News Release

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Hitachi Zosen Corporation

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Completion of Joint Research with Japan Institute of Wastewater Engineering and Technology

～ To Reduce N_2O Emissions form Sewage Treatment Plants Investigated Relationship with Higher Temp. ～

Hitachi Zosen Corporation (hereinafter “Hitachi Zosen”) has completed a joint research project on reducing N_2O emissions at sewage treatment plants together with Japan Institute of Wastewater Engineering and Technology (Shinjuku-ku, Tokyo, Chairperson of the Board; Katsuhisa Shioji, hereinafter "JIWET"), and has confirmed that increasing the combustion temperature in sewage sludge incinerators to a higher temperature will reduce N_2O emissions.

The joint research conducted by JIWET with private companies aims to solve complex and advanced issues in the field of sewerage which local governments are facing. The purpose is to compile the effectiveness, application scope, and points of attention of the technologies developed by private companies into technical manuals and technical materials. This "Joint Research on Technologies for Reducing N_2O Emissions at Sewage Treatment Plants" was conducted by JIWET, SANKI ENGINEERING CO., LTD. (water treatment), and Hitachi Zosen (sludge incineration) during the research period:　October 2022 to March 2024, and we have been conducting research on technologies to reduce N_2O emissions from sludge incineration at sewage treatment plants.

This collaborative study was conducted under the guidance of the Joint Research Committee on Sludge Treatment and Recycle Technology Study, which consists of academics in specialized fields and experienced practitioners in local governments, as well as the superior Technical Committee. It received guidance and advice from a fair, neutral, and expert perspective. As a result, we are now able to publish the results of our research as a technical document.

The domestic sewerage sector emits approximately 5 million tons-CO_2 of greenhouse gases (GHG) annually, which constitutes a significant proportion of GHG emissions associated with the business activities of local governments. N_2O, which is generated from sewage treatment and sludge incineration, has a global warming effect about 265 times that of CO_2. As it accounts for about 25% of GHG emitted from sewage sector, reducing N_2O emissions is crucial for reducing GHG emissions.

In this joint research, we examined technologies to reduce N_2O emissions from sewage sludge incinerators. The main findings of the research were the following three points:

1.Combustion Temperature and N_2O Emission Reduction

Based on the 2022 performance survey on new type incinerators※ by Ministry of Land, Infrastructure, Transport and Tourism (hereinafter “MLIT”) and our demonstration test results, N_2O emissions from sewage sludge incinerators have been significantly reduced by increasing the combustion temperature to over 900°C. In other words, we found that N_2O emissions from sludge incinerators depend on the furnace combustion temperature. In particular, the median N_2O emission factor for combustion at 900°C or higher in the new type incinerators was 35 g-N_2O/wet-t. Compared to the median N_2O emission factor of 199 g-N_2O/wet-t for combustion at over 850°C to less than 900°C, the N_2O reduction was 82.4%. Furthermore, the median N_2O emission factor in our demonstration test was significantly lower at 0.8 g-N_2O/wet-t.

2. N_2O Emission Coefficient

We verified the actual measurement of the N_2O emission coefficient of the new type incinerators based on the 2022 performance survey by MLIT and compared it with the N_2O emission factor in the Manual on Global Warming Countermeasures (Ministry of the Environment・MLIT). In this joint research, we proposed a median N_2O emission factor of 35 g-N_2O/wet-t for the incineration of sewage sludge at over 900°C, as an additional category, based on the 2022 performance survey by MLIT.

