



Jeanette Mosbæk

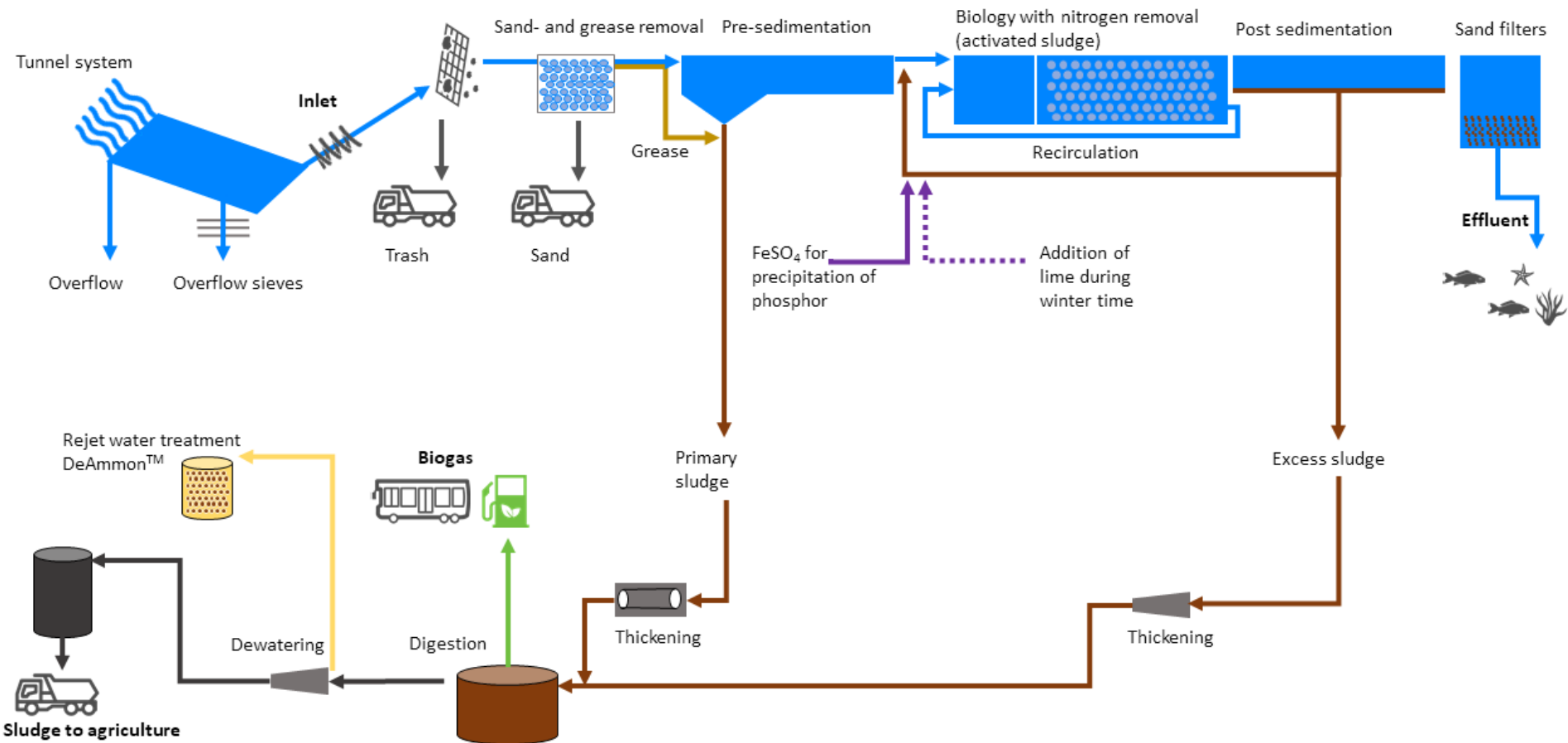
Morten Rostad Haugen

~~Lystgassmålinger og~~
driftserfaringer fra
DeAmmon[®] ved Bekkelaget



DeAmmon[®] at Bekkelaget is a side-stream nitrogen removal process on reject water from dewatering of digested sludge

