



March 29, 2007

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Leif Hockstad

Climate Change Division (6207J)

U.S. Environmental Protection Agency

1200 Pennsylvania Ave, NW Washington DC 20460

Via Email: Hockstad.Leif@epa.gov

**Re: NACWA Comments on Wastewater Treatment Emissions Estimates in EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, Draft for Public Review***

Dear Mr. Hockstad:

The National Association of Clean Water Agencies (NACWA) has reviewed Section 8.2, *Wastewater Treatment*, of the U.S. Environmental Protection Agency's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2005, Draft for Public Review (Draft Inventory)*. NACWA represents the interests of nearly 300 publicly owned wastewater treatment agencies nationwide. NACWA's members serve the majority of the sewered population in the U.S., and collectively treat and reclaim more than 18 billion gallons of wastewater each day. NACWA members are very much aware of the growing importance of global climate change and are already engaged in efforts to reduce greenhouse gas emissions. As more state-wide and national efforts are launched to curb levels of greenhouse gases, EPA's *Inventory* will certainly take on added significance.

Our review of the *Draft Inventory* indicates that greenhouse gas emissions from wastewater treatment may have been over-estimated, and our attached comments outline the factors that appear too conservative and lead to the over-estimation. These comments are a revision of NACWA's previously submitted comments on the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2005, Draft for Expert Review*. We appreciate EPA's response to our previous comments, including further explanations of how emissions estimates were calculated in the *Inventory* and how EPA must use the Intergovernmental Panel on Climate Change (IPCC) protocol for the estimates in the absence of other data. NACWA appreciates the clarifications made to the text of the *Draft Inventory* based on our previous comments, and we thank EPA for its willingness to work with NACWA members to refine the greenhouse gas emissions estimates for wastewater treatment using a data-based approach, as opposed to theoretical assumptions. We are already investigating what data we could collect to support our recommendations for changing the emissions estimates, and we look forward to sharing our results with you in the future.

Thank you for the opportunity to comment on the *Draft Inventory*. Please contact me at 202/296-9836 or [cfinley@nacwa.org](mailto:cfinley@nacwa.org) if you have any questions about our review.

Sincerely,

Cynthia A. Finley

Director, Regulatory Affairs

Attachment

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**Comments on EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, Draft for Public Review***

The National Association of Clean Water Agencies (NACWA) has reviewed the wastewater treatment greenhouse gas (GHG) emission estimates contained in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2005, Draft for Public Review (Draft Inventory)*. Overall, we are concerned that the methodology used for the emission estimates leads to an overestimation of the contribution of wastewater treatment to total GHG emissions from all sources. We recognize that uncertainty exists in calculations of this type and that EPA has attempted to calculate a “mid-range” value of the GHG emissions, and determine upper and lower bounds on the emissions estimate through an uncertainty analysis. However, we believe that some of the factors used in the calculations are conservative, which results in elevated values for the emissions estimates and the uncertainty bounds. NACWA’s specific comments regarding these factors are provided below.

1. As we understand the methane (CH<sub>4</sub>) emission methodology, the maximum CH<sub>4</sub> producing capacity for domestic wastewater, termed the B<sub>0</sub> value, of 0.6 kg CH<sub>4</sub>/kg BOD assumes that all organic matter in wastewater treated anaerobically is converted to CH<sub>4</sub>, whether it is biodegradable or not. This B<sub>0</sub> value is then multiplied by a methane correction factor (MCF) which quantifies how much of the influent organic matter is actually converted to CH<sub>4</sub>. The MCF is 0.5 for septic systems and 0.8 for anaerobic systems. We believe that the maximum MCF should be 2/3 or 0.67, since several well-recognized and commonly accepted references (e.g. Metcalf & Eddy<sup>1</sup> and Grady, Daigger, and Lim<sup>2</sup>) indicate that no more than about two-thirds of the organic matter in domestic wastewater is biodegradable. The MCF accounts for the portion of the organic matter that is stabilized anaerobically (versus aerobically) and also for the portion that is incorporated into sludge. The fact that all wastewater treatment facilities produce sludge reinforces the fact that an MCF of 0.8 is overly conservative. Thus, it appears that the maximum CH<sub>4</sub> producing potential was coupled with the maximum potential conversion to CH<sub>4</sub>, resulting not in a “mid-range” estimate but rather a “worst case” estimate. This methodology therefore appears to result in an overestimation of CH<sub>4</sub> emissions from domestic wastewater treatment.
2. The *Draft Inventory* separates central wastewater treatment systems into two categories: aerobic and anaerobic. No direct CH<sub>4</sub> emissions are assumed for the aerobic systems, but an MCF of 0.8 is assumed for the anaerobic systems. As explained in Comment 1 above, we suggest that the MCF should be no more than 0.67 if the system is fully anaerobic. However, exclusive anaerobic treatment of domestic wastewater is not practiced in the U.S. Instead, the general practice is to use facultative lagoons which incorporate a combination of aerobic and anaerobic processes or natural treatment systems such as wetlands that use largely aerobic treatment mechanisms (see Metcalf & Eddy). Given the fact that these systems incorporate both aerobic and anaerobic treatment mechanisms, we suggest that a MCF of less than 0.67 (our recommended maximum value for anaerobic systems from Comment 1) is appropriate for these systems. In the *Planned Improvements Discussion* section of the *Draft Inventory*, EPA indicates their intention to investigate this further and potentially “differentiate between anaerobic systems to allow for the use of different MCFs for different types of anaerobic treatment systems.” We support this planned improvement.