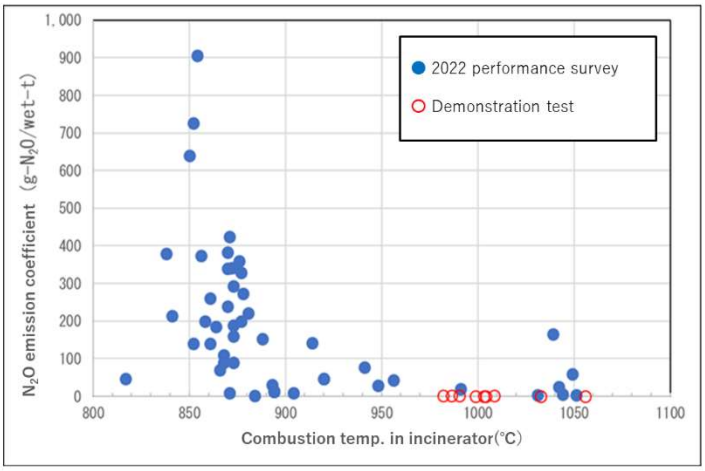
3.Case Study on GHG Emissions

We worked on a case study of GHGs emissions from a sludge treatment plant when mixed raw sludge and digested sludge are incinerated at temperatures over 900°C. As a result, in a stoker incinerator, the total GHG emissions from the combustion of mixed raw sludge were significantly lower than those from a fluidized-bed incinerator. In addition, the GHG emissions for dewatered sludge throughput of over 100 t-wet/day were negative. Furthermore, as the amount of dewatered sludge treatment increased, the GHG emission reduction effect increased. In the case of digested sludge, since it is self-combustible, all the digestion gas could be used for power generation, resulting in a significant negative GHG emissions.

We aim to realize stable treatment of sewage sludge by leveraging the technology of stoker incinerator developed in waste-to-energy plants, while contributing to the achievement of the SDGs and the realization of a sustainable society.

※ Incinerators with an N_2O emission coefficient, as defined in the Manual on Global Warming Countermeasures in Sewerage, lower than that of sewage sludge dewatered with polymer coagulant and incinerated at high temperature of 850°C in a fluidized-bed incinerator.

【Reference : Combustion temperature and N_2O emission coefficient (per wet-1 ton, over 900°C)】

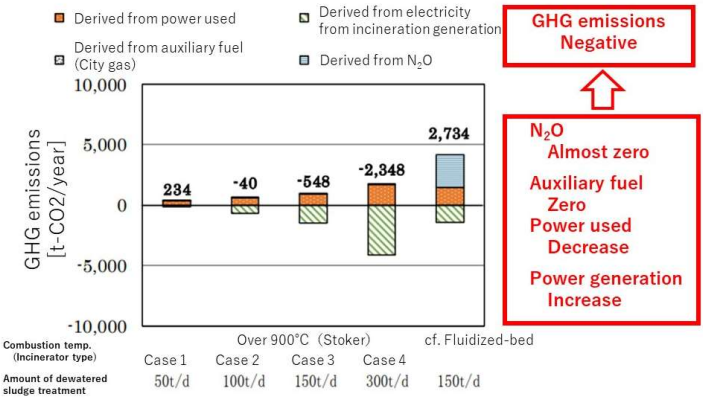


Combustion temp.	N_2O emissions (g-N_2O/wet-t)				N_2O emissions (g-N_2O/t-DS)			
	Max.	Min.	Avg.	Median	Max.	Min.	Avg.	Median
2022 performance survey								
Over 850℃ to less than 900℃	906	2	240	199	4,441	3	1,116	921
900℃ or higher	166	4	48	35	363	6	115	72
N2O reduction			80.0%	82.4%			89.7%	92.2%
Demonstration test								
900℃ or higher	1.9	0.01	0.9	0.8	9.2	0.03	5.1	4.0

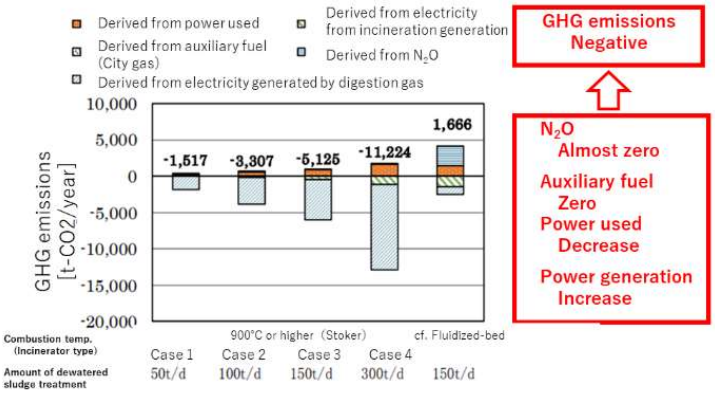
Number of data n : 2022 performance survey n=47, Demonstration test n=9

【Source: "2022 Performance Survey" (MLIT), "Demonstration Test Results" (Hitachi Zosen)】

Trial calculation result of GHG emissions (Mixed raw sludge)



Trial calculation result of GHG emissions (Digested sludge)



(Note) GHG emissions calculation exclude digestion gas (auxiliary fuel)

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