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Rachel Schmeltz
Climate Change Division
Office of Atmospheric Programs
U.S. Environmental Protection Agency
1200 Pennsylvania Ave, NW
Washington, DC 20460
Via Email: GHGInventory@epa.gov

RE: NACWA Comments on Wastewater Treatment Emissions Estimates in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019, Draft for Public Review, Docket ID No. EPA-HQ-OAR-2021-0008

Dear Ms. Schmeltz:

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: 1990-2019 (Inventory)*, and specifically Section 7.2, *Wastewater Treatment (CRF Source Category 5D)*, as part of the public review process. NACWA represents the interests of over 300 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. Since EPA uses guidelines published by the Intergovernmental Panel on Climate Change (IPCC) to calculate emissions for the *Inventory*, the basis of EPA's estimates did not change between the 2005 and 2018 *Inventories*. However, with the publication of the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Refinements)*, EPA's calculations changed in the 2019 *Inventory*. This has resulted in higher POTW emissions estimates for both methane and nitrous oxide.

NACWA offers the comments below on the public review draft of the *Inventory*. These comments build on the comments that NACWA submitted in November 2020 on the draft *Inventory* for expert review.

General Comments on Wastewater Emissions Estimates

The wastewater section of the *Inventory* is clearly written and demonstrates EPA's understanding of domestic wastewater treatment processes. This section defines the boundaries of the emissions estimates, with the sources and offsets that are included in the estimates. NACWA appreciates that EPA has followed the Association's previous recommendation that the calculation variables and data sources be presented in table form. NACWA also appreciates the clarification that EPA has provided in the public review draft on the use of the terms "biosolids" and "sludge."

EPA asked for comment on the disaggregation of national estimates and the availability of disaggregated data, such as at the state level. This would require emissions calculation methods other than the IPCC methods, since the IPCC methods are based largely on population and on estimates of nitrogen and biological oxygen demand (BOD) loading per capita. Some utility-level and state-level data is available, but there is a need for more data to be collected. Although consideration of data at a more granular level is preferable, it must also be used carefully when drawing conclusions at a broader level.

EPA Incorporation of IPCC Refinements

The calculations from the *IPCC Refinement* are based entirely on influent nitrogen loading and do not account for whether POTWs have nitrification/denitrification (N/DN) processes at the treatment plant. Nitrous oxide cannot form without nitrification and/or denitrification occurring. However, as the calculations are set up, the emission estimate is the same for a plant with N/DN as for a plant without N/DN.

Previous IPCC guidance used population as the basis for nitrous oxide calculations, as does the current *IPCC Refinement*. However, the previous IPCC guidance used different emissions factors depending on whether plants use N/DN processes, with lower emissions resulting from plants without N/DN. The IPCC calculations for nitrous oxide should 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.

Input on Data Used in Emissions Estimates

Developing US- and treatment-specific methods for estimating nitrous oxide emissions, rather than using IPCC methods, should be a priority for EPA. It is more accurate to have factors for each type of treatment process applied, such as N/DN, in place of an IPCC default factor for domestic wastewater of 0.005 kg N₂O-N/kg N.

NACWA recommends that additional consideration be given to where wastewater discharges occur in the aquatic environment. 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.

Recommended Changes to Text

NACWA recommends the following edits to the text of Section 7.2 of the *Inventory*. Although these edits will not affect the emission calculations, they will clarify aspects of the wastewater treatment process.

- Page 7-21, line 31 – Replace the phrase, “or as a later treatment step...” with: “or are more commonly used as a final treatment step...”
- Page 7-22, line 14 – At the end of the paragraph, add: “although most POTW discharge points (outfall locations) are regulated to ensure conditions of the receiving water body and the effluent quality are conducive.”
- Page 7-22, line 26 – Replace the sentence beginning with, “The principal factor...” with this sentence: “While research has shown that there are many factors that influence the actual generation of N₂O across wastewater treatment processes, for the purposes of this *Inventory*, the principal factor in determining the N₂O generation potential of wastewater is the amount of N in the wastewater.”

Additional Comments

NACWA agrees that there are needed improvements for the *Inventory* and strongly encourages development of US- and treatment-specific methodologies and emission factors. Specifically, NACWA recommends that EPA consider the following next steps regarding methane emissions:

- Continue collecting and reviewing published research and articles on methane release from treatment processes.
- Consider further the relationship of methane saturation of streamflow (influent to each treatment process) and the potential for methane emissions.
- Determine the feasibility of performing direct methane measurements at POTWs.

Regarding N₂O emissions, NACWA recommends the following next steps:

- Keep reference to the original IPCC emission factor for non-N/DN plants, since they are not represented in the refinement, or equate their N₂O process emissions to zero.
- For POTWs practicing N/DN processes, and in the absence of site-specific data, consider providing the option to use an equation Kartik Chandran determined (just prior to releasing his work in the 2012 WERF study¹) as a calculation-based method that accounts for aerobic and anaerobic conditions and diurnal and seasonal variability at the wastewater treatment plant (WWTP).

$$N_2O_{WWTP} = Q_i \times TKN_i \times EF_{N_2O} \times (44/28) \times 10^{-6}$$

where: N_2O_{WWTP} = N₂O emissions generated from WWTP process (Mg N₂O/hr)
 Q_i = wastewater influent flow rate (m³/hr)

¹ Chandran, K., 2012, *Nitrogen Emission from Wastewater Treatment Operation, Phase 1: Molecular Level Through Whole Reactor Level Characterization*, Water Environment Research Foundation, 170 pp.

TKN_i = amount of TKN in the influent (mg/L = g/m³)

$EF_{N_{2O}}$ = N₂O emission factor (g N emitted as N₂O per g TKN in influent)

= 0.0050 g N emitted as N₂O/g TKN (Chandran, 2010)

44/28 = molecular weight conversion, g N₂O per g N emitted as N₂O

10⁻⁶ = units conversion factor (Mg/g)

- In addition to the equation above, consider reference factors in published literature (e.g., 2012 WERF study) for treatment processes when the factor aligns well with processes used by a large portion of POTWs.
- Continue collecting and researching articles on the evolving understanding of N₂O emissions by treatment process.
- Further examine the relationship of nutrient load in the influent versus effluent to show (1) potential loss of nitrogen from non-N/DN plants (if any), and (2) if the emission factors for N/DN are over-estimating nitrous oxide emissions.

NACWA also suggests that EPA provide diagrams showing emissions sources and offsets related to each process stage in the domestic wastewater treatment train that is necessary for achieving water quality objectives. This would provide context of the function and objective of POTWs to protect public health and water quality through wastewater treatment.

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

Sincerely,



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