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<sup>1</sup> Tchobanoglous, G., F.L. Burton, and H.D. Stensel, *Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, Inc.* 4<sup>th</sup> Edition, McGraw-Hill, New York, 2003.

<sup>2</sup> Grady, C. P. L., Jr., G. T. Daigger, and H. C. Lim, *Biological Wastewater Treatment*, 2<sup>nd</sup> Edition, Marcel Dekker, NY, 1999.

3. Our analysis indicates that the total nitrogen load to wastewater treatment plants is systematically overestimated in the *Draft Inventory*, resulting in an overestimation of N<sub>2</sub>O emissions from wastewater treatment. The *Draft Inventory* estimates nitrogen discharges to wastewater based on reported annual protein consumption, which is the methodology used in the Intergovernmental Panel on Climate Change (IPCC) protocol document<sup>3</sup> (*IPCC Guidelines*). Expressed as nitrogen (N), the estimate for domestic sources is developed as follows:

$$42.1 \text{ kg protein/person/year} \times 0.16 \text{ kg N/kg protein} \times 1.4 \text{ Factor for Non-Consumption} \\ = 9.43 \text{ kg N/person/year}$$

This is further increased by a factor of 1.25 to account for industrial discharges, resulting in a total value of  $1.25 \times 9.43$  or 11.79 kg N/person/year

This value differs significantly from per capita wastewater discharge rates presented in standard references such as Metcalf & Eddy. Metcalf & Eddy report per capita nitrogen discharge rates to wastewater of 0.015 kg N/person/day. Converting this to a yearly value gives:

$$0.015 \text{ kg N/person/day} \times 365 \text{ days/year} = 5.48 \text{ kg N/person/year}$$

This is less than half the value used in the *Draft Inventory* calculation. The values presented in standard industry references such as Metcalf & Eddy are supported by a wealth of data and have been widely confirmed in U.S. practice. We recommend that the IPCC protocol be replaced by a nitrogen discharge rate based on data collected from wastewater treatment plants in the U.S. This type of data, which was used in Metcalf & Eddy, includes all domestic sources of nitrogen, including meal production and consumption, the use of other nitrogen containing compounds, and both residential and commercial sources. The extent that this data includes incidental industrial discharges is unknown. In our judgment, the “base-line” or “mid-range” estimate of per capita nitrogen discharge should use a standard value near Metcalf & Eddy’s 5.48 kgN/person/year. The uncertainty analysis should then consider the possibility of industrial discharges not incorporated into the standard per capita values, multiplying by the 1.25 factor currently used in the *Draft Inventory*. We recognize that EPA will need data to verify this recommended change, and NACWA is willing to work with EPA to obtain this data from wastewater treatment plants.

4. The *Draft Inventory* utilizes default IPCC emission factors to calculate N<sub>2</sub>O emission rates from wastewater treatment. These emission factors are very uncertain, though, as explained in the *IPCC Guidelines* and noted in the *Planned Improvements Discussion* section of the *Draft Inventory*. For example, the default emission factor for nitrogen discharged in plant effluents is 0.005 kg N<sub>2</sub>O-N/kg sewage-N produced, but the range of possible values extends over many orders of magnitude, from 0.0005 to 0.025 or 0.25. In the *IPCC Guidelines*, the upper bound is shown as 0.025 in Table 11.3 and as 0.25 in Section 6.3.1.2. The upper range used by EPA should be clarified. Also, the results of the uncertainty analysis in the *Draft Inventory* indicate a 95 percent confidence interval of only 38 percent below to 47 percent above the emission estimate, which does not seem to reflect the high degree of uncertainty in the emission factor. Based on this large uncertainty and the seemingly arbitrary choice of the 0.005 factor value in the *IPCC Guidelines*, NACWA believes that more work is needed to refine the emission factors and determine a more accurate N<sub>2</sub>O emission estimate for wastewater treatment.

Thank you for consideration of our comments on the *Draft Inventory*. Please contact Cynthia Finley at 202/296-9836 or [cfinley@nacwa.org](mailto:cfinley@nacwa.org) if you have any questions about NACWA’s comments.

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<sup>3</sup> IPCC, 2006 *IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National 18 Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T., and Tanabe K. (eds.) 19 Published: IGES, Japan, 2006.