

Experiences with DEMON reactor at HCR Syd

Reject water seminar at HCR Syd
30th & 31st of March 2022

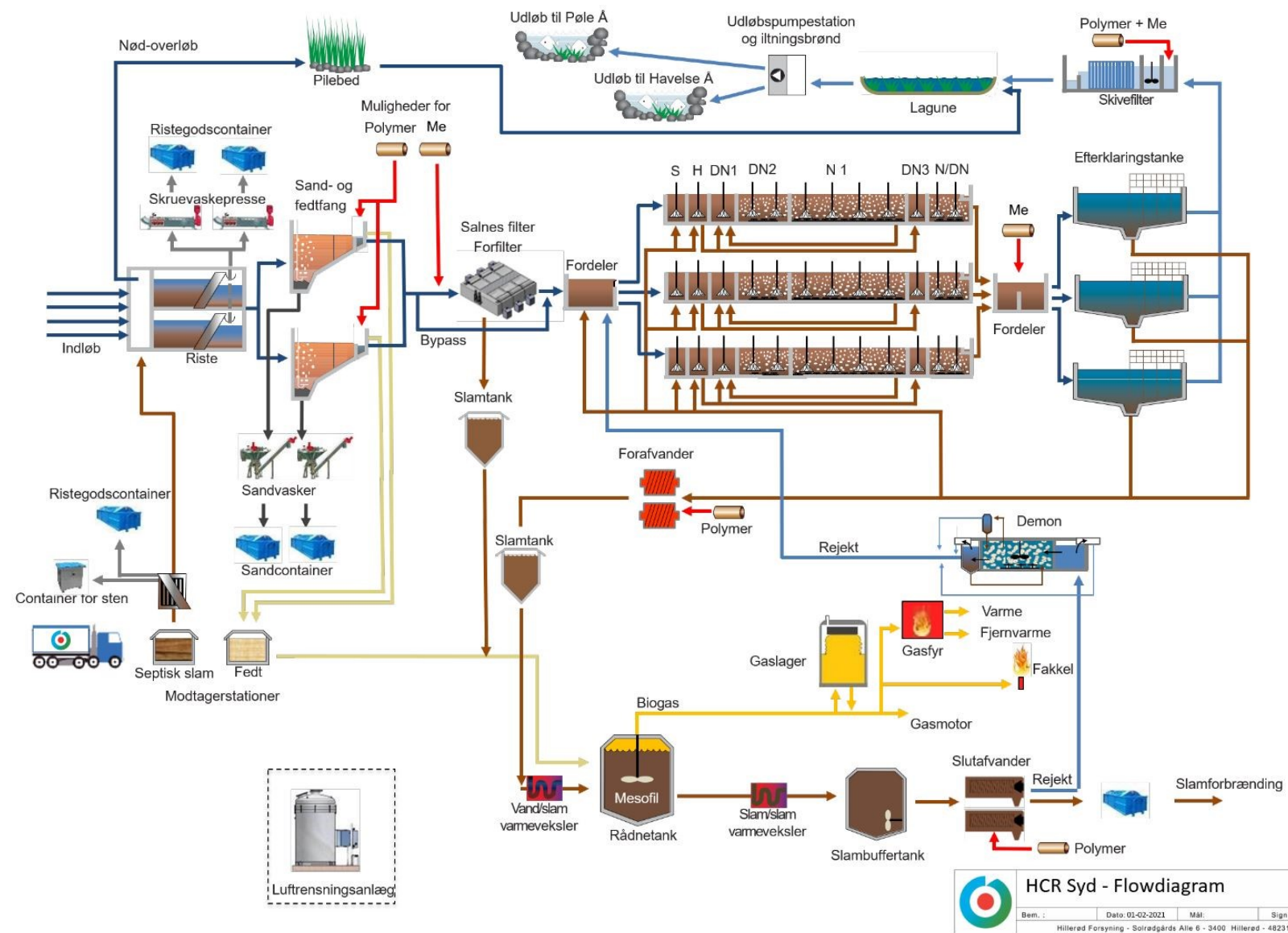
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An aerial photograph of a wastewater treatment plant. The facility features several large circular tanks, including a prominent black one in the foreground and a white one to its right. Two smaller white vertical tanks are positioned near the black tank. A building with a green roof is visible on the left side of the plant. The entire facility is enclosed by a fence. In the background, a multi-lane highway runs horizontally across the frame. The surrounding landscape consists of brown, tilled agricultural fields. A stylized circular logo is located in the bottom right corner of the image.



HCR Syd



Build in 2016-2018 – first fully covered in DK

Capacity: 65.000 PE (mechanically)
100.000 PE (hydraulic)

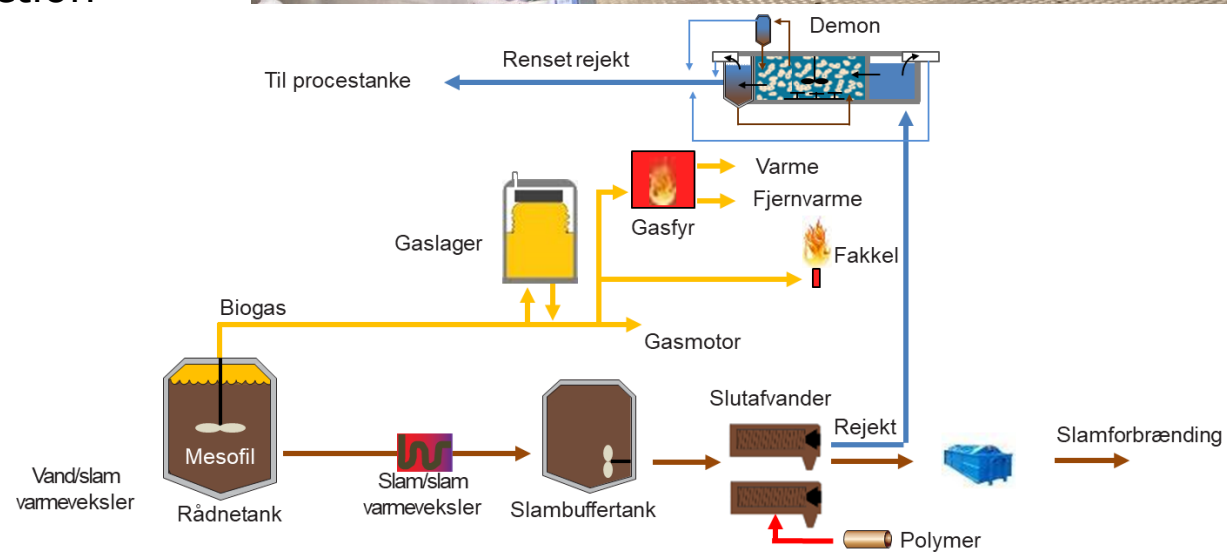
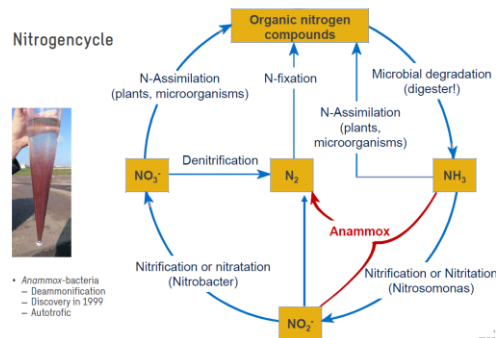
Load: 66.000 PE

