

**IWA Webinar “Quantifying, Modelling and Mitigating Process Emissions-
Masterclass 1”
Post Webinar Report – 19/04/2022**

Webinar available at: <https://iwa-network.org/learn/process-emissions-masterclass-1/>

Questions received from participants during registration:

#	Questions	Speaker	Answer
1	What role does on-line nutrient monitoring play in drive to reduce GHGs		It is possible to minimize GHG emission by more accurate control hence online control would seem to be a necessity
2	Why is CO2 from organics oxidation not monitored whilst N2O is monitored. They are both part of the Carbon and Nitrogen Cycle.		A good question and in reality, all emissions of CO2 should be reduced. It could be argued that N2O is more potent.
3	With more process N2O monitoring will we adjust calculation methods to closer correlate between calculated & measured emissions		Yes – in Denmark we are now using a factor different to the IPCC factor due to measurements
4	Is there a possibility to use affordable technology tools like Foldascope to monitor key microbes to predict NOx emissions		
5	Has any consideration been give to how we can harness these emissions in a beneficial manner beyond current norms?		Not so far- to the best of my knowledge
6	What prevents us from accurately predicting WwTP N2O & CH4 emissions?		Difficult to measure and validate the predictions
7	How do you compare reliance, availability and preference for sensor measurements, lab analyses of grab samples and simulation?		

Questions received from participants via the Q&A:

#	Questions	Speaker	Answer
1	How relevant are the emissions from Storage (dams)? and are these even considered anthropogenic ?		So far based on my understanding the emissions of CH ₄ and N ₂ O are not required to report in the IPCC and national guidelines. But I think if the dam is receiving any wastewater effluent stream from upstream, which may bring C&N in, this should be considered anthropogenic.
2	How relevant are N ₂ O emission in simple aerobic WWTPs that are NOT designed to do Biological Nitrogen Removal (BNR)?		If the plant is not designed for N removal but only COD removal, there are much less N ₂ O generated, since the nitrification and denitrification processes will be much less compared with the plant that will remove N;
3	Is it correct to assume that generally WWTPs with more advanced treatments including BNR produce more N ₂ O emissions than a conventional activated sludge processes?		Yes, it's a valid assumption. As N ₂ O is mainly produced during biological N removal process
4	Sorry - was wondering how much Oxygen limitation in the SBRs affected production rates?		If your question is about the DO impact on N ₂ O production in SRR, the answer is DO will play a role but low DO doesn't mean a higher N ₂ O emission. If you can find a publication on a full-scale mitigation study, Duan et al, 2020 in Water Research, it tells exactly what happened of DO effect on N ₂ O emissions in a full-scale SBR process
5	Does the panel think that the desired outcome, reduction, is more important than accurate measurement? As long as we reduce in a reproducibly		live answered

	measurable way the absolute value of e.g N2O is not vital		
6	Does the panel think that the desired outcome, reduction, is more important than accurate measurement? As long as we reduce in a reproducibly measurable way the absolute value of e.g N2O is not vital		in my opinion accurate measurement is needed to verify reduction however it is not needed to establish full year baseline. as mentioned, it is silly to measure for 12 months just to see what the variations are, we can use other methods to look at the historical data and monitor, mitigate and monitor either with physical measurements or soft sensor going forward
7	Do the mitigation strategies have an impact on the performance of the plant?		live answered
8	Do the mitigation strategies have an impact on the performance of the plant?		yes it normally improves process efficiency because N2O can be considered a by-product of process inefficiency
9	Does the book focus on the stresses of ammonia load fluctuation has on the suspended growth system? I am curious about how reactor configurations (plug flow vs. CSTR) and then the diurnal pattern of influent load impacts the N2O emissions.		Hi Daniel - yes the book does cover the ammonia load fluctuation as one of the drivers of N2O production and we'll have Masterclass 2 which will cover this in more detail. Chapters 2 and 3 will be a really good overview here and please bring more questions to Masterclass 2!
10	Does the book focus on the stresses of ammonia load fluctuation has on the suspended growth system? I am curious about how reactor		The N2O emission sometime did follow the same pattern of the flow, if you receiving a higher N loading, sometime, you may see an increase of N2O emission. My current knowledge is that the configuration itself is not the key that affect the N2O emission, it's more the "operation conditions" that you've

