

Continuous monitoring reveals **nitrite accumulation** as the likely driver of elevated nitrous oxide emissions

Stabilising nitrification

Bammental · Baden-Württemberg · Germany



EmiCo lite at the aeration tank

KEY FACTS

- Continuous monitoring returned an **emission factor of 1.02%**, with nitrous oxide causing **97.5%** of the biological stage's greenhouse-gas footprint.
- The data point to **nitrite accumulation** as the likely driver of the elevated N_2O emissions, indicating intermittently unstable nitrification.
- The analysis identified three concrete levers to stabilise the process: a stable dissolved oxygen around **2 mg/L**, **pH above 7**, and watching the COD/TN ratio.

PROJECT AT A GLANCE

1.02 %

N_2O -N EMISSION FACTOR

76 days

CONTINUOUS N_2O MONITORING

97.5 %

N_2O SHARE OF THE GHG FOOTPRINT

3

OPTIMISATION APPROACHES

activated sludge with digestion

1 The starting point

The Bammental wastewater treatment plant operates a continuously aerated activated-sludge tank. Over a 76-day campaign, an EmiCo lite system continuously measured N_2O , CH_4 , CO_2 and O_2 in the off-gas. The aim was to capture the greenhouse-gas emissions of the biological stage and to identify possible causes of the elevated nitrous oxide emissions.

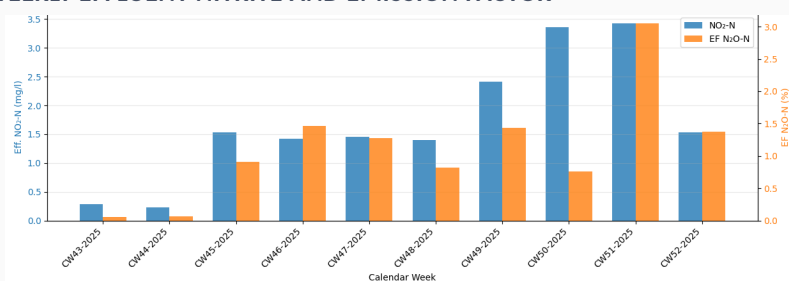
2 What continuous monitoring revealed

Continuous monitoring returned an **emission factor of 1.02%**, with nitrous oxide causing **97.5%** of the biological stage's greenhouse-gas footprint. Comparing low- and high-emission operating states, an elevated **effluent nitrite** concentration stood out in particular. The results indicate that nitrite accumulation, resulting from intermittently unstable nitrification, was a major driver of the elevated N_2O emissions.

3 What drives it, and how to fix it

The data point to two likely triggers: an intermittently low dissolved oxygen that drops toward **1 mg/L** in high-emission phases (NOB are more sensitive to oxygen shortage than AOB), and a **pH below 7**. In addition, incomplete denitrification from a low COD/TN ratio could support N_2O formation. This yields three concrete optimisation approaches: ensure a stable DO around **2 mg/L**, keep **pH above 7**, and watch the COD/TN ratio.

WEEKLY EFFLUENT NITRITE AND EMISSION FACTOR



Continuous monitoring linked elevated weekly effluent nitrite concentrations with increased N_2O emissions, identifying unstable nitrification as the likely cause. Based on these findings, three concrete optimisation approaches were derived to stabilise the process.

THE TAKEAWAY

Continuous monitoring captures not only greenhouse-gas emissions but also makes the underlying process causes visible. Here, it turned a **1.02%** emission factor into three concrete optimisation approaches to stabilise nitrification.