

OPTIMIZATION OF A WALNUT SHELL FILTRATION SYSTEM

BACKGROUND

Walnut shell filtration is used in the upstream oil & gas industry to remove solids and oil from produced water. The foulants in the produced water build up within the media bed, increasing the pressure drop across the bed, and eventually, when the media is saturated, breaching into the filtrate. As with all media filtration, nutshell filters are not an absolute barrier and if not properly maintained, will exceed bed saturation and oil breakthrough, which adversely affects the effluent water quality and downstream treatment. Media cleaning is performed intermittently by fluidizing the bed, and scrubbing the media in a tangential flow filtration system.

AUTOMATION RETROFIT

Customer's 6000 bbl/day capacity walnut shell filtration system was retrofitted with IntelliFlux to optimize the filter performance and media cleaning process in response to fluctuations in influent produced water quality. An in-line oil content monitor was also installed at the outlet of the filter to monitor the effluent oil concentration.

The original operation of the two media filters before installation of IntelliFlux involved time-triggered cleaning after every 12 hours of filtration. Cleaning was triggered manually by an operator if required earlier. With IntelliFlux, the flow rate, bed pressure drop, and effluent oil concentration were continuously monitored. Cleaning was triggered autonomously when the bed pressure drop exceeded a limiting value. The rate of bed pressure drop increase, and the oil loading in the bed were used in a machine learning and digital twin model to deploy different types of media cleaning strategies. More intense cleans could be deployed when the system encountered heavier oil loading in the bed, and cleaning intensities were less when the extent of fouling was less. Furthermore, the flow through the media filter could be adjusted or shut-off depending on throughput or when the downstream produced water tanks were full.

SUMMARY



APPLICATION AREA: **OIL & GAS**

CUSTOMER: **INDEPENDENT OIL PRODUCER**

LOCATION: **CALIFORNIA**

SYSTEM: **NUTSHELL FILTERS**

CAPACITY: **6000 bbls/day**

OPERATING SINCE: **2018**

BENEFITS: **Water Savings, Energy Savings, Reduