NACWA
A Clear Commitment to America's Waters

April 7, 2008

Leif Hockstad
U.S. Environmental Protection Agency
Climate Change Division (6207J)
1200 Pennsylvania Ave, NW
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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: 1990-2006, 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 (EPA) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2006*, *Draft for Public Review* (*Draft Inventory*). NACWA represents the interests of nearly 300 publicly owned wastewater treatment agencies nationwide, serving the majority of the sewered population in the U.S. NACWA members are very much aware of the growing importance of global climate change and are already engaged in activities to reduce greenhouse gas emissions. EPA's *Inventory* will certainly take on added significance as state, regional, and national efforts to curb levels of greenhouse gases increase, and it is important to NACWA members that the *Inventory* estimates accurately represent actual emissions from the wastewater category.

Our review of the *Draft Inventory* indicates that greenhouse gas emissions from wastewater treatment plants may have been over-estimated, and our attached comments outline the factors that have caused the over-estimation. These comments are a revision of the comments NACWA submitted in 2007 for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2005*, *Draft for Public Review*. We appreciate EPA's response to our previous comments and the Agency's willingness to work with NACWA to refine the greenhouse gas emissions estimates for wastewater treatment using a data-driven approach, as opposed to theoretical assumptions. In response to EPA's suggestion that more specific data be provided for use in updating the *Inventory* estimates, NACWA has collected nitrogen loading data from wastewater treatment plants throughout the U.S. We hope that these data will lead to changes in the nitrous oxide emissions estimates made in the *Inventory*.

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

Sincerely,

Cynthia A. Finley
Director, Regulatory Affairs

Attachment

NACWA
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Comments on EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, 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 – 2006*, *Draft for Public Review* (*Draft Inventory*). We are pleased with the adjustments made to the estimation methods in this *Draft Inventory* from the 1990-2005 *Inventory*. We are still concerned, though, that the methodology used for the emission estimates leads to an overestimation of the wastewater treatment greenhouse gas (GHG) emissions. 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 estimates through an uncertainty analysis. However, NACWA has found that some of the factors used in the calculations are overly conservative, which results in elevated values for the emissions estimates and the uncertainty bounds. NACWA's specific comments regarding these factors are provided below. The first two comments, dealing with nitrous oxide emissions, build on the comments that NACWA submitted in 2007 for the 1990 – 2005 *Draft Inventory*. Our concerns about the methane emissions estimates remain the same as in our previous comments.

1. Our analysis indicates that the total nitrogen load to wastewater treatment plants is systematically over-estimated in the *Draft Inventory*, resulting in an overestimation of N_2O 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[1] (*IPCC Guidelines*). Expressed as nitrogen (N), the estimate for domestic sources is developed as follows:

   42.1 kg protein/person/year x 0.16 kg N/kg protein x 1.4 Factor for Non-Consumption
   = 9.43 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 x 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[2]. 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 kg N/person/day x 365 days/year = 5.48 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

[1] IPCC, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National 18 Greenhouse Gas Inventories Programme, Eggleston H.S., Buenida L., Miwa K., Ngara T., and Tanabe K. (eds.) 19 Published: IGES, Japan, 2006.

[2] Tchobanoglous, G., F.L. Burton, and H.D. Stensel, *Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, Inc.* 4th Edition, McGraw-Hill, New York, 2003.

rate based on data collected from wastewater treatment plants in the U.S. This type of data, which was used in Metcalf & Eddy, would represent all domestic sources of nitrogen, including meal production and consumption, the use of other nitrogen containing compounds, and both residential and commercial sources.

To support this request to change the nitrogen discharge rate used in the *Inventory*, NACWA collected data from wastewater utilities that have measured per-capita nitrogen loadings for their communities. The data were found in plant records or in reports prepared by consultants. As shown in Table 1, the data represent 48 wastewater treatment facilities throughout the U.S., with a total service population of over 17 million people. The smallest service population for a wastewater treatment facility included in the data set is 2,000 people, and the largest population is over 2 million people. The collected data therefore provide a reasonable representation of the wastewater treatment nitrogen loading for different sizes of communities and treatment facilities in the U.S. The period of data collection varies, but in many cases the per capita nitrogen loading is based on many years worth of influent loading data. The names, cities, and other information about the treatment facilities are not included in this table, but this information can be provided by NACWA if needed.

