River reservoirs are greater than 20 years old and therefore classified as Flooded Land Remaining Flooded Land (FLRFL). CO₂ emissions are not included in the Inventory for FLRFL to avoid double counting.

The commenter also states "...John Twa documents how he estimates the PNNL studies to be revealing the release of 10 tons of methane per hour, (86,000 metric tons per year)." In a review of John Twa's unpublished 2016 report, the EPA could not reproduce this estimate. Rather, Twa (2016) uses the upscaled emission rate reported above (103 kg CH₄ ha-1 year-1) to estimate that the flooded lands along the Lower Snake River emit 1,447 metric tons of CH₄ per year.

Although the commentor suggests that the Inventory underestimates methane emissions from flooded lands along the Lower Snake River, the Inventory uses an emission factor that is nearly 50% greater than estimated from the Twa (2016) reanalysis of data in the PNNL report (150.9 vs 103 kg CH₄ ha-1 year-1). Finally, as stated above, the EPA confirms that Lower Snake River and Columbia river flooded lands are included in the 1990 – 2021 Inventory.

Commenter: Private Citizen

EPA Docket ID No.: EPA-HQ-OAR-2023-0001-0013

Janis Burger

Comment 24: Account for emissions from logging (including wood pellets), clearing forests (lifecycle approach) etc.

I live in a place with huge old trees and forests that sequester more carbon than most other forests in the world in the trees and soil. A tiny remnant is protected in Olympic National Park and wilderness areas in nearby national forests. These and other forests are an essential park of equation for addressing the climate emergency. So honest, transparent accounting of the true GHG emissions from harvest, transport, processing, impacts on soil, and the full accounting of the temporary nature of carbon in forest products is essential for an impartial analysis of forest emissions from harvest regimes.

It's great that the EPA is now accounting for emissions from forest fires separately, but emissions from logging represent a larger share of forest carbon loss. We hope the scientific literature on this should be incorporated into GHG Inventories. The papers below provide specific examples of the full impact on carbon flux in forests.

Harris NL, Hagen SC, Saatchi SS, Pearson TRH, Woodall CW, Domke GM, et al. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance Manag. 2016;11: 24.

Curtis PG, Slay CM, Harris NL, Tyukavina A, Hansen MC. Classifying drivers of global forest loss. Science. 2018;361: 1108–1111.

Logging (including for wood pellets), is the primary cause of carbon loss, tree cover loss, and forested wetland loss in the US. In the South, forest carbon losses are overwhelmingly due to the impacts of increased extraction from Southern forests. The Harris et al. (2016) paper found that a full 85% of carbon emissions from US forests was attributed to silvicultural activities like clearcutting, more than fire, insect, drought, and wind damage combined. The Curtis et al. (2018) study found that around half of tree cover loss in North America was driven by forestry activities, and that particular type of tree cover loss was predominant in the United States, not Canada.

The ideal Greenhouse Gas Inventory would include the sector of Forestry alongside other sectors like Agriculture and Waste Management. This sector's analysis would include:

The amount of CO2e emitted from forest clearing, displayed in the Forest Land Remaining Forest Land category.

The amount of CO2e stored in each wood product type (e.g., lumber, paper, pellets) alongside expected time to complete emission into the atmosphere (1-5 years, 5-10 years, 50+ years, etc).

Transparently accounting for forest emissions associated with logging is essential to meeting climate goals. I am trying to reduce my individual carbon footprint with biking, building a passive solar straw bale home, installing photovoltaic and solar thermal, and being active in local climate education. But it takes action on all scales, including the scale of our forests and their natural climate solutions of sequestering carbon for us as part of need for an all hands on desk solutions. Honest accounting on that front is essential. Thank you.

Response: Data and information on emissions associated with logging and forest clearing are currently accounted for in the estimates of forest land net carbon stock change, found in Chapter 6 and Annex 3.13 available online at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021. EPA can explore, in collaboration with USFS, and dependent upon available data, opportunities to provide additional analyses.

