# A Case of Utilizing Results

## Identifying the Emission Factors of Dinitrogen Oxide in Sewage Treatment Processes and Reflecting Them in Greenhouse Gas Inventory

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### 1. Introduction

Of the greenhouse gas emissions from sewerage works, dinitrogen oxide ($N_2O$) accounts for about 10% [1] and, therefore, needs to be reduced. However, there are two main issues: one is that the $N_2O$ emission factors of sewage treatment facilities used in the Cabinet Order for the Law for the Promotion of Measures to Deal with Climate Change and Greenhouse Gas Inventory are greatly uncertain due to the variation in measurement data used as the basis of factor calculation, and the other is that the factors are unified values and do not vary according to treatment methods, and, therefore, do not reflect the actual situation. Therefore, in order to promote climate change countermeasures, we conducted a survey to identify the generation of $N_2O$ from sewage treatment processes and estimated more accurate emission factors from the study findings. Moreover, we present an outline of the Greenhouse Gas Inventory that we revised based on the findings of this study.

### 2. Survey on $N_2O$ emissions and estimation of emission factors

We conducted 37 field surveys of 18 sewage treatment facilities in terms of main sewage treatment methods (conventional activated sludge process, circulating denitrification process, anaerobic-aerobic activated sludge process, pseudo-anaerobic-aerobic process, anaerobic-aerobic process, OD process, MBR process, etc.). As shown in the Figure, the measured values in most sewage treatment facilities were lower than the current $N_2O$ emission factor of 160 mg-$N_2O$ /$m^3$. The reason for this is that the current $N_2O$ emission factor was calculated as an average for a limited number of data, i.e. 8 cases of data from 5 treatment facilities. Therefore, it may be overestimated given the extraordinarily high value (approx. 1,000 mg-$N_2O$ /m3) affected the average. In this survey as well, a certain number of extraordinarily high values were measured in the processes without nitrogen removal, and the average value calculated, 137 mg-$N_2O$ /m3, was close to the current $N_2O$ emission factor. In contrast, in the treatment methods with nitrogen removal, there were no extraordinarily high values detected and the average was low at 9 mg-$N_2O$ /$m^3$. Thus, the value of the $N_2O$ emission factor differed greatly between treatment with and without nitrogen removal.

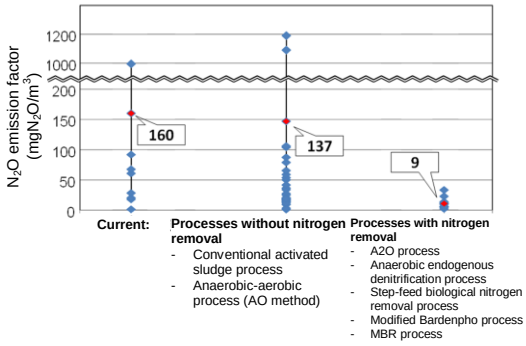


**Figure: Current Values and Estimated Values from Survey Results**

### 3. Reflection in Greenhouse Gas Inventory

Emission factors according to wastewater treatment methods were newly developed, as shown in the Table, using the data of this survey and other surveys. [2] In response to these values, the factors of "$N_2O$ Emissions from Treatment of Household / Commercial Wastewater (Sewage Treatment Facilities)" in the Greenhouse Gas Inventory were revised [3] and incorporated into Japan's greenhouse gas emissions reports up to fiscal 2011. We will continue to work to promote climate change countermeasures.

**Table: Revised $N_2O$ Emission Factors in Sewage Treatment Facilities [2]**

| Conventional activated sludge process | Anaerobic-aerobic activated sludge process | Anaerobic-anoxic-oxic process<br>Circulating denitrification process | Circulating nitrification denitrification type Membrane separation activated sludge process |
|---|---|---|---|
| 142 | 29.2 | 11.7 | 0.5 |

(Unit: mg$N_2O$/$m^3$)

**[Reference]**

1) Miyamoto et al, "Collection of Presentations of Studies on Wastewater Systems," 2010, pp. 155-157.
2) Ministry of the Environment Task Force for Reviewing Greenhouse Gas Emissions Calculation Method, "Results of Review concerning Greenhouse Gas Emissions Calculation -- Improvement of the Calculation Method Used for the Waste Treatment, March 2013, p. 3.
3) National Greenhouse Gas Inventory Report of Japan, April 2013.