DOP case study:
Safe and long-term operations of Produced Water treatment facility in Fredericia

The world's largest plant for purification of Produced Water using MBBR technology

Produced Water from offshore oil & gas production facilities contains a range of substances from the production that can be harmful to environment and therefore optimal and efficient treatment is required prior to discharge to receiving water bodies.

Case background

Danish Oil Pipe A / S (DOP, part of ØRSTED), which operates the crude oil transport system from the North Sea to the mainland, has decided to build a treatment plant for the saline Produced Water from oil production in the North Sea.

The SUEZ-MT Højgaard consortium has been awarded a contract for the design and construction of a dedicated wastewater treatment plant in 2021, as well as a contract for its operation and maintenance, which can be extended to 2050.

Solution implemented

SUEZ has developed a multi-barrier solution that makes it possible to treat very varying quality of Produced Water.

The plant replaces the disposal of the water to an external treatment facility and thus the new plant will result in a local purification of the water resulting in big savings on transport. This will ensure a significant environmental improvement overall for DOP.

Due to the highly variable quality of the incoming water, the system is designed with several different adjustable solutions that the operator can adjust in real time according to the variations in the flow and composition of the inlet water.

This highly adjustable and robust treatment line offers a very reliable solution where the water is purified environmentally optimally, but also optimizes operating costs.

About the technology

This project is the largest treatment plant in the oil and gas industry using MBBR (Moving Bed Biofilm Reactor) technology.

The MBBR process is the core of the treatment line and consists of an aeration tank with special carriers that provides a surface where a biofilm can grow.

The carriers are mixed in the tank by the aeration system and will thus have good contact between the substrate in the wastewater and the biomass on the carriers. The active biomass in the biofilm makes a biological degradation of the contaminants in the Produced Water.

As some of the contaminants are slowly biodegradable and also due to the varying concentrations, additional treatment steps (barriers) using a dualmedia filter and a granular activated carbon (GAC) filter are possible if needed downstream of the biological treatment.

Also, an innovative approach of using integrated ozonation is added as an additional treatment that can be used in the MBBR process.

Benefits and value

- optimization of operational costs
- higher volume of treated water
- technologies that are safe and known
- no added risks to operations
- most advanced technology used today
- more controled discharge water quality

suez

Safe and long-term operations of Produced Water treatment facility in Fredericia

DOP case

Plant Operations

SUEZ has been awarded both the contract for the construction and following operation & maintenance of the plant. On this basis, the plant has been designed and built in order to ensure safe and efficient operations.

The plant is designed to treat up to 700 m^3/d as maximum capacity but at the same time the plant is required to accept and treat large variations in load both in terms of flow and contamination of the Produced Water.

To handle this and to ensure efficient operations, SUEZ has applied its many years of global experience as a plant operator to design the plant with a lot of flexibility in the different process steps.

This allows to optimize the consumption of energy, chemicals and other consumables without compromising final water quality.

Dual media filter

How it works

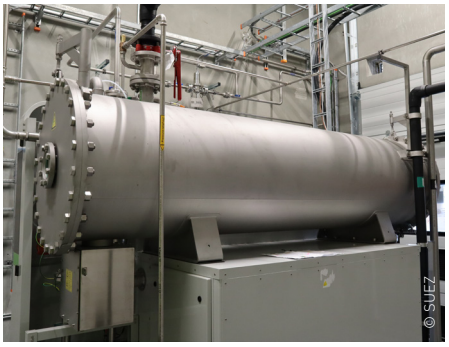
The multi-barrier solution consists of successive treatment steps to ensure that the treated produced water meets the discharge requirements.

Moving Bed Biofilm Reactor (Meteor™):
The first step of the treatment line is a biological treatment in a fully aerated Moving Bed Biofilm Reactor (MBBR). In these process reactors, the contaminants are degraded through the metabolism of the active bacteria growing in the biofilms attached to specially designed carriers.

Integrated ozonation (Oxyblue™):
As an add-on to the biological treatment, it is possible to use ozonation to help degradation of slowly biodegradable compounds. This treatment is implemented through a return pumping pipeline including an ejector where the ozone is dosed and mixed into the water phase. This treatment can be turned on when required.

Dissolved Air Flotation (DAF):
The active bacteria in the MBBR process produces new biomass that will besuspended in the water passing out of the process tanks. This suspended biomass is removed by the next treatment step, a dissolved air flotation unit, where chemicals are added to coagulate and flocculate the biomass with remaining oils and solids into particles that can be skimmed from the surface or extracted from the bottom of the flotation unit.

Dual media filter:
As the water quality entering the plant can have very large variations, it is foreseen that the flotation unit will not always work under optimal conditions. Therefore, a polishing step is added after the DAF to improve the removal of particulate material before discharge to the sewer.



Ozone generator

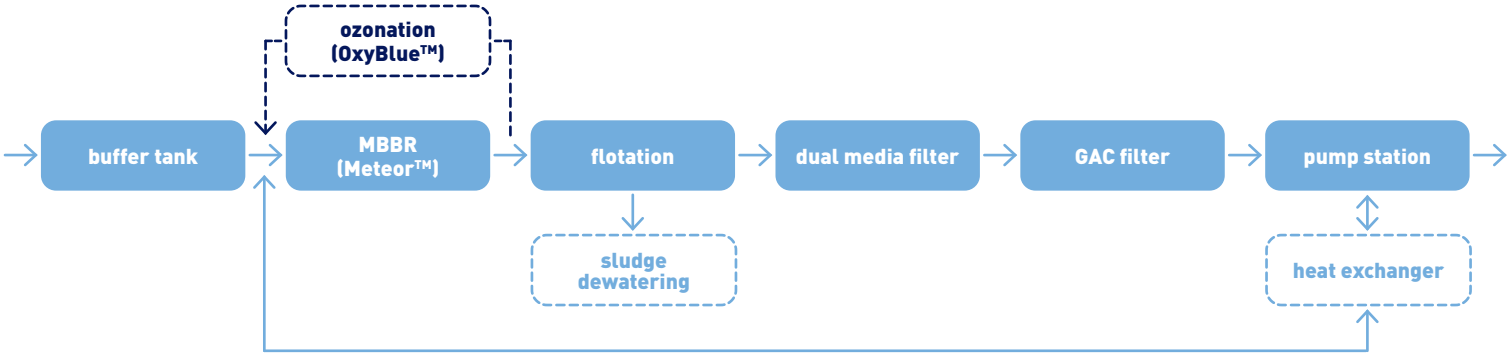
GAC filter:
As an optional final polishing step, a Granular Activated Carbon (GAC) filter is included in the treatment line. This treatment step is again implemented due to the large variations in inlet water quality and also variations in the biodegradability of the contaminants.The GAC filter can thus be included in periods with high levels of slowly biodegradable contaminants.

The facility

The treatment line is complemented by other elements to establish a complete plant:

- 2 storage tanks for the inlet water of 750m^3 each
- 2 basket strainers for inlet water straining
- 1 TOC analyzer for online measurement of TOC in both inlet, outlet and intermediate samplings points on the treatment line used for plant control
- chemical dosing skids for antifoaming agent, coagulation and flocculation chemicals as well as nutrients
- 1 sludge buffering tank
- 1 decanter centrifuge and collection container for sludge dewatering
- 1 treated water storage tank
- office and lab facilities for the operators

Process flow diagram



SUEZ Water A/S
Sletvej 2E
8310 Tranbjerg J, Denmark

tel.: +45 69 15 66 00
mail: kontakt.danmark@suez.com
web: suez.dk