Flow sheet; Bekkelaget WWTP

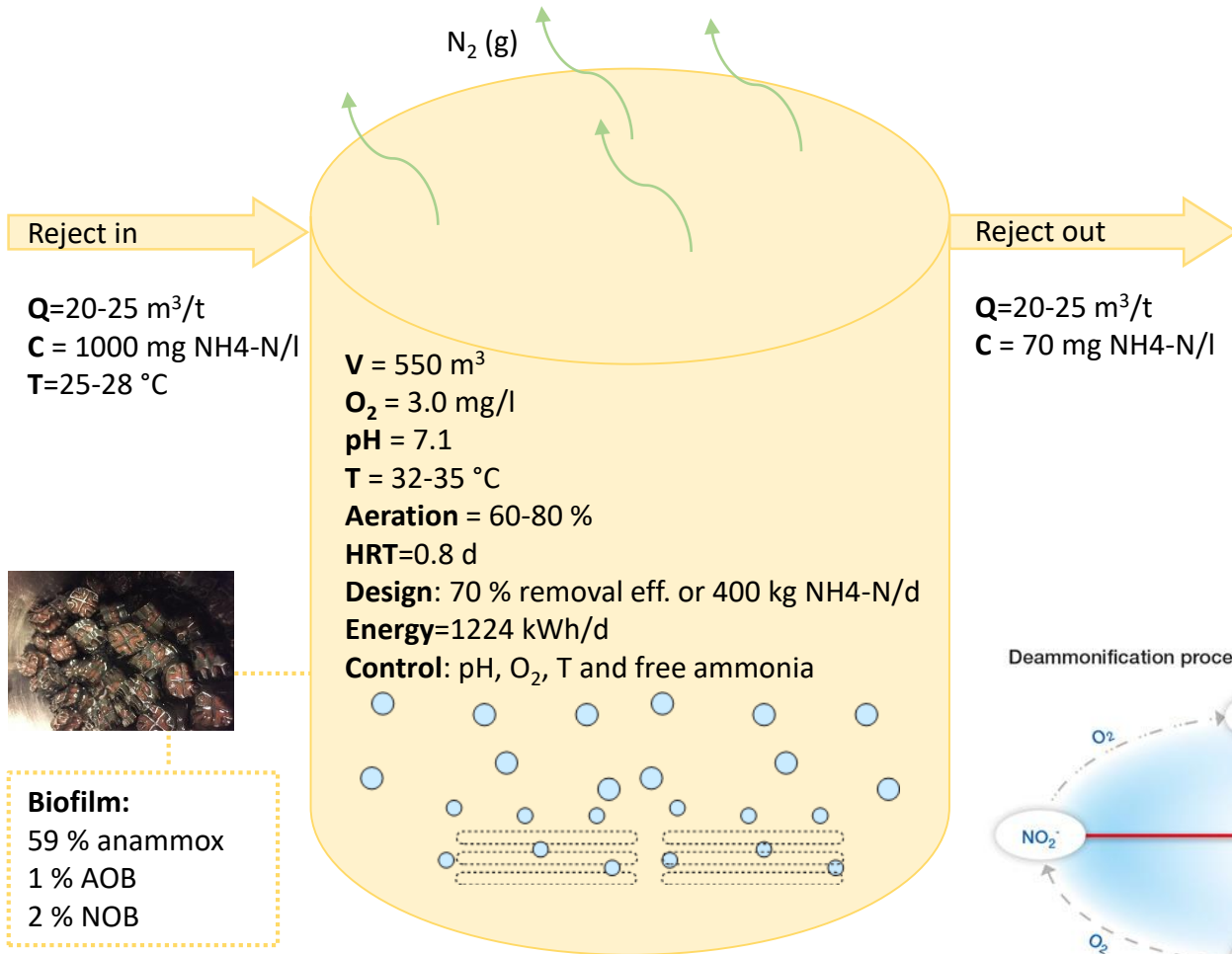


Facts about Bekkelaget

- 300 000 PE
- Dry weather flow of 110 000 m³/d
- Conventional nitrogen removal by activated sludge process
- Before 2015 carbon source was needed to the activated sludge process to overcome 70 % nitrogen removal. This is not needed anymore, because of DeAmmon.

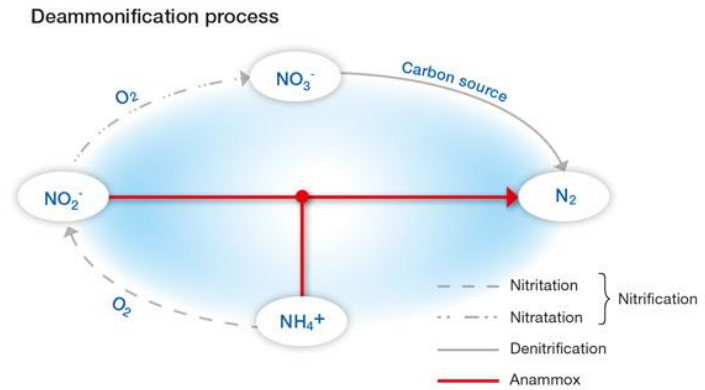


DeAmmon at Bekkelaget is a moving bed biofilm reactor (MBBR) that removes 9% of the total nitrogen load to the plant.



