

IWA Webinar “Monitoring and mitigating nitrous oxide: Danish lessons for global action”
Post Webinar Report – 04/09/2023

Webinar available at: <https://iwa-network.org/learn/monitoring-and-mitigating-nitrous-oxide-danish-lessons-for-global-action/>

Questions received from participants during registration:

#	Questions	Speaker	Answer
1	How do you envision the upcoming N2O taxation will influence how N2O is monitored? Can we use online monitoring for taxation?	Anna Katrine	Anna Katrine: In my opinion, because of the inherent temporal fluctuation in N2O production, some sort of high-resolution temporal measurement will be needed.
2	How do we approach the regulators, as an industry, to improve reporting methodologies such as emission factors	Anna Katrine	Anna Katrine: As Mikkel mentioned during the webinar, it would be great some sort of standard for documenting measurements and the meta data connected to such measurements.
3	What is your advice for municipalities that are just getting started with monitoring and controlling N2O?		Anna Katrine: <ol style="list-style-type: none"> 1. Do an analysis of the number and type of WWTPs in your municipality in order to determine the most suitable measurement technique. 2. Then start measuring to determine a baseline. 3. Gather concurrent operational data in order to determine pathways responsible for N2O emissions 4. Implement dedicated mitigation strategies
4	What technologies have shown to better manage nitrous oxide	Anna Katrine	Anna Katrine: It depends on the WWTP layout, possible control handles and predominant pathways for the N2O production

	emissions from secondary treatment?		
5	Is there a correlation between higher-level data and emissions intensity that could use to estimate a facility's emissions	Anna Katrine	Anna Katrine: It depends what is meant by higher level data. But in NL STOWA has published a risk model based on NH4 and NO2 concentrations in the effluent. This sort of approach could work for plants that have similar layouts.
6	What techniques can be applied to reduce nitrous oxide emissions, what are the remaining questions that need to be answered		As for Q8: It depends on the WWTP layout, possible control handles and predominant pathways for the N2O production
7	What are the key three drivers for utilities to act on mitigation strategies?		AK: <ul style="list-style-type: none"> - ESG goals to reduce CO2 footprint - Being prepared for future regulation - Mitigation strategies might go hand in hand with other operational objectives (e.g. equalizing flow to operate equipment at optimal range).
8	What was the approximate investment per plant related to N2O during this exercise? What are the key generic insights obtained?		AK: Four WWTP varying between 50.000 PE to 400.000 PE have reported approx. costs of euro 20-45k for monitoring campaigns of 6-12 months based on liquid phase sensors.

Questions received from participants via the Q&A:

#	Questions	Speaker	Answer
1	A large emission factor range. Have you collected any data from pure O2 activated sludge systems ?		live answered

2	Can I ask if you think WWTP size will have an impact on emissions factors? In many cases smaller WWTPs may be more inefficient and might not have the same possibilities for control in the aeration basins (or influent balancing etc)?		live answered
3	From monitoring experience, can you comment on other environmental and/or operating condition variables that influence emission variation. e.g. temperature, feed split/COD availability or aeration rate? I note the two examples you presented appear to be attributed to N load		live answered
4	One of the topics in water sector was climate neutrality. Is there a common standard or definition for this term in Denmark?		So far, the so-called "Parismodel" for the water sector have been used. This is a simple model of the emissions from the operational phase. I'll see if I can find some published info on this in English to add as info with the post-webinar info.
5	Does controlling aeration to minimise energy demand from blowers cause more GHG emissions due to N ₂ O release?		live answered
6	Mikkel, in your opinion, what sensor setup should be present in an utilities plant to monitor & report the N ₂ O emissions ?		live answered
7	Great presentation Mikkel. Thank you. Really liked the optimisation slide. Sludge age is an interesting one. Do we have data which indicates the influence of sludge age / changes in microbial composition? Is this collected from a single process or compared across sites?		Hi Peter, We do have data, see in this link: https://pubmed.ncbi.nlm.nih.gov/35594748/
8	Do you think the reduction of N ₂ O emissions will come from adjusting the way the plants are operated or from the		live answered

	development of new technologies?		
9	Do you think the reduction of N2O emissions will come from adjusting the way the plants are operated or from the development of new technologies?		Dear Anne-Maëlle, In all cases i have been involved in, adjusting plant operation has led to 30-70% N2O reduction without extra kWh usage. DO/ABAC, COD/N balance and nitrates controllers are efficient tools for N2O reductions. newly developed intensifications should be monitored to make sure that they er CO2e-sound.
10	For either presenter - have you experience in measuring from systems such as oxidation ditches (or other plug-flow type systems) and systems such as constructed wetlands? Thank you for the talks and the variation in emissions between WWTPs factors seems to be a huge issue and agree we can optimise both energy efficiency and emissions but also discharge standards.		live answered
11	Has Denmark developed updated design guidelines reflecting the new understanding of N2O emissions.?		live answered
12	Some are using Henry's law to calculate offgas from liquid phase. Does this seem reasonable? Whats the benefits/ pitfalls?		please connect via email if more information is needed: mha@unisense.com Also see this paper: https://www.sciencedirect.com/science/article/abs/pii/S004313542030381X
13	Are there mature technologies for the conversion and reuse of N2O under the concentrations found in a WWTP?		AK: There are a lot of investigations into thermal conversion, catalytic and biological conversion, but
14	What timeframe is likely to see a significant reduction / mitigation in N2O emissions in wastewater treatment? are we likely to see significant progress prior to 2030? What		We will see reductions in denmark once regulations are in place, regulations will to be a key driver for utilities.

	can we do about new plants coming online into the future?		
15	The only solution to limit the N2O emission is to create financial or regulatory incentive!. But what should the limit value be and how do we uphold/control/monitor that limit and calculate a "tax" it...?		AK: Agree. It will be a challenging task to form a model that are both precise and generates incentive for action.