N2ORisk DSS FAQs

Is the water sector ready for a solution like the *N2ORisk DSS* or is it too early?

Answer: The approach is simple, but powerful because it is based on the knowledge of N_2O pathways and influencing factors – knowledge we have gained from research over the last 10 years. The time to apply this knowledge and start taking climate action and targeting low-hanging fruit like N_2O is now. We have the knowledge, we have the tools, and we can now more easily measure N_2O. As a water sector, we no longer have an excuse to wait.

If there is data (either offline or online), we can assess risk and identify mitigation strategies. We can measure N_2O to immediately verify effectiveness of mitigation strategies. We have trained accurate machine learning models. We have also demonstrated how the mitigation works in multiple plants and have gotten very good results. It is not too early.

What type of N_2O mitigation strategies can be identified with the *N2ORisk DSS*?

Answer: Low dissolved oxygen (DO) in the process is one risk factor. There is also High DO. We have seen that in most cases it will either be one or both that pose a problem in nitrification. So the mitigation strategies would be to either increase or decrease DO from current levels at different times of the day. However, other risk factors include low pH and COD/N for denitrification which can be addressed with carbon dosing.

We also do not only look at risk. The idea is to concurrently look at other process parameters like MLSS, ammonia, nitrate, wasting rates, and SRT which can directly impact DO or other risks. When looking at risk and emissions with process data dynamically, correlations can be easily spotted. The process engineer can then decide whether it makes sense to adjust DO or carbon dosing to lower risk, or adjust other process parameters that can directly lower risk, and N_2O emissions indirectly.

Looking at the continuous machine learning training results also helps identify which parameters are directly affecting risk, and N_2O indirectly. We can provide this insight from the backend, but the data science tools we will soon be adding will also allow users to identify and quantify correlations. And if there is no risk, then you will now know that, and knowing whether you have a problem or not is already powerful and provides a value that does not currently exist.

Is a lot of data needed to train machine learning (ML) models and accurately predict N_2O?

Answer: Machine learning (ML) supplements and extends actual measurements. Measurements should always be in place, so technically ML is not needed, but is there to add value to be able to predict N_2O in other places in the plant where you do not have sensors (like in parallel trains) but have process data. ML can also serve as fault detection for N_2O sensors. For a given set of conditions, the ML model can be trained extremely fast (without needing to collect a lot of data for a long period of time) to predict N_2O very accurately for current conditions. As conditions change, the model immediately learns and adjusts. If needed, we can even apply models trained with data from other plants (covering a wide range of temperatures and conditions) and still get fairly good accuracy – much better than using IPCC emission factors. But the idea is that each plant will have its own model.

As we have seen with the risk, the conditions leading to N_2O production are very consistent from plant to plant, so it is not surprising the predictability of N_2O is high. The combination of conditions is what can vary widely from plant to plant. But that is what the risk and ML model helps us track closely so that we can easily mitigate.

What is the suitability and robustness of the *N2ORisk DSS* throughout the year, with varying seasonal conditions?

Answer: We have validated the risk outputs with a 15-month historical dataset (NL), as well as with datasets with plants across the world (USA – 12 plants summer and winter; Spain – 2 plants summer and winter; NL – 4 plants summer and winter), and spanning various seasonal conditions. The high total GHG reductions we have achieved have been in both summer (40%), and winter (70%) conditions. We do not yet have an installation running for 12 months, but the suitability in different conditions has been demonstrated. With the optional ML-based optimization feature to be added soon, the process can also be fine-tuned to always maximize N_2O reduction as desired, and as the process changes and as seasons change.

Is there a general lack of awareness of what role N_2O can have in achieving net zero emissions?

Answer: Yes, indeed. We are making efforts in raising this awareness. See recent LinkedIn article here…
https://www.linkedin.com/pulse/n2o-low-hanging-fruit-net-zero-water-utilities-jose-c-porro/

There are a lot of options out there. What does the *N2ORisk DSS* provide that other options do not?

Answer: To our knowledge, the *N2ORisk DSS* is the only AI N_2O solution commercially available. We are not aware of a lot, or any other options.

What do you recommend for water utilities considering developing an N_2O solution in house?

Answer: If developing a solution in house, the N_2O expertise and experience mitigating in multiple plants and applying AI for this specific problem may not be available. It could be beneficial to put the responsibility on the top experts in the field of N_2O and use time and resources of in-house staff on other solutions. Progress on N_2O and net zero could also be achieved much faster using the *N2ORisk DSS* than with a solution that has to be developed from scratch.

Can the fine-tuning of the AI solution be tricky?

Answer: The predictability of N_2O has been very high and the fine-tuning is based on this predictability. Furthermore, because it is self-learning, predictability only gets better with time.

Is it difficult to justify the cost of the solution?