Local industries and urban development
→ 95.000 - 110.000PE

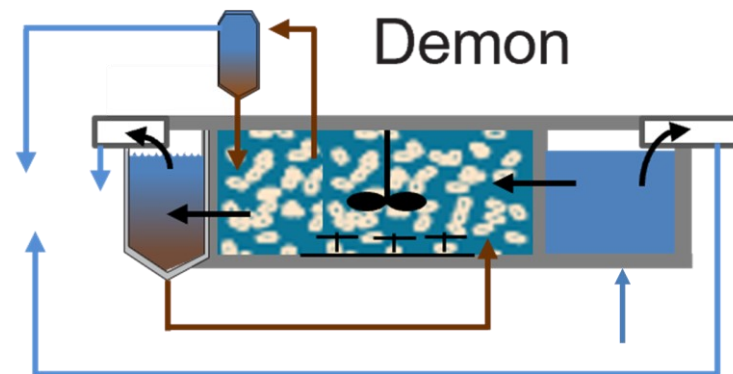
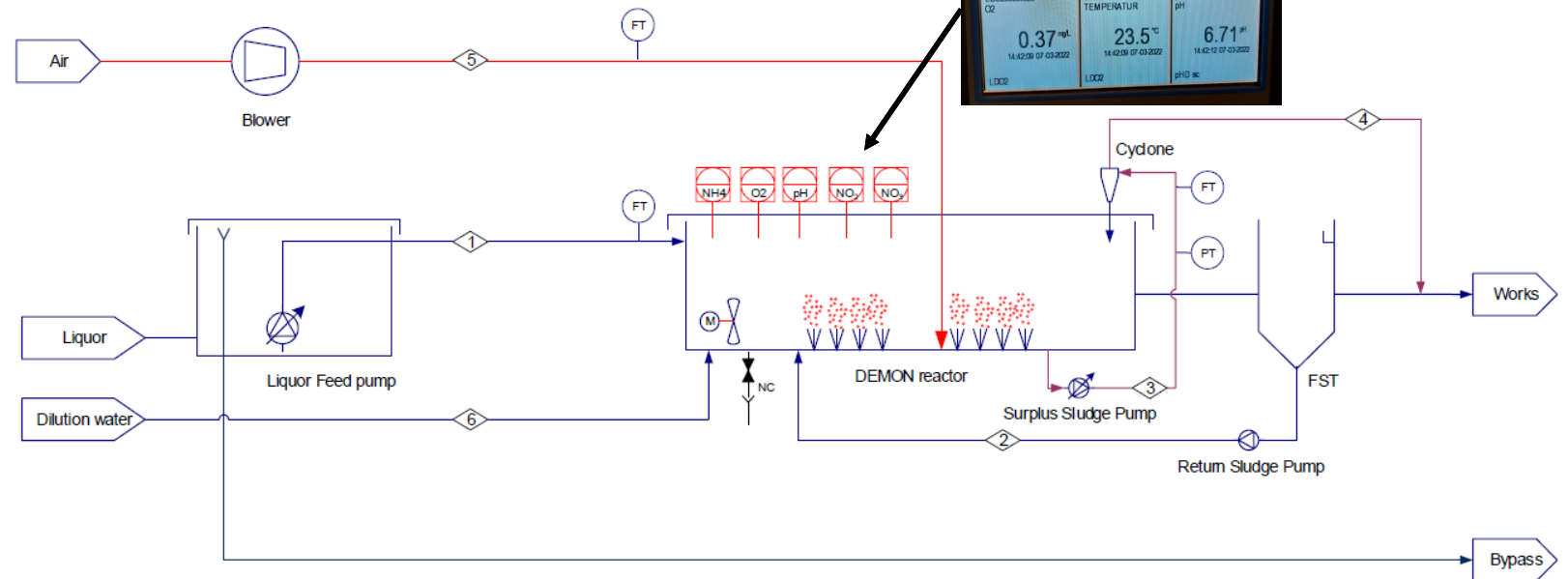
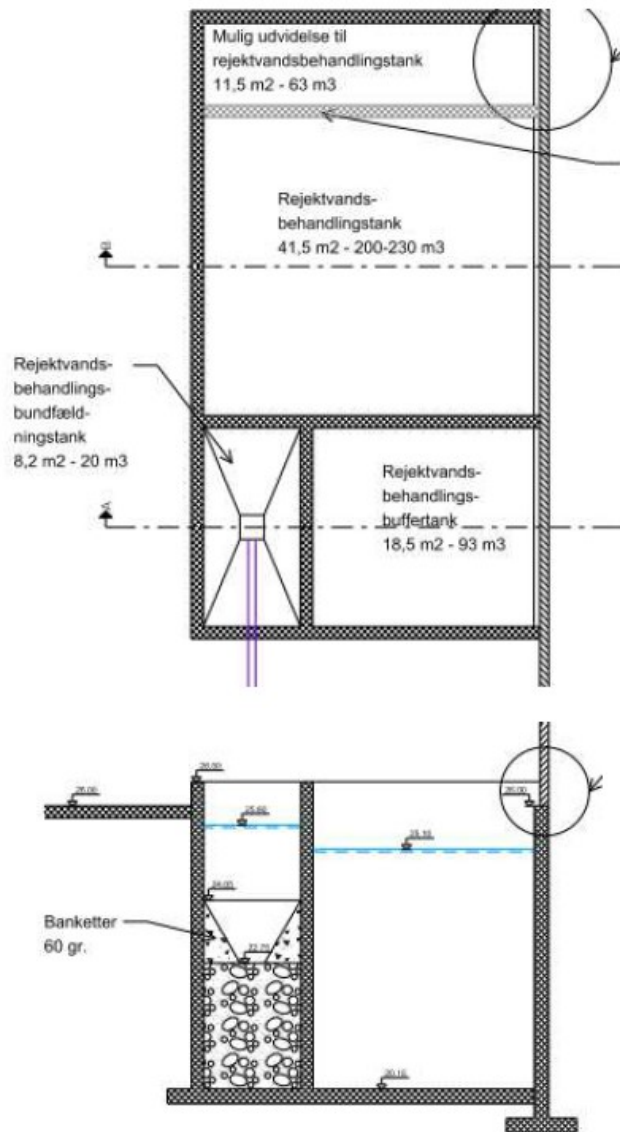
Parameter	Design	Current requirements	Future requirements?
BI ₅ [mg/l]	6,0	3,0 (6,0)	2,5
COD [mg/l]	75	75	50
Tot-N [mg/l]	6,0	3,66	2,04
Tot-P [mg/l]	0,27	0,182	0,11