Commenter: Private Citizen

EPA Docket ID No.: EPA-HQ-OAR-2023-0001-0007

Dana Moskowitz

Comment 25: Use 20-year timescale rather than 100-year timescale for GWPs, underestimating impact of more powerful GHGs, like methane, provides recent paper. Provide other metrics alongside to reflect risks from short-lived climate pollutants

Global climate change is creating unpredictable and disastrous consequences to our weather systems and ecosystems. We are obligated to reduce these impacts by lowering our greenhouse gas emissions to keep warming below 1.5 °C. However, the current most common method for estimating emission impacts is the global warming potential (GWP). This method compares greenhouse gasses to carbon dioxide (CO2) using a preset timescale. This most common timescale is 100 years. However, we need to peak our emissions within 2 years to reach the 1.5 °C goal. Using a timescale of 100 years will lead to underestimating more powerful greenhouse gasses, such as methane, and hinder our ability to combat climate change. I am commenting to advocate for the use of a shorter timescale of 20 years rather than 100 to better understand the impact of our emissions within the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021.

The effects of climate change are already being felt by communities across the globe. The current international goal is to stop global warming by 1.5 °C from pre-industrial levels, as set out in the 2015 Paris Agreement. We are currently about 1.11 °C over pre-industrial temperatures. To limit the disastrous effects of climate change, the world needs to peak greenhouse gas emissions by 2025, 2 years from now. Then the world needs to become net zero by 2050, less than 3 decades in the future. 1 Effects of climate change are occurring on the time-scale of single years not centuries.

To estimate the effect of emissions and compare greenhouse gasses, the Global Warming Potential (GWP) was created. Explicitly, "it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2). The larger the GWP, the more that a given gas warms the Earth compared to CO2 over that time period." 2 This time period is the issue of concern. Most commonly, 100 years is used, but this was an arbitrary timeline set in the Kyoto Protocol as a middle ground between the alternative 20 year and 500 year timelines. 3

The United Nations Intergovernmental Panel on Climate Change authors Assessment Reports on the international progress combating climate change and makes recommendations for how to estimate emissions. This panel continues to use the 100 year timeline in their 4th and 6th assessment reports (2014 and 2022 respectively). 4,5 These reports are recommended by the United Nations Framework Convention on Climate Change (UNFCCC) to be used in estimating emission impacts. The United States EPA continues to mostly use the 100 year timeline. 2

The problem lies in the fact that methane gas is 80 times more potent than carbon dioxide when comparing the first 20 years in the atmosphere (methane usually lasts around 12 years in the atmosphere while CO2 can last anywhere from 300 to 1,000 years). 2,6,7 Remember, when thinking about the effects of climate change we are thinking in the time-scale of years not centuries. If we continue to use the 100 year timeline as has been the standard protocol, we are greatly underestimating the effects of methane emissions.

I am commenting to advocate for the EPA to consider timeframes that are based on scientific justification rather than the arbitrary timeline of 100 years for the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. A recently published paper in Environmental Research (which is

attached with the comment), created a model to set a timeframe that is based on aligning with the 1.5 °C and 2 °C warming goals set in the Paris Agreement. Based on their modeling they found the best timeframe for the 1.5 °C goal was 24 years. For the 2 °C goal the best timeframe would be 58 years. Note that both of these are well below the 100 year timeframe. They conclude by recommending the 20 year timeframe over the 100 year time frame when binary choices must be made. 3 By using the shorter timeframe of 20 years, we can better estimate the effects of methane emissions and therefore create standards for methane emissions that will actually help us achieve our goals of limiting climate change to 1.5 °C.

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Response: EPA uses 100-year Global Warming Potentials (GWP) from IPCC's Fifth Assessment Report to calculate CO₂ equivalent emissions as required for reporting annual inventories to the UNFCCC. This is required to ensure that national GHG Inventories reported by all nations are comparable. See decision 7/CP. 27 available online at

https://unfccc.int/sites/default/files/resource/cp2022_10a01_adv.pdf for more information.

The U.S. Inventory also includes unweighted estimates in kilotons (see Table 2-2 of the Trends chapter) and stakeholder/researchers can and have used these values to apply other metrics. Further, Annex 6 of the Inventory includes information on effects to inventory estimates in shifting to AR5 and AR6 100-year GWPs. The U.S. Inventory report website is available at

<u>https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks</u>. More information on GWPs is available on the IPCC's Working Group 1 website for AR5 (Chapter 8) and for AR6 (Chapter 7) online at <u>https://www.ipcc.ch/working-group/wg1/</u>.