Answer: The solution is like getting access to an expert 24/7, plus reducing a large percentage of GHG on top of getting the expert insights. Compared to other options for reducing or offsetting an equivalent CO_2e, it can be almost three times lower on a cost per tons of CO_2e basis. The pricing is also flexible based on whether there is a need to mitigate. The biggest value is in the large GHG reduction without capex. So if reduction is not needed, then the subscription price is only 2000 EUR to do the risk analysis throughout the year and confirm mitigation is not needed throughout the year. For info on pricing and possible package deals, please contact us…. info@cobaltwater-global.com

How can you ensure that cost, emissions, and effluent are all minimized together?

Answer: These are all tracked individually to be able to confirm and make manual adjustments to find the right balance, but the optional ML-based optimization is intended to find the balance you want for you.

How is data quality addressed?

Answer: The general SCADA data quality has to be known ahead of time and we assume that data quality is already being addressed to some degree; however, fault-detection can be used to address data quality if data quality is a concern.

What if there is missing data?

Answer: Data gaps can be filled but initial focus can also be on what is available to get immediate reductions. Offline or lab data can even be used initially to fill gaps. An onboarding interview is used to discuss data availability and to determine whether the solution will provide value based on the data availability before committing to a subscription.

What if there are no regulatory drivers to reduce N_2O?

Answer: This is true in most cases, not all (Denmark, NYC have regulations), but net zero pledges are effectively like regulatory drivers. It is only a matter of time before even more pressure and regulations to reduce GHG emissions come. Furthermore, since in each case we have seen the overall process efficiency to improve, if there is interest in improving process efficiency and at the same time be able to claim GHG reductions, then you can be ahead of the game with the *N2ORisk DSS*.

What if some WRRF operators are not ready for AI solutions yet or feel that it may be too complicated to operate the system with the solution?

Answer: The support services are intended to provide expert, human support to always maintain a high comfort level. Because, it the solution is based on knowledge and risk is based on easy to understand operational parameters, it is not a black box. It does not get simpler than "lower DO setpoint or increase DO setpoint to low risk value". Furthermore, the solution can be kept as simple as desired at the operations staff discretion.

Is the solution only applicable for high-risk WRRFs?

Answer: An assessment is required to determine which WRRFs are at high risk and that is what the solution verifies - whether there is risk or not, and if there is, what can be done. If there is no risk or very little risk, low emissions estimated, and no mitigation needed, subscription to do the risk analysis throughout the year is 2000 EUR. It can very well be that risk and emissions change during the year.

What is the relation between N_2O and effluent water quality?

Answer: N_2O reduction is closely correlated with increased process efficiency, lower ammonia peaks, lower nitrate, better BioP removal. So improving treatment and effluent quality. Control actions will also be validated by expert process knowledge and tested in one treatment line before implementing them for the whole plant.

Are N_2O sensors needed?

Answer: Either N_2O sensors or off-gas analyzer are needed for emissions verification, but the *N2ORisk DSS* can be used first to determine if there is risk and to estimate emissions before purchasing sensors, or to prioritize which plants to measure first based on risk and an estimate of emissions. At least one or two sensors will eventually be needed but not to begin using *N2ORisk DSS*. *N2ORisk DSS* can also minimize the number of sensors needed because the ML can be used to predict and monitor N_2O in other locations. You can either equip a plant with 10 hardware sensors, or only with 2 with our solution and use ML to have 8 soft sensors instead of hard ones.
Important note: sensor maintenance can be labor-intensive and expensive in a plant. If you only need to maintain 2 instead of 10, that is a huge cost saving.

Will pay-back be limited if the WRRF is already well-optimized?

Answer: If already well optimized, lower tier subscription is charged to be able to check how well site remains optimized for N_2O throughout the year. The value is in knowing, and this will be critical for reporting. If you do not assess, you will not know.

Does it make more sense to first monitor with N_2O sensors and perhaps use simpler control algorithms?

Answer: The *N2ORisk DSS* can be used first to prioritize which sites get measured first based on risk and estimated emissions. Control actions can be as simple as desired. It does not get simpler than "lower DO or increase DO to low risk value". Or "increase carbon dose to meet low risk C/N ratio". ML-based optimization is optional and added later once the team is comfortable with simply adjusting process to knowledge-based set points.

Is the solution compatible with existing aeration controls that are in place?

Answer: Many times the existing control strategy can stay in place and is only fine-tuned based on the expert insights to minimize N_2O risk and emissions.

What if N_2O is not a problem and other problems exist?

Answer: The *N2ORisk DSS* will help confirm whether N_2O is a problem. Without assessing it is not known. For other problems, the same AI approach can be applied. Sludge bulking risk, for example, can be added to the DSS as can other process risks or analyses with the expert knowledge/ML framework. Please feel free to contact us to discuss how we can use our AI and water expertise to help solve other problems and add value to your planning on operations… info@cobaltwater-global.com