OIL AND GAS OPERATOR OPTIMIZES SEPARATOR PERFORMANCE WHILE REDUCING MAINTENANCE WITH EMERSON'S ONLINE SAND MONITORING SOLUTIONS

Customer

Offshore installation in the North Sea.

Application

Monitoring an Oil and Gas wellhead with Emerson's SAM Acoustic Sand Monitor to accurately quantify the sand production and the accumulation in the separator.

Challenge

Located in the northern part of the North Sea, this platform utilizes small separators to manage the separation of oil, gas, condensate and water. This approach is typical for sites operating in remote or space-constrained environments, such as offshore platforms. The production started in January 2015, but in recent years, the reservoir has experienced a rapid decline in pressure, which has significantly reduced the recovered volume of hydrocarbons. Image 1 charts production from the field since 2015, showing a steady decline over time following the initial peak.

Results

- Avoided a major incident by shutting down well after observing a rapid increase in sand production, which helped avoid major maintenance interventions and financial losses
- Maintained both environmental and personnel safety by eliminating risks of hydrocarbon leaks or spills due to separator failure

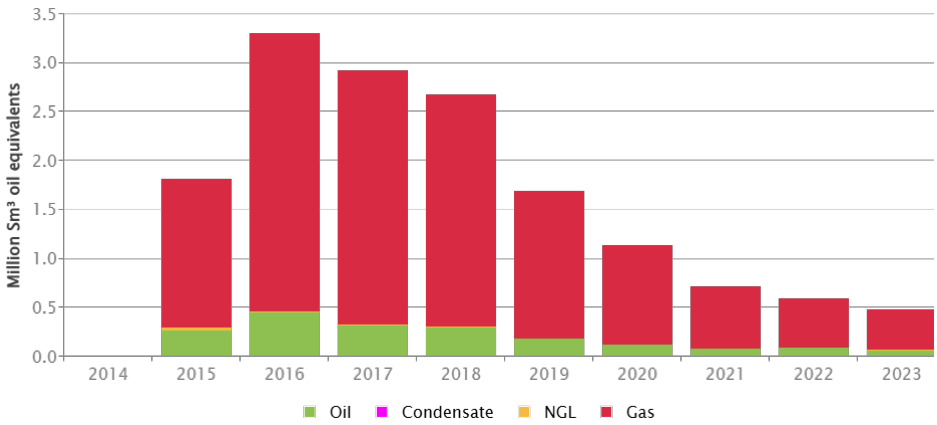

Image 1. *Production overview 2015-2023 showing declining production. Source: https://www.norskpetroleum.no/en/facts/field/*

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As a side effect of the pressure drop, the reservoir started producing large amounts of sand, which began accumulating at the bottom of the separators. Given their small size, this means shorter retention time for separation of the different fluid phases, which makes the system more sensitive to sand accumulations. This faced the operator with two costly challenges:

1. Inefficient separation process - when sand accumulates in the bottom of separators, it reduces the available space for effective separation of oil, water, and gas. This can result in low product quality, as oil may contain more water or gas, gas may carry liquid droplets, and water may be mixed with oil. If fluids are not separated properly, it can also reduce the overall throughput of the facility, leading to revenue losses.
2. Increased maintenance interventions - as more sand is accumulated, the separators require maintenance interventions for sand removal more frequently than planned. The costs associated with sand disposal in offshore sites are high, exacerbated by expensive offshore mobilizations that imply rigorous planning, especially for unmanned sites. All this means increasing operational expenditure for a field with already declining production.

Solution

To address the challenges, the oil and gas operator chose to install Emerson's SAM Acoustic Sand Monitors (Image 4) at each wellhead and on the inlet pipes to the separators. The detector uses a sensitive acoustic transducer to monitor the noise produced by the sand particles impacting the pipe. This data is then processed into a produced sand rate and accumulated sand mass. To achieve the highest accuracy, the detectors receive continuous velocity inputs and undergo both background noise calibration and a more comprehensive calibration with measured sand injection on a yearly basis. With such a solution in place, the operator then had an online sand monitoring system that plotted the sand rate and mass accumulation in real time (Image 2) so that they are aware of the amount of sand collected in the separator at any point in time.

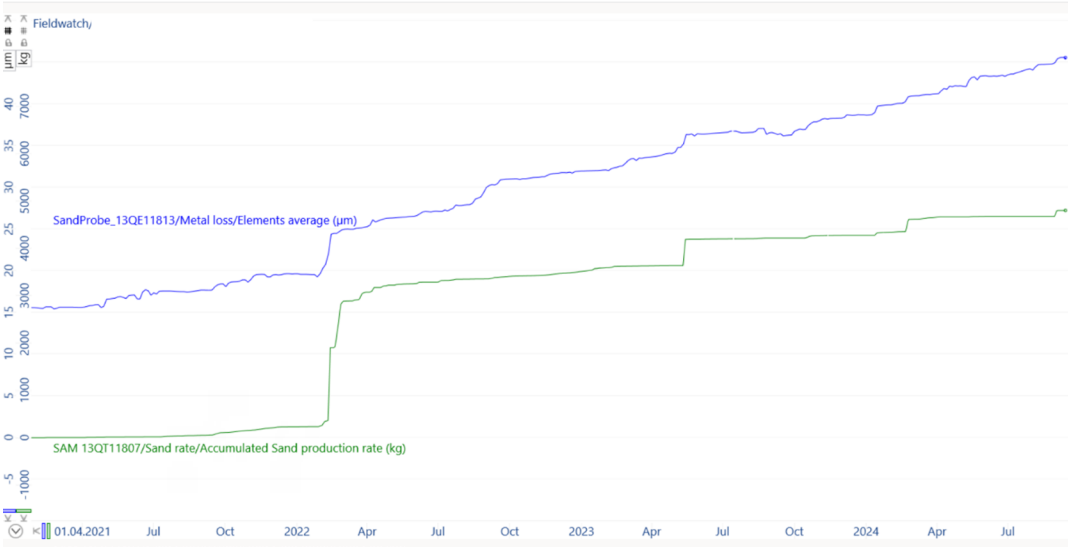

Image 2. *Example of online monitoring of sand accumulation and indicative metal loss from one of the wells.*