Results so far

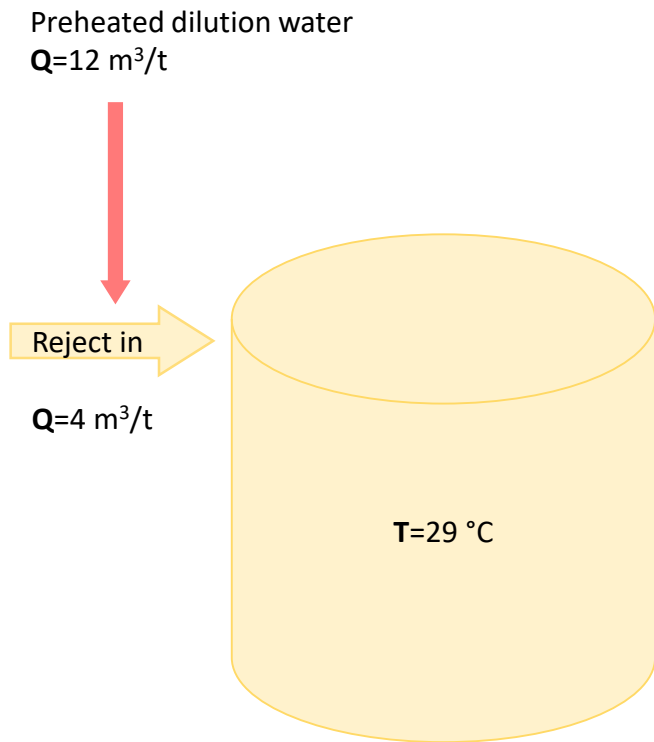
	2014	2015	2016	2017	2018 (YTD)
Process status	Start up	Moving carriers to new reactor	Stable	Stable	Stable
NH₄-N removed (tonnes)	4-10	50-80	123	113	114



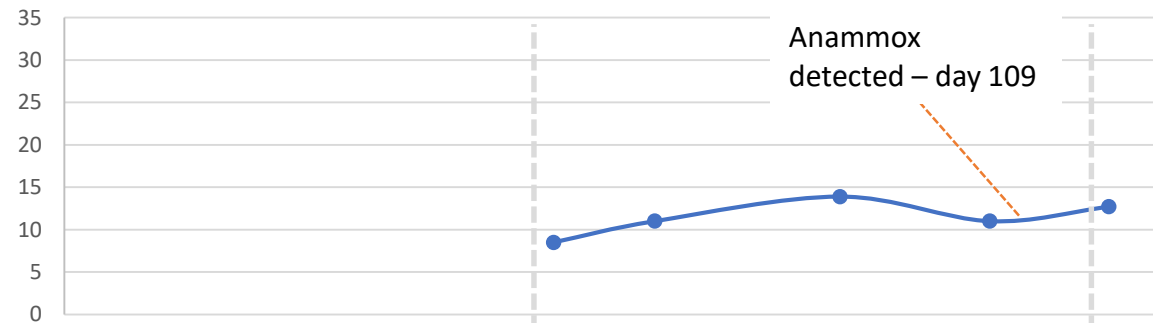
~9 % of total N-load to the Bekkelaget WWTP