	configurations (plug flow vs. CSTR) and then the diurnal pattern of influent load impacts the N ₂ O emissions.		applied to operate. Chapter 6 has some interesting discussion around the configuration impact and the loading impact.
11	Can you name some utilities using Tier 3 EFs? and are there case studies available?		Yes, In Australia, SA Water, Melbourne Water, Water Corporation. In Denmark, you will see a talk soon from a panel member. also a few in UK, Spain, Netherland, Austria.... If you to chapter 5 of the book, in the quantification chapter, it mentioned the specific methods applied to the full-scale studies.
12	Does the book focus on the non-optimal operation of WWTPs which is one of the common feature in emerging economies, where the capacity building in terms of WWTP building is not matched by operational knowledge of the plant operators and inadequate supply of electricity?		There is no specific chapter addressing the point you raised up, but in the full-scale studies, many plants are not operated under “optimised operation” condition. I think these were covered in the quantification campaign. However, the current studies did show a trend that N ₂ O emission factor seems to be decreasing along with the increase of TN removal (see the figure in Chapter 11). That more or less tells us, the better your plant performance is, the less N ₂ O it is generating...
13	Other than country level reporting, is there any value in the Tier 1 EFs for reducing emissions? They are so coarse, and provide no guidance on whether a treatment asset is being operated well or not, or what changes could be made to reduce emissions.		This is a really important comment. The IPCC EF does provide conservative estimates, so the need for countries to report using these in the absence of improved Tier 2 and 3 methods is important however to actually understand at facility level we need site based approaches - e.g. Tier 3. There are some emerging examples of Tier 2 (e.g. national approaches) to estimate EFs across different asset types but this remains very much emerging from a number of studies and even if this gives us a better EF for a class of assets, we still need site level monitoring to actually mitigate.

14	For reported EF for sidestream reactor, is the EF based on N load into the sidestream reactor or the N load in the influent?		N load into the sidestream reactor
15	Are the hood measurement devices ATEX rated?		If the devices referred to the “floating hoods”, the hoods itself can be made by different materials, I know some water utilities are using steel to make the hoods.
16	what do we mean by mechanistic model?		This is based on the mechanisms, which is the understanding of the bacterial pathways and chemical reactions we know. If you refer to chapter 7 and 8, these chapter introduce the models developed based on the biological pathways.
17	@Liu, now you have changed my thought process in this. I would then say the reactor configurations (i.e. plug flow) can create limitations in mass transfer (i.e. OUR limitations) which then creates the operational conditions (DO Sag). Therefore reactor configurations may not be the direct link, but can be the first part in a chain reaction.	Liu Ye	Hope this change is a positive one:). Yes, I agree that the reactor configuration may be the first part in the reaction chain, but how it reacted is required decided by how you are going to control it and the operation will play the major role rather than the “design”.
18	Is there a difference in the mass of N ₂ O produced between nitrification and denitrification processes? Or are they pretty much the same?		Different emission pathways have different contribution to the total N ₂ O emitted, it depends on the operational conditions

19	If we can monitor NH ₄ , NO ₂ , NO ₃ , and liquid N ₂ O (together with DO, pH, ORP, airflow...), is it sufficient to build the control strategy to minimize N ₂ O?		In theory, if you have enough on-line sensors and also a good model of your plant, it'll be enough.
20	Question on the CO ₂ tax mention in Denmark. Is the tax to be paid for direct CH ₄ and N ₂ O emissions or only CO ₂ -e (from electricity)?	Per Henrick Nelson	It is still not clear how the regulation/tax will be introduced but most likely a direct payment. The tax on effluent (BOD, TH,TP) is based on kg discharged
21	Does the MABR emit less N ₂ O due to the improved oxygen transfer efficiency through the membranes? Or are there other reasons for the lower emissions?		we should compare optimized MABR for N ₂ O with optimized other process for N ₂ O to get a fair comparison
22	In case of BNR plant operated at same conditions, can we predict the contribution separately in nitrification vs denitrification		It can be predicted by modelling, but often difficult to validate with direct measurements
23	Agreed, accurate measurement is needed for verification. Process control would be based on difficult to measure parameters that need high maintenance instruments. We might be better off		indeed accurate measurement of N ₂ O is not needed for control purposes

	with simple to measure parameters.		
24	Does VCS have a Net Zero target? And if so does it include Scope 3 emissions?		Answered live
25	Can you take more about the catalytic process.		The project is in its early phases and results are not available yet. However it is a relative simple treatment of offgas/ventilation air running it through a catalytic converter. One of the problems are the need for heating the air before treatment