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To protect separator efficiency, the system alerts the user whenever sand rate surpasses a predetermined limit. The user then has the opportunity to control the flow rate to avoid potential problems.

One example occurred in February 2022 when one of the wells experienced a sudden surge in sand production, resulting in the accumulation of approximately 1.5 tons of sand within just 9 hours. With sand accumulating at such rapid rate, the separators would have quickly filled up, disrupting the separation process and affecting the overall production performance. With access to all relevant data, the operator was able to respond promptly and shut down the well before the sand accumulation would have compromised the separators performance and cause further erosion damage. Image 3 provides a visualization of the incident.

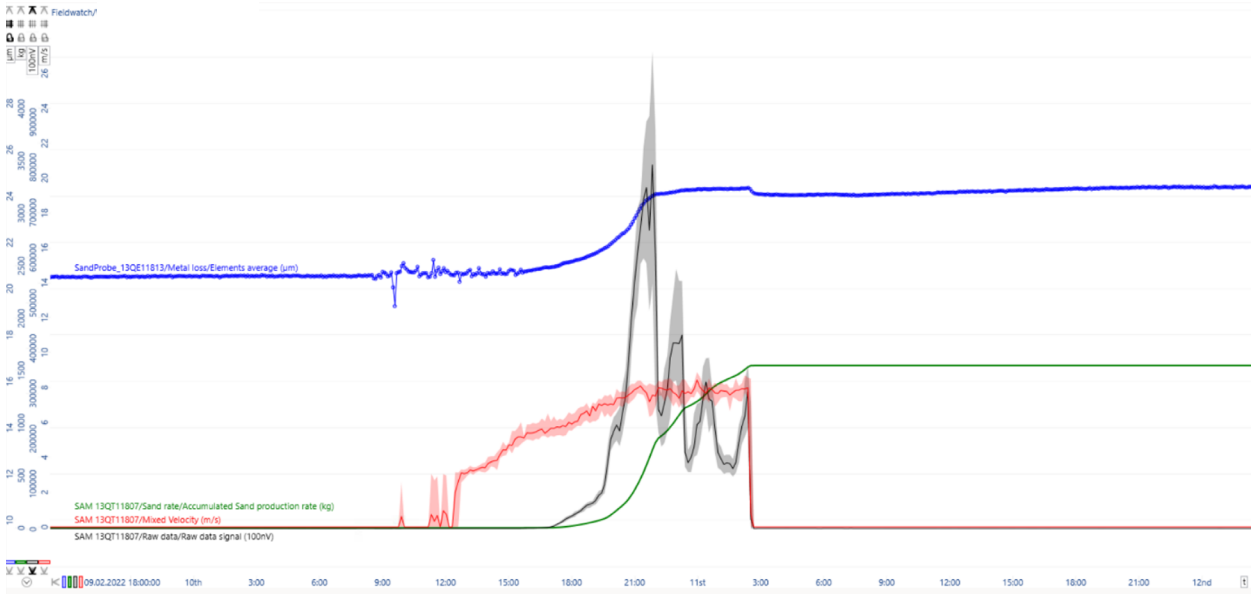

Image 3. *Plot showing flow velocity, sand noise, sand accumulation and indicative metal loss.*

The system alerted immediately after the first spike in raw signal was detected on February 9th around 6pm (represented by the black curve in the graph), likely indicating an anomaly in the well's behavior. Shortly after the spike, the mass accumulation could be observed picking up, showing consistent growth throughout the night and indicating an ongoing issue (represented by the green curve in the graph). In parallel, the sand probe installed at the facility indicated a metal loss of 5 microns in only 3 hours, projecting serious threat to the integrity of the facility (represented by the blue curve in the graph). The platform is controlled remotely from an anchor operational facility onshore, but by having all the key indicators available in real time, after several hours of continuously observing the well's behavior, the team was able to make the call and close the well to prevent separator fill-up and further damage to the infrastructure.

Image 4. *Emerson's Acoustic Sand Monitor accurately detects sand accumulation in real-time.*

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Conclusion

The small separators used on this North Sea platform provide a compact and efficient solution for separating oil, gas, condensate, and water. However, managing the risks associated with sand production, short retention times, and erosion is critical for maintaining their efficiency. Proactive sand control measures and real-time monitoring systems are essential to ensure the ongoing integrity and performance of these separators. The ability to monitor sand production and well performance in real time played a crucial role in preventing a massive costly incident. Thanks to Emerson's comprehensive sand management tools combined with remote control capability, the operator was able to avert a major incident by shutting down the well after observing a rapid increase in sand production. This swift action helped preserve the integrity of the facility, avoid major maintenance interventions and financial losses. If sand production continued unchecked, there could have been a risk of hydrocarbon leaks or spills due to separator failure, which would pose environmental and safety hazards.

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