Demon reactor

- Reject water ~10-15% of total N load
- Sidestream anammox
- Reduce load on CAS
- Save aeration energy
- More organic matter for biogasproduction
- Expected efficiency at 80-90% ammonium reduction



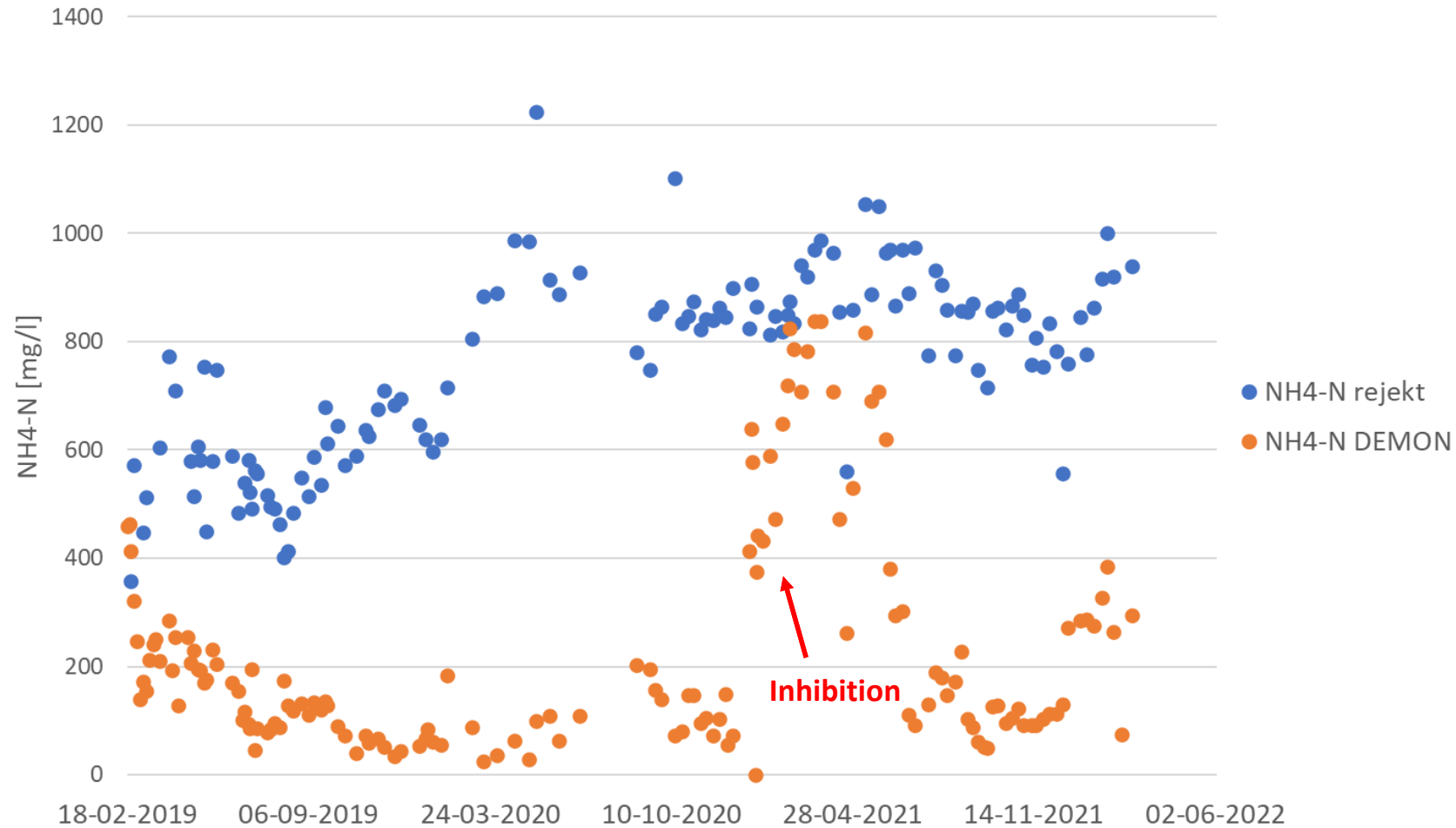
Demon reactor



HOVEDKOMPONENT	STK.	VOLUMEN	KAPACITET
Buffertank	1	90 m ³	
Procestank	1	230 m ³	
Bundfældningstank	1	40 m ³	
Cyklon	1		
Fødepumpe	1		8,8 l/s
Blæser	1		500 m ³ /h
Beluftning	8		Max 40 Nm ³ /h
Propelomrører	1		705 rpm
Returslampumpe	1		101,4 l/s
Overskudsslampumpe	1		5 l/s

Demon - efficiency

NH₄-N in rejekt & DEMON reaktor



Design:

Feed flow avg. = 130 m³/day

Feed flow max = 150 m³/day

Loading = 170 kg NH₄/day

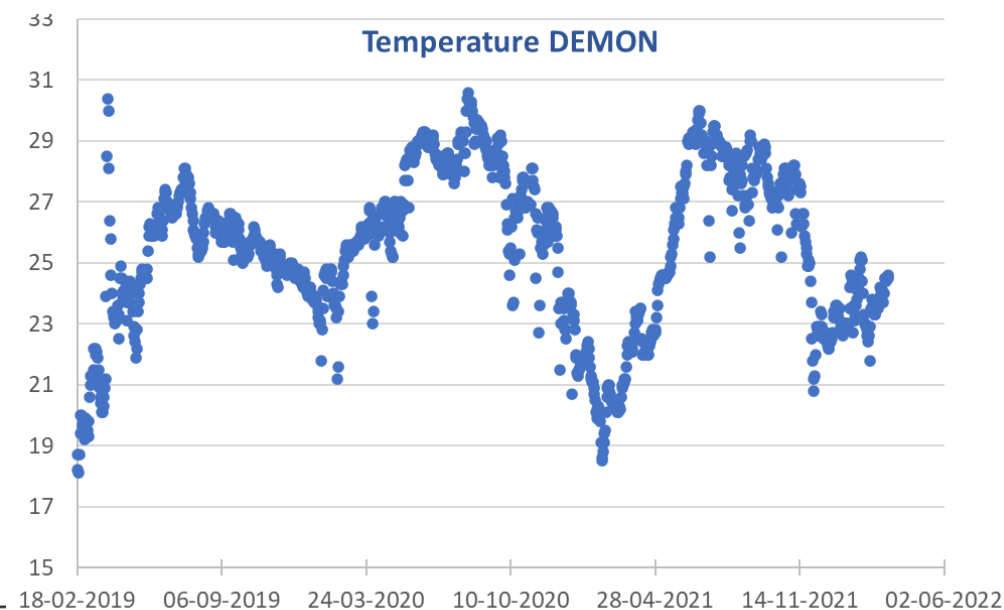
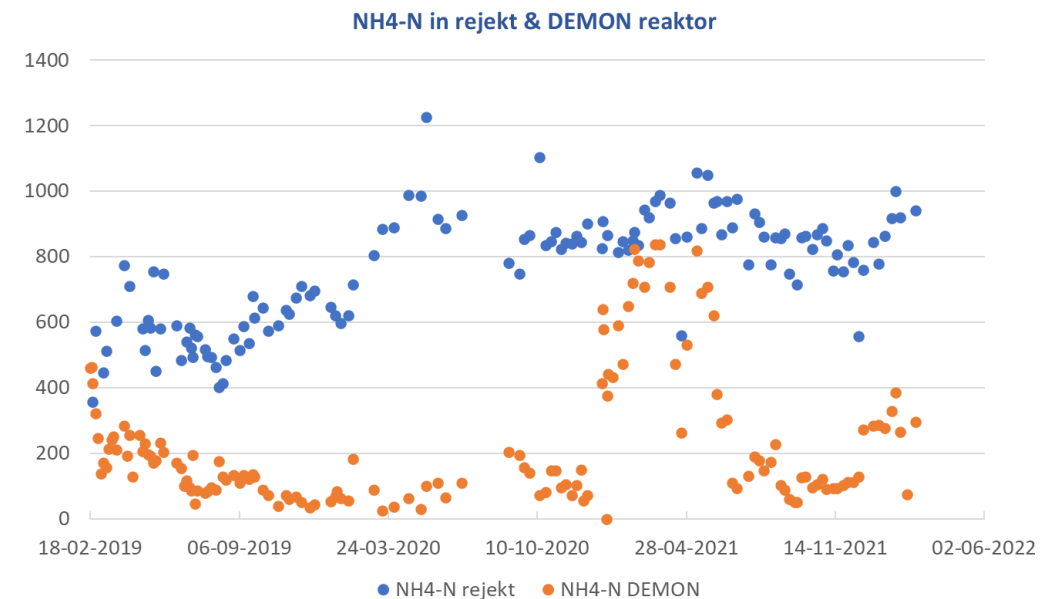
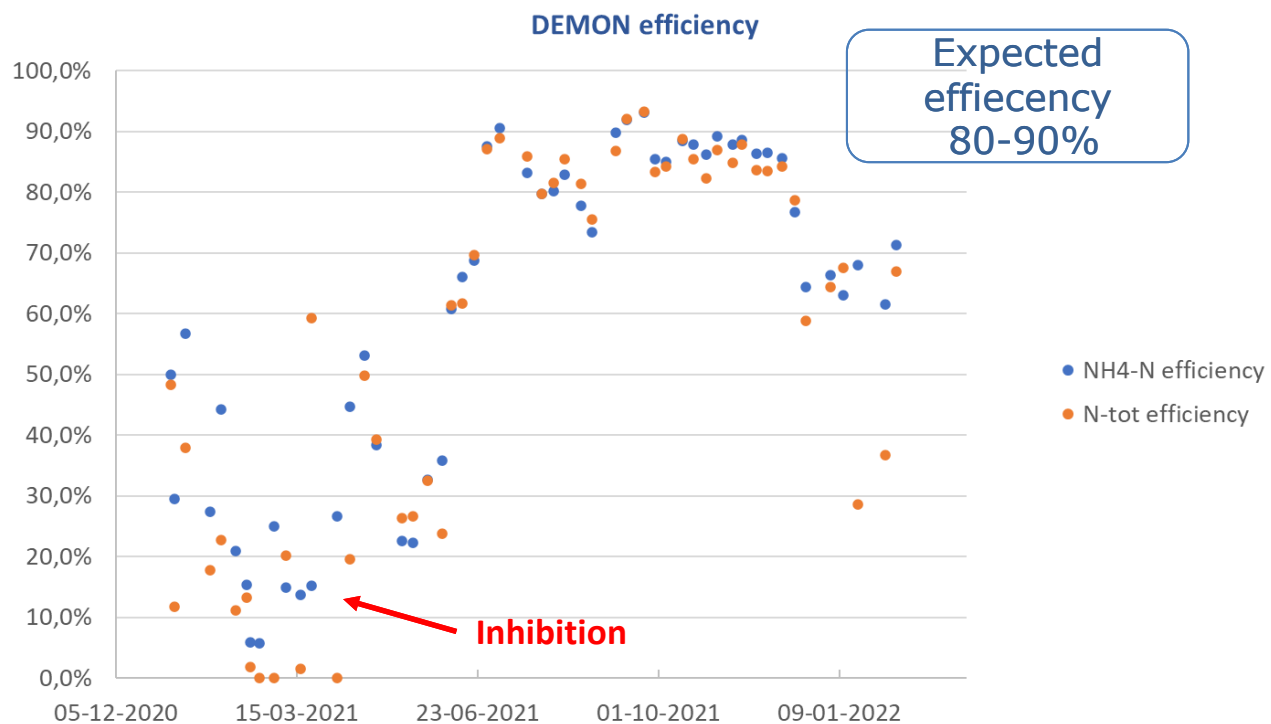
Actual avg. load = 80 kg NH₄/day