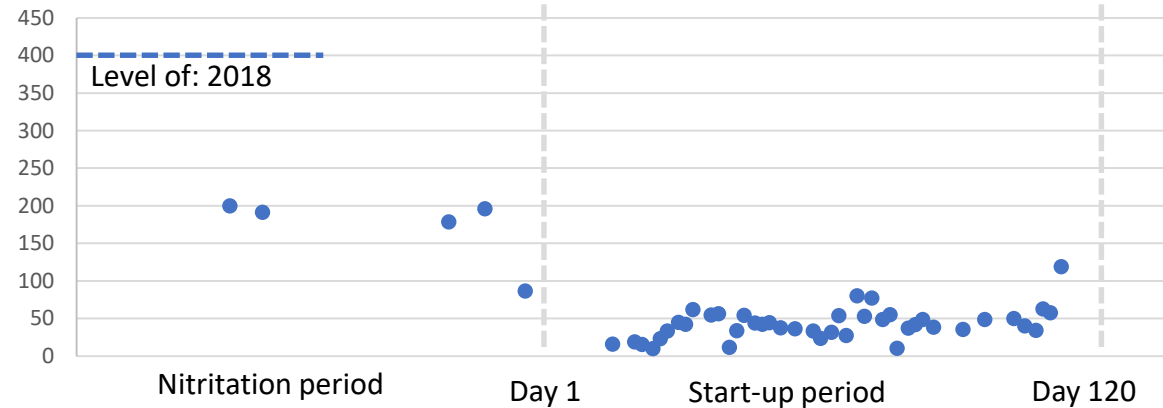
History of DeAmmon[®]: DeAmmon was successfully started in 2014 in cooperation between Purac and BEVAS.



Biofilm thickness; (g/l)



NH₄-N reduced; (kg/d)



After 120 days, preheated dilution water was no longer needed – start up period completed. ^[1]