The results documented an average per-capita nitrogen loading of 15.09 g/person/day, or 5.51 kg N/person/year, which is consistent with the 5.48 kg N/person/year reported by Metcalf & Eddy. These data include all domestic and commercial sources for these service communities. These data further substantiate NACWA's assertion that industry standard influent total nitrogen data should be used in the *Inventory*, rather than a calculation procedure that does not compare accurately to known and well-documented values. The uncertainty analysis could 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*.

Table 1. Nitrogen loading data from wastewater treatment facilities in the U.S.

State	Service Population (End of Data Period)	Nitrogen Loading (g/person-day)	Period of Data Record
CA	95,000	15.2	1995-2000
CA	80,000	11.0	1995
CA	102,000	16.6	1985-1986
CA	25,800	13.3	1993
CA	200,000	14.4	1988
CA	60,000	16.3	1994
CA	360,000	9.1	1983
CA	35,900	11.4	1995
CA	965,185	15.0	2007
CA	1,337,912	17.0	2007
CA	127,658	13.0	2006
CA	156,759	17.0	2006
CT	18,585	16.8	1998-2005
CT	5,400	20.0	-
CT	12,980	14.1	1999-2001

Table 1 (continued).

State	Service Population (End of Data Period)	Nitrogen Loading (g/person-day)	Period of Data Record
CT	17,650	16.8	-
CT	49,815	13.2	2002-2003
FL	187,320	15.6	1990-1999
IA	-	19.07	-
IL	67,500	10.6	1999
MA	2,060,000	15.0	1986-1987
MA	89,589	15.4	2000
MA	6,986	11.8	2001-2006
MA	9,000	14.1	1997-2000
MN	52,150	7.0	1998
MT	139,200	14.53	2000-2005
MT	31,700	10.44	2003
MT	33,000	9.99	2004
MT	35,700	11.80	2005
NC	800,000	14.53	2007
NE	3,350	16.80	Dec. 2007
NH	17,000	20.0	2005
NJ	192,089	15.9	1999-2001
NM	-	16.8	2002-present
NV	600,000	16.80	2007
NY	26,622	22.7	1997-1999
NY	26,000	16.5	Jan. 2004- July 2007
OR	2,000	19.5	2000-2004
OR	2,000	15.9	1994-2000
OR	60,000	20.43	2005-2006
PA	900,000	9.7	2005
RI	139,000	19.1	1997-1998
TX	875,355	13.2	1996-2005
VA	300,818	15.9	2007
VA	273,356	15.9	July 2005 – June 2006
VA	361,582	14.5	FY 1990-2007
VA	115,000	19.1	2004-2006
VA	412,700	11.53	2001-2003
VA	82,000	18.16	2003-2006
WA	96,500	16.3	April-Oct. 2007

2. The *Draft Inventory* utilizes default IPCC emission factors to calculate N_2O emission rates from wastewater treatment, such as the value of 0.005 kg N_2O N/kg sewage N produced. These emission factors are very uncertain, though, as explained in the *IPCC Guidelines*. More work is needed to refine the emission factors and determine a more accurate N_2O emission estimate for wastewater treatment.

3. We are pleased to see that the procedure for calculating CH_4 emissions from centrally treated wastewater has been modified to account for the BOD removed during primary treatment. However, the maximum CH_4 producing capacity for domestic wastewater, termed the B_o value, of 0.6 kg CH_4/kg BOD still assumes that all organic matter in wastewater treated anaerobically is converted to CH_4, whether it is biodegradable or not. This B_o value is then multiplied by a methane correction factor (MCF) which quantifies how much of the influent organic matter is actually converted to CH_4. 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 and Grady, Daigger, and Lim[3]) 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_4 producing potential was coupled with the maximum potential conversion to CH_4, resulting not in a "mid-range" estimate but rather a "worst case" estimate. This methodology therefore appears to result in an overestimation of CH_4 emissions from domestic wastewater treatment.

4. The *Draft Inventory* separates central wastewater treatment systems into two categories: aerobic and anaerobic. No direct CH_4 emissions are assumed for the aerobic systems, but an MCF of 0.8 is assumed for the anaerobic systems. As explained in Comment 3 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 3) 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.

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

[3] Grady, C. P. L., Jr., G. T. Daigger, and H. C. Lim, *Biological Wastewater Treatment*, 2nd Edition, Marcel Dekker, NY, 1999.