Low load during upstart in 2019

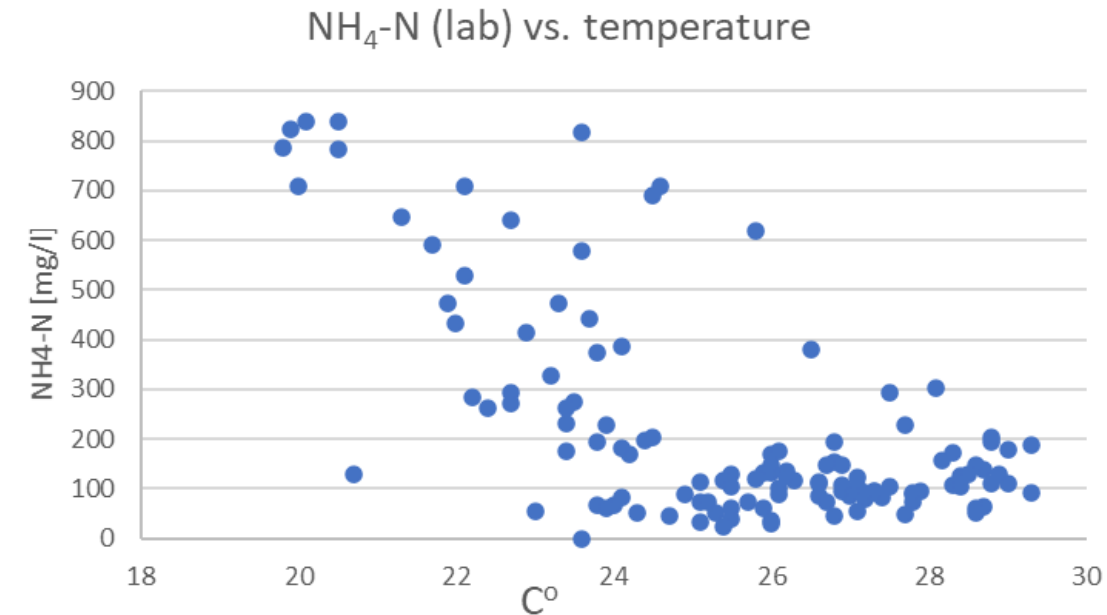
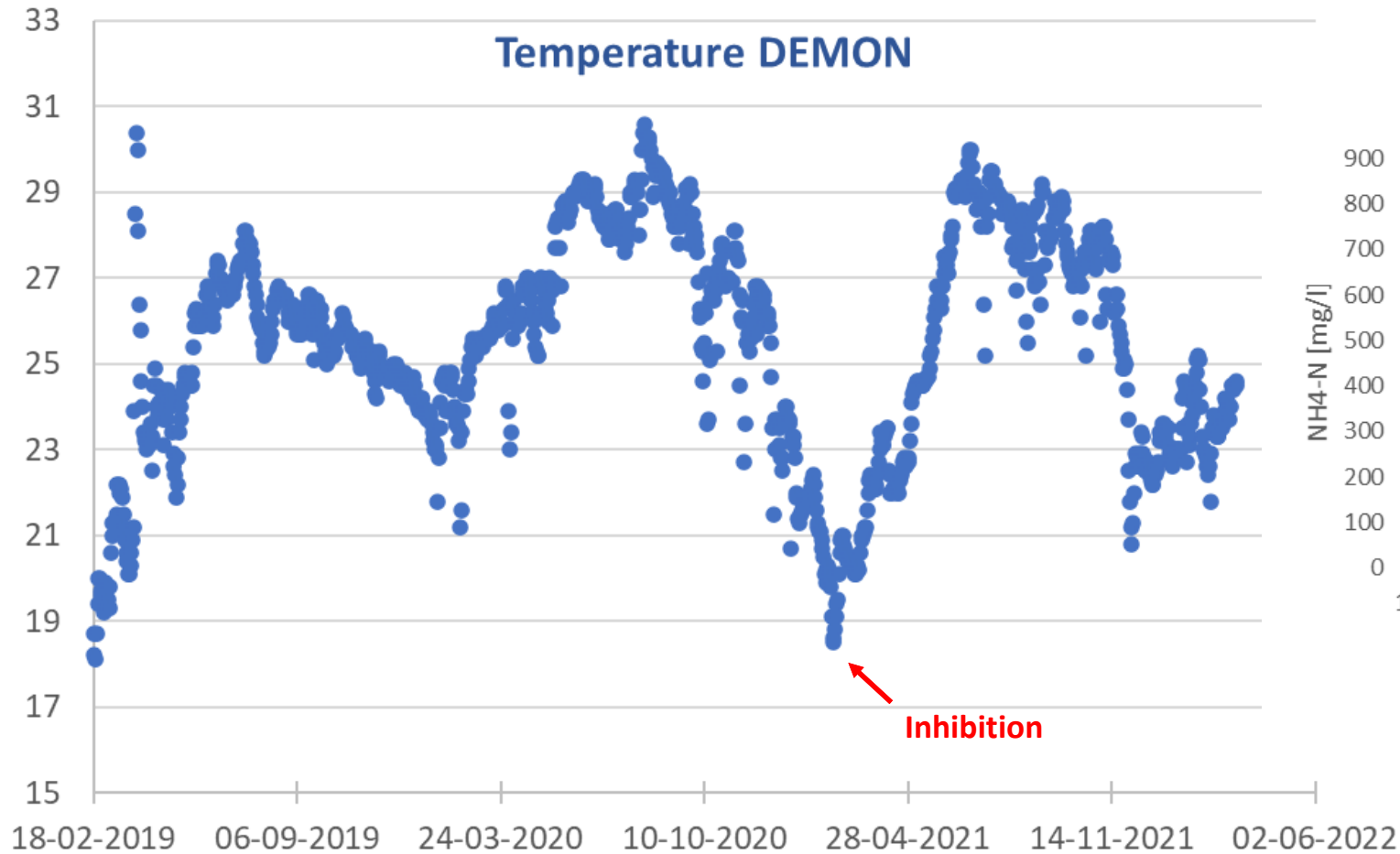
Acceptable variation in load