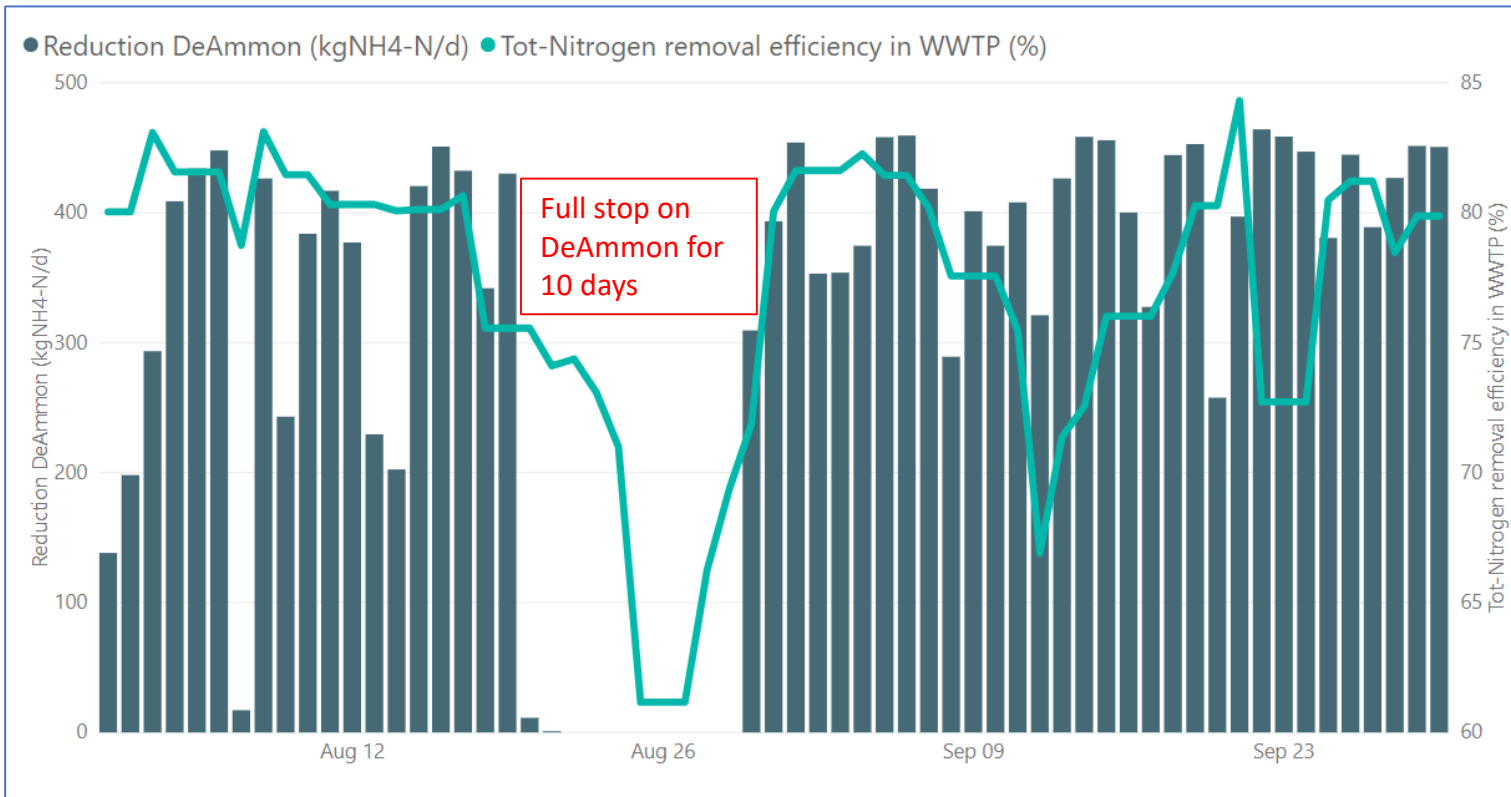


DeAmmon was installed to overcome the nitrogen removal challenge, and we are totally depended on the process today.

Removal efficiency at Bekkelaget with demand from local goverment of 70 % total nitrogen-removal

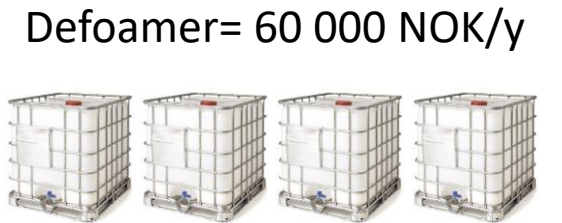
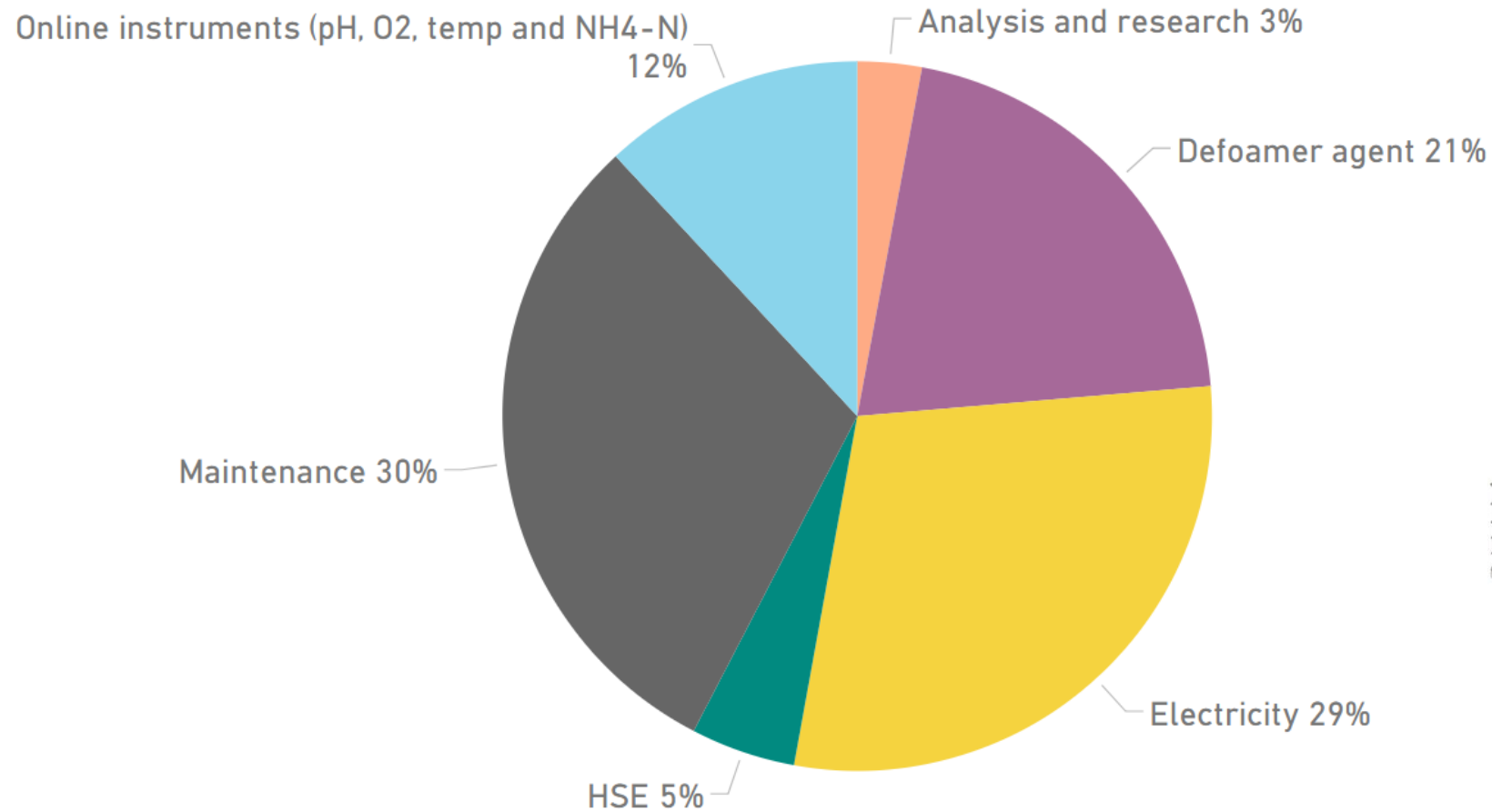
	2010	2011	2012	2013	2014	2015	2016	2017	2018 (YTD)
Results (%)	68.9	65.5	70.7	67.5	69.2	74.2	73.4	72.8	76.7

