

Offshore Produced Water Treatment

Baleen Process Solutions delivers a successful solution for an offshore produced water project in the GOM.

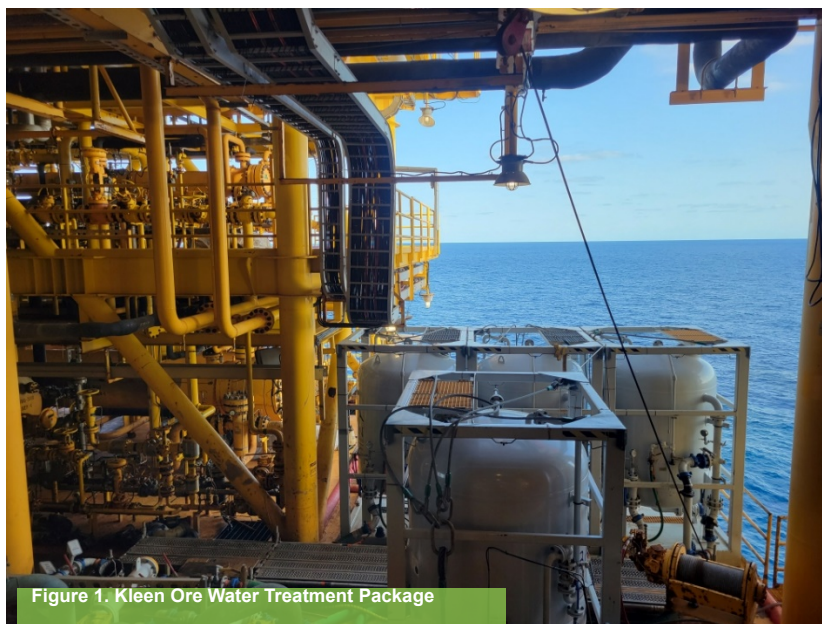


Figure 1. Kleen Ore Water Treatment Package

Project Data:

- **Location** – Deepwater Gulf of America
- **Production Sources** – 4 subsea tiebacks w/ different producing zones.
- **Produced Water Rate** – 20K BWPD
- **Opportunity** – Overboard water out of spec. (170+ PPM) & sheening events due to oil wet solids.
- **Solution** – Baleen filtration spread with Bulk Media Vessels w/ Kleen Ore media.
- **Value** – Overboard water is now in specified range (<29 PPM) & no more sheening events.

BACKGROUND

Baleen Process Solutions' client requested a turnkey solution for an offshore produced water project in the Gulf of America. The platform was experiencing issues with its overboard water quality with high oil in water readings (170+ PPM) as well as sheening events.

The platform production sources are unique with three tie-back partners as well as their own producing wells. The produced water from four different production zones creates a dynamic treatment plan as each asset's water production is unique and when combined creates new challenges such as organic solids (asphaltenes) and inorganic solids (scale) precipitation leading to oil wet solids.



Figure 2. Inlet & Outlet Samples



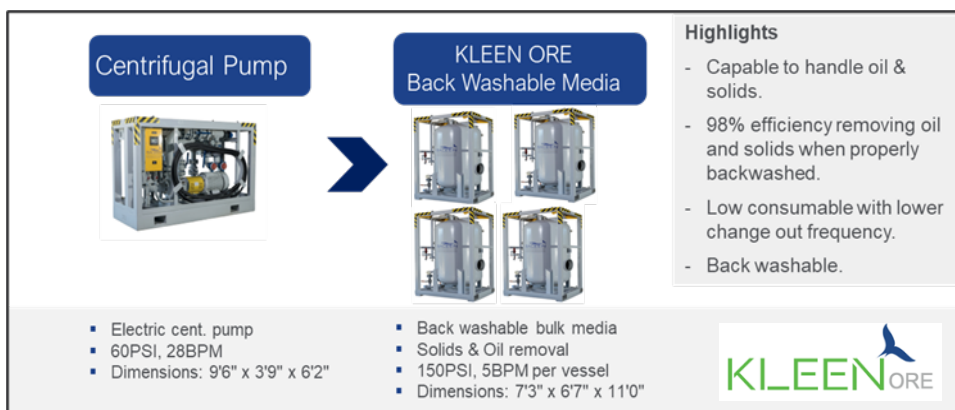
Figure 3. Inlet & Outlet Samples

SOLUTION

Baleen Process Solutions, worked with the operator to develop a detailed process for filtering its produced water to meet overboard water quality NPDES specification. Our solution was tailored to meet the items identified during our in-depth whiteboard discussions with the customer.

The main issue identified was low retention time for separation resulting in oil wet solids causing high oil in water readings as well as sheening events.

Baleen Process Solutions provided a water filtration package with our innovative **Kleen Ore** media that allows for high oil and solids content to be removed with very low to no waste.



Kleen Ore is our bulk media technology used to filter free, non-soluble and dispersed oil and oil wet solids out of produced water. Kleen Ore is regenerable via backwashing with many great benefits compared to absorbent type media.

In our process flow diagram, we start by taking fluids from the vertical flotation cell that feeds into our High-Volume Pumps, CP-28, capable of 28 BPM (40K BFPD). Our pump is in place to energize fluids to our Bulk Media Vessels that contain our Kleen Ore media. Our Bulk Media Vessels are each capable of handling 7,200 BFPD and 29K BFPD combined. We needed capacity to meet the current production rate of 20K BFPD as well as additional room for back washing the media that extends the life of the media.

Our engineered solution ensured 100% of the dischargeable fluids met overboard compliance limits and successfully captured the pipelines' oil inventory. Baleen Process Solutions engineering team provided all necessary documentation (PFD, PIDs, procedures, and SAFE chart).

RESULTS

In total, we have been filtering produced water with elevated oil in water (170+ PPM) on this facility with our Kleen Ore media for three months. The filtered fluids have met overboard NPDES discharge compliance and there has been additional value with once lost oil now captured sold via pipeline. The expertise of Baleen Process Solutions' engineering and operations team ensured successful and incident-free operations.

Baleen Process Solutions worked closely with the operator to engineer a custom-tailored solution to achieve the project goals:

- Performed Incident-Free Operations (IFO)
- Separated crude oil to send back to sales pipeline.
- Met NPDES discharge requirements
- Achieved produced water to be < 29 PPM oil in water daily to comply with NPDES requirements.
- No sheening events.
- Kleen Ore media was sustainable and regenerable via backwashing with no consumables required.
- Small footprint to achieve filtering 20K BWPD.
- Be able to treat fluids 150+ PPM oil in water.

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