Inhibition January 2021

Demon - efficiency

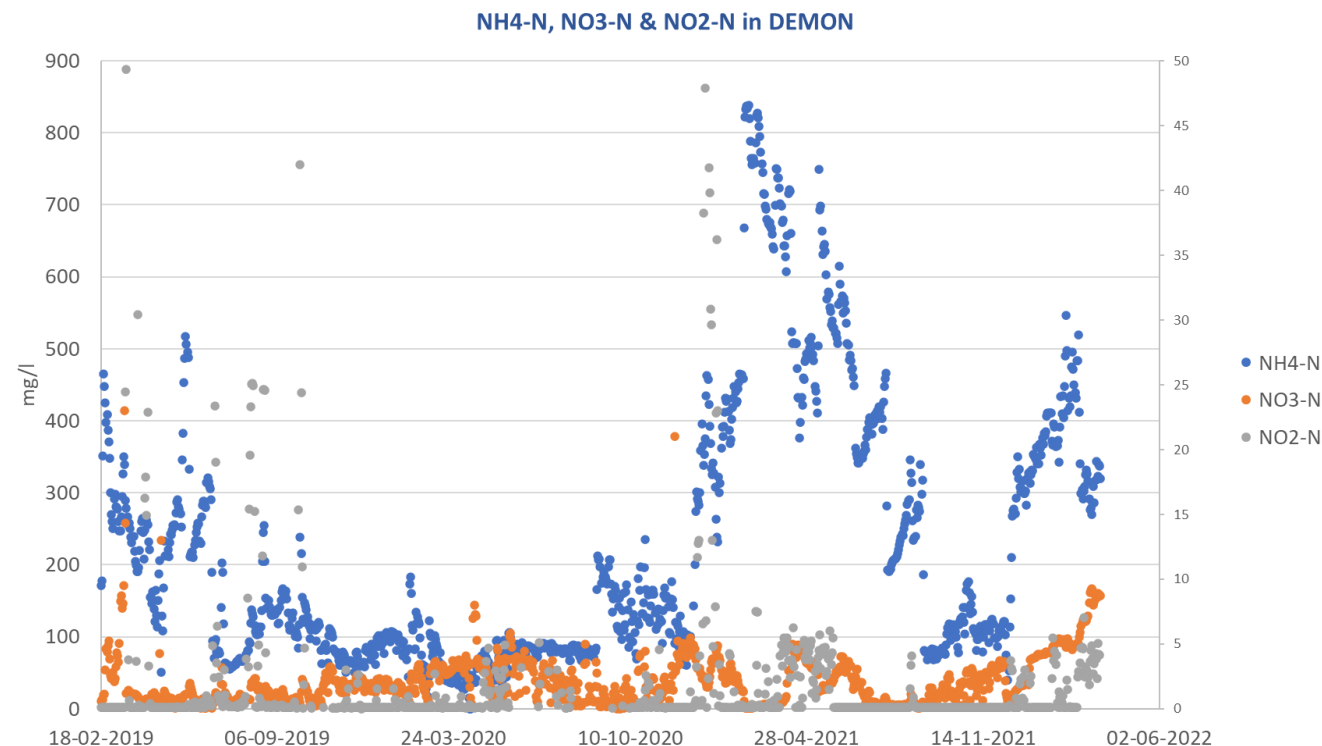
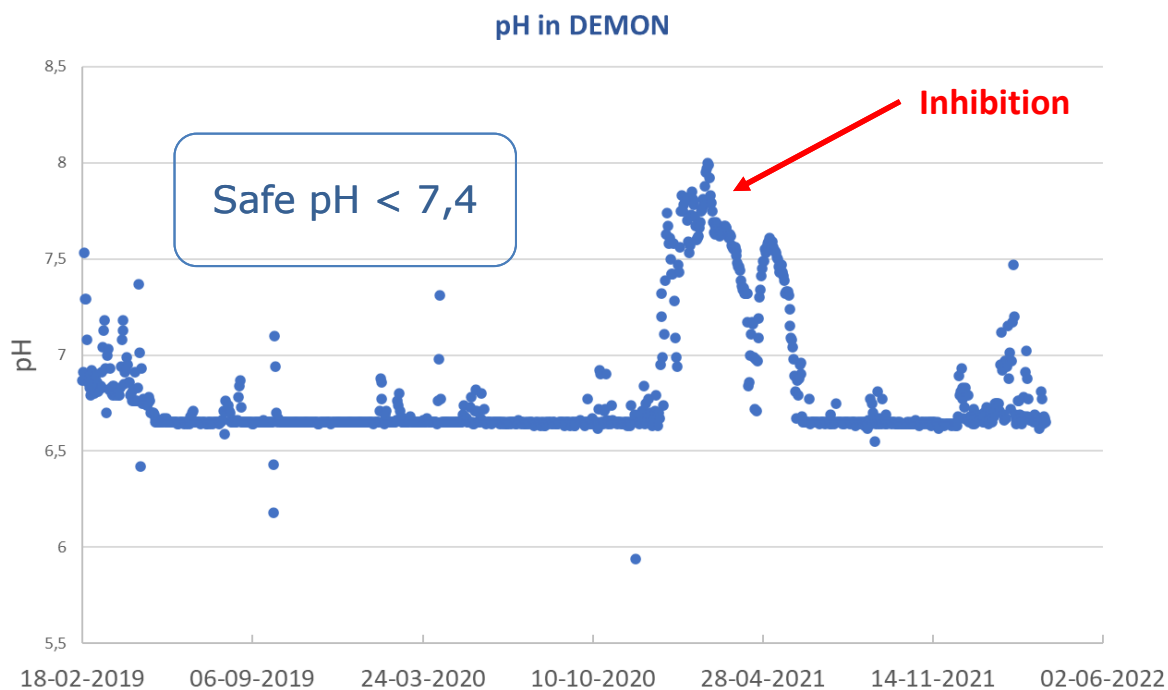