DeAmmon start



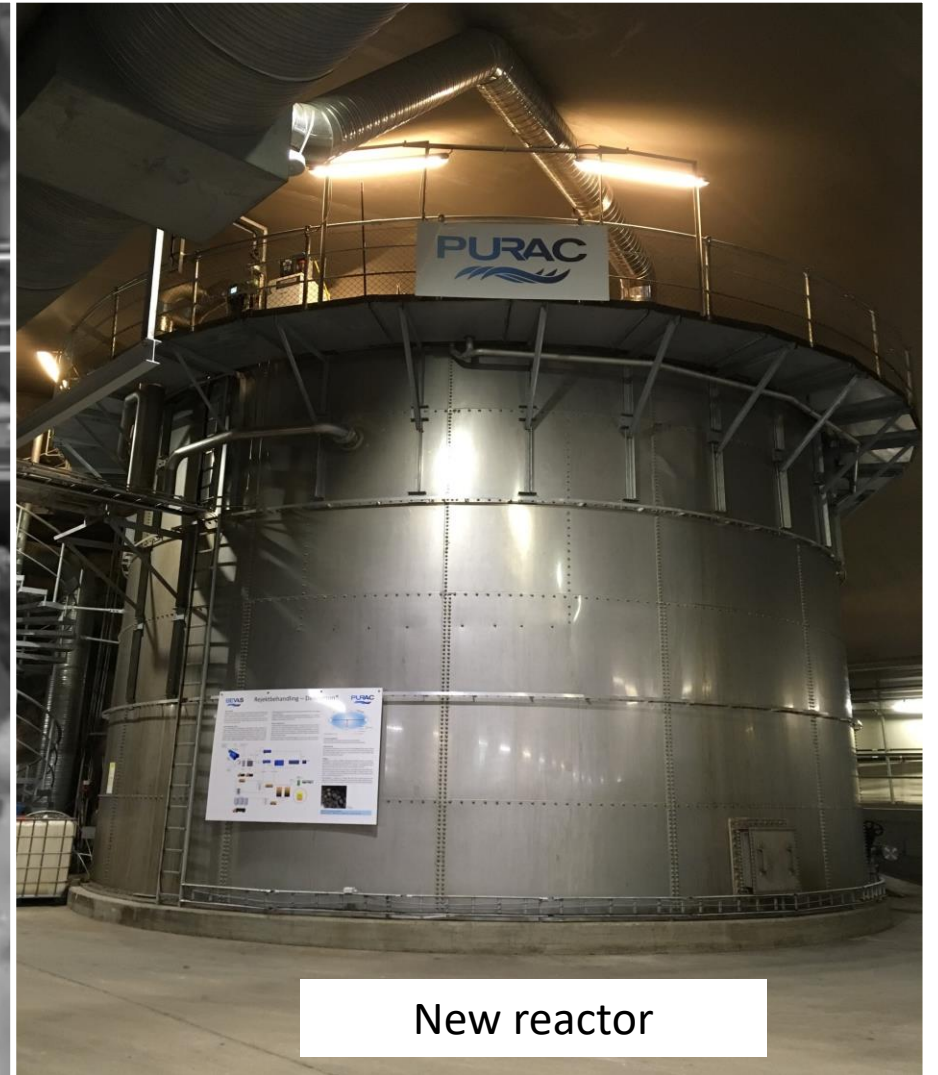


One of the main contributor to costs at DeAmmon is defoamer.
We have been overdosing for years without any problems.





Main problem in the past was related to HSE. The process emits hazardous endotoxins from bacteria, however no legionella has been detected in the air.

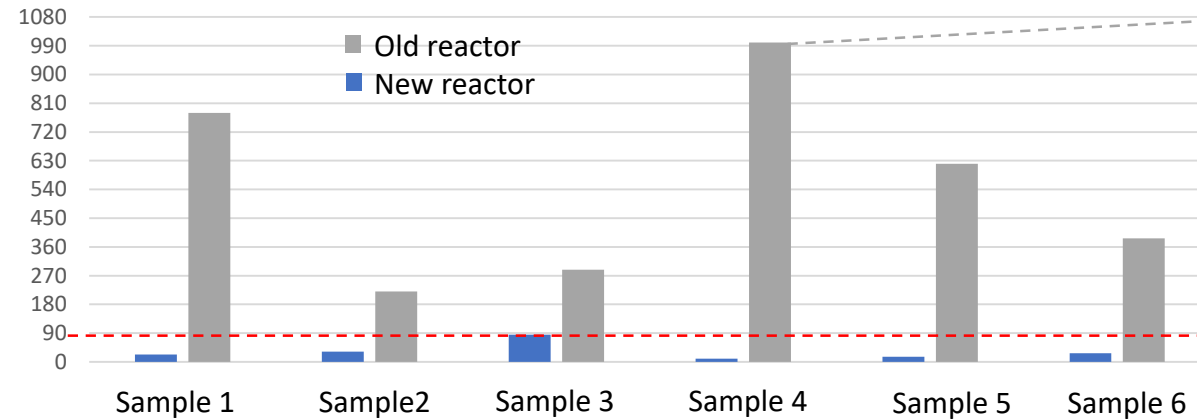




Main problem in the past was related to HSE. The process emits hazardous endotoxins from bacteria, however no legionella has been detected in the air.

Challenge we have overcome

Endotoxins in air; (EU/m³)



One operator became sick when working around the old reactor

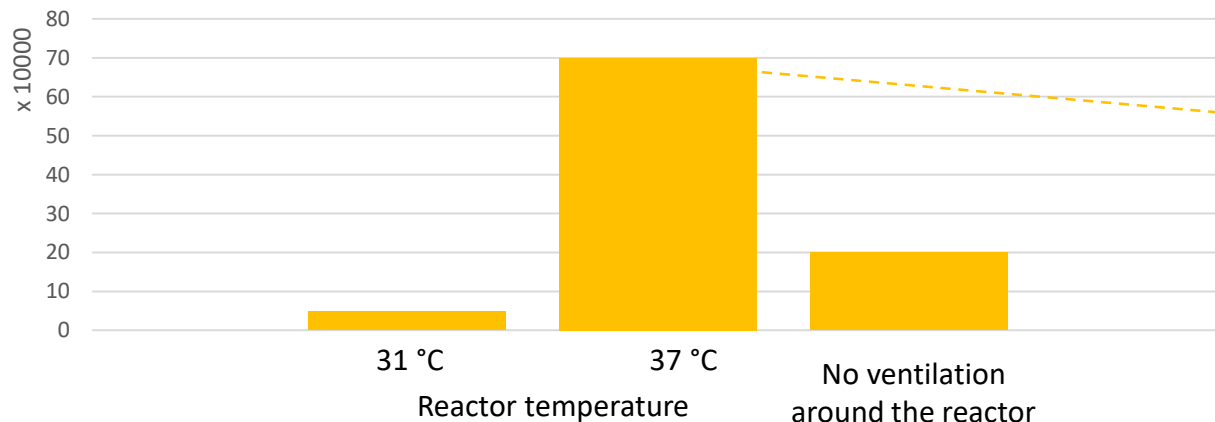
Recommended limit from Dutch expert Committee on Occupational Safety, 2010

Solution

- Changed the process to closed system
- Added more ventilation

Current challenge

Bacteria in air around new reactor; (number/m³)



We are using P3-masks if the reactor temperature is above 35 °C

Current workaround solutions

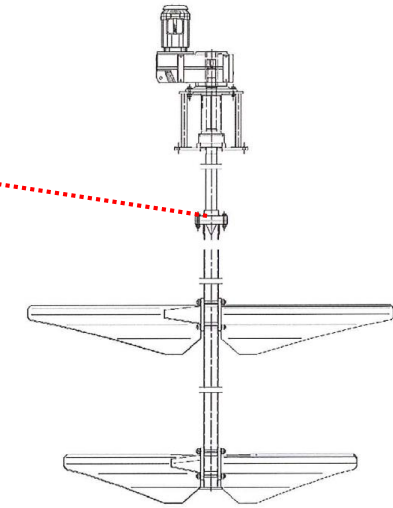
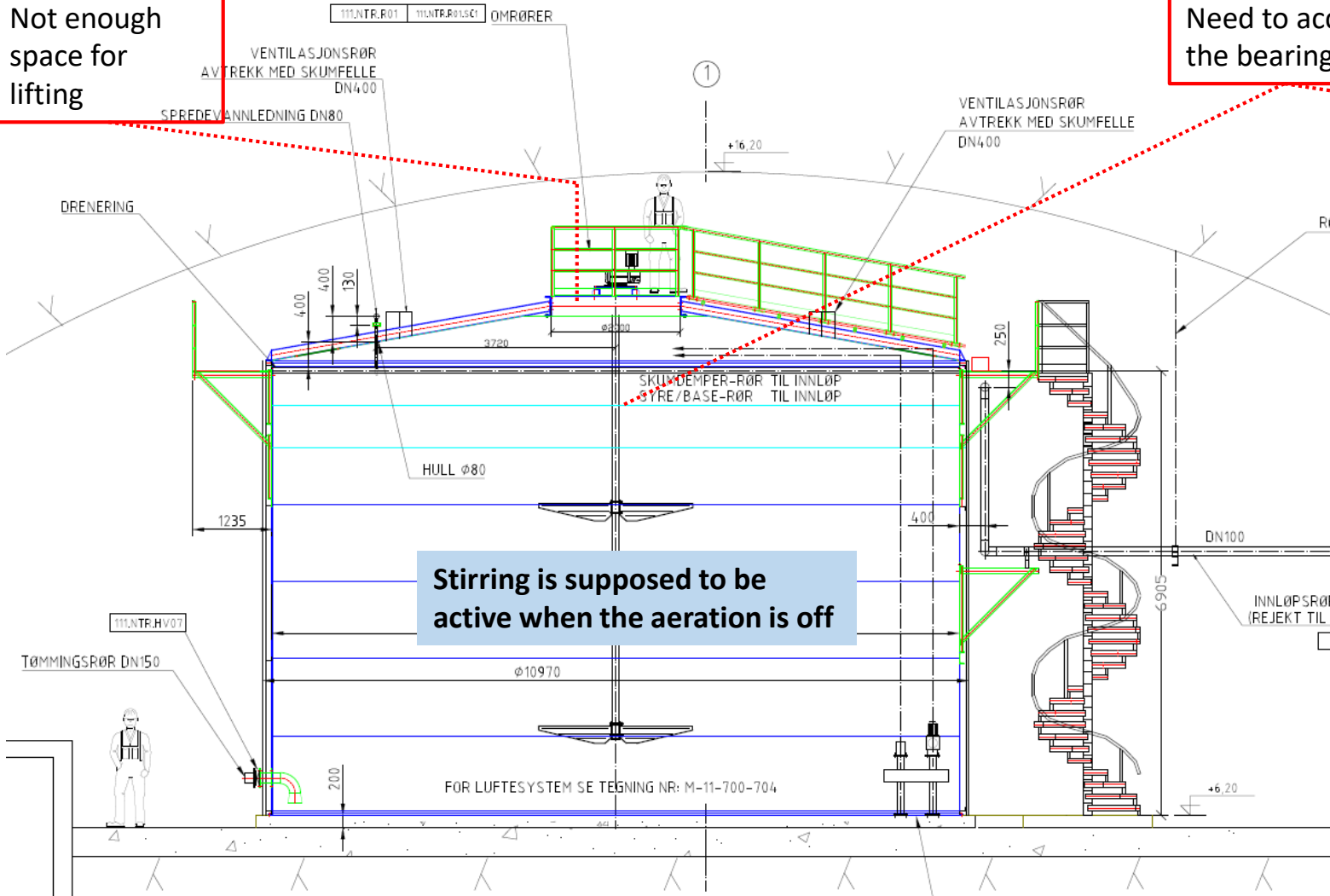
- Keep temperature below 35 °C
- Use P3-masks if temperature is above 35 °C



Current problem(?): Our stirrer has been out of function for over a year.

Not enough space for lifting

Need to access the bearing



Efficiency of the process is still good.

How important is the stirrer?