Demon - temperature



Cold sludge during winter
→ low efficiency
→ heating necessary

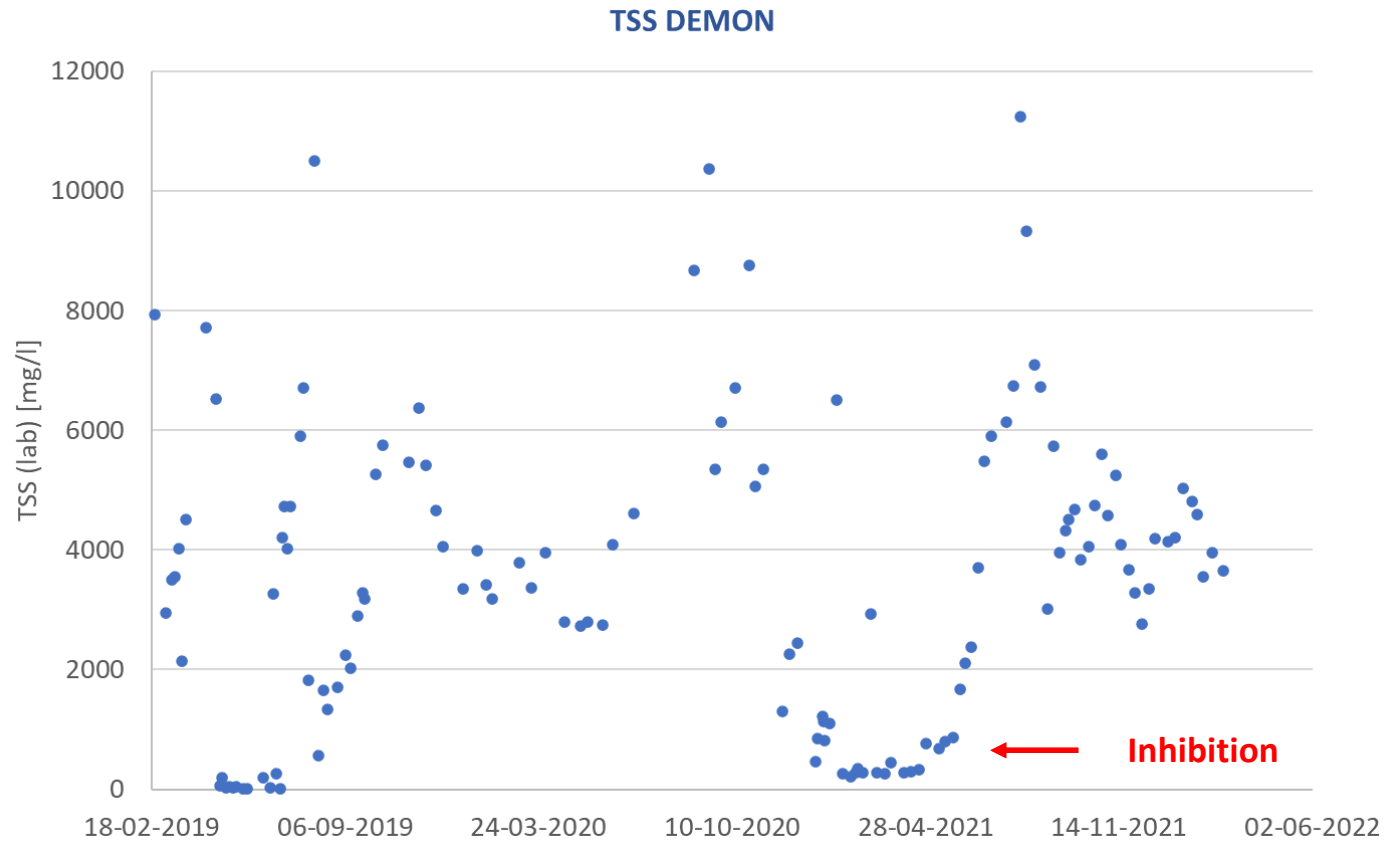
DEMON condition parameters



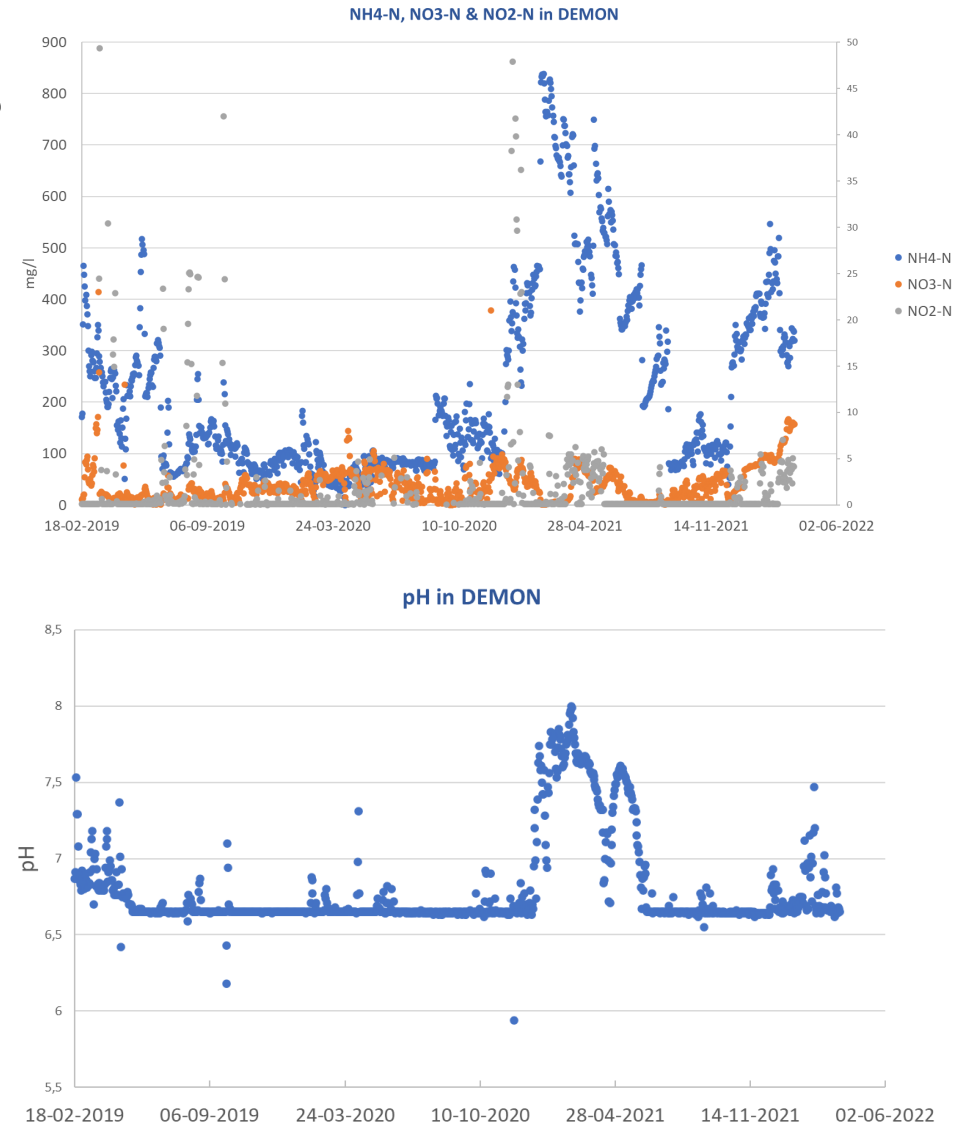
Safe boundaries:

- NH4 < 300 mg/l
- NO3 < 100 mg/l
- NO2 < 25 mg/l

DEMON condition parameters



Safe dry solids: 1 g/l < 5 g/l



DEMON inhibition

What happened?

- Observed NH₄, NO₂, pH levels rising
- Temp was dropping due to winter
- **Main problem:**
we were losing sludge (low SS)

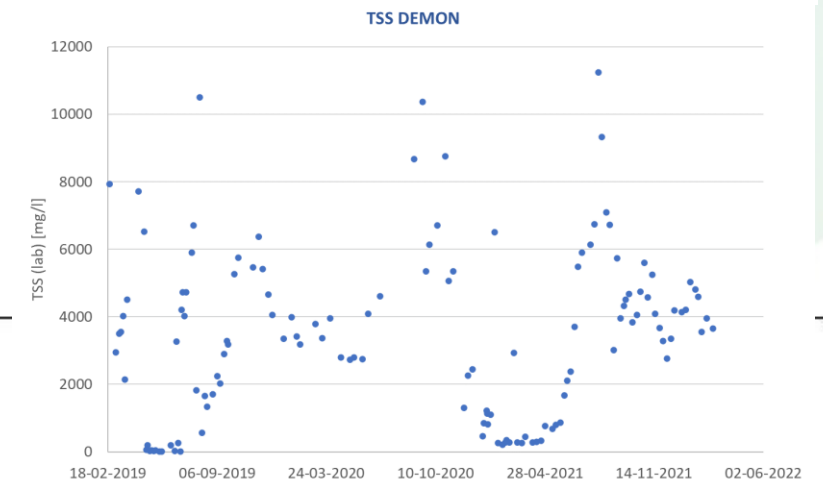
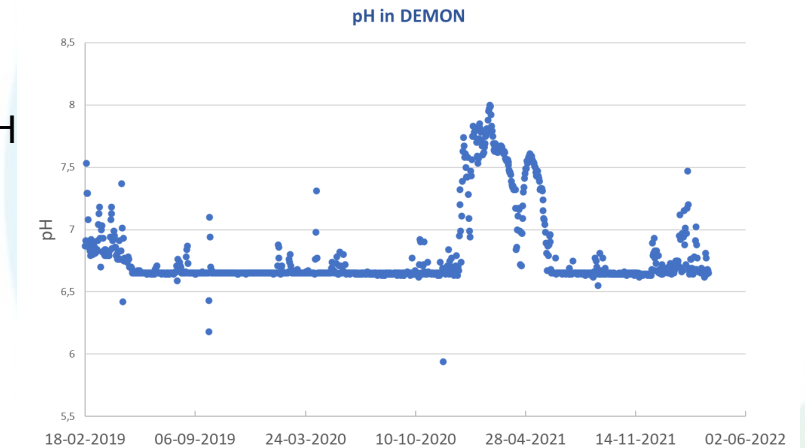
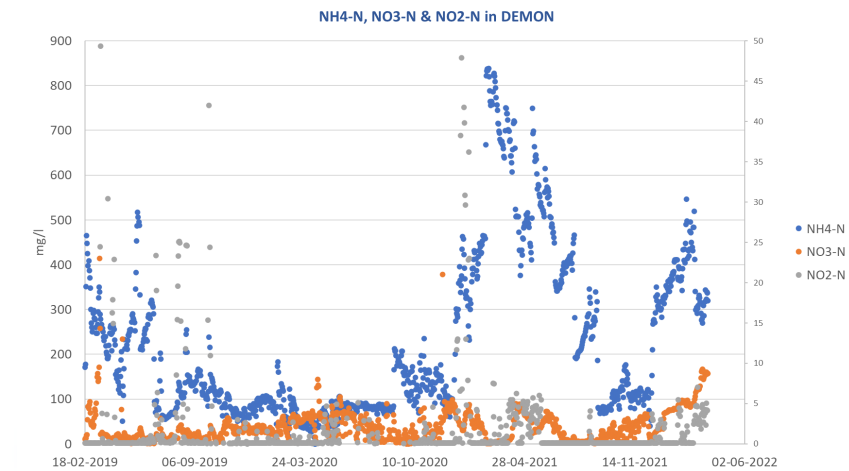
Why?

- **Overdosing of polymer led to inhibition and floating sludge**



What did we do?

- Stop sludge discharge
- Reduce load
- Reduce oxygen, keep eye on pH
- Keep calm and be patient
- No control of discharge → Optimize control program



Key points

- Reduction efficiency 80-90% at stable conditions
 - from 900 to about 100 mg/l
- Temperature (25-35C°) is essential
 - A heater must be installed
- Overdosage of polymer is inhibiting
- Inhibition recovery without seeding is possible but requires time and patience





Tak for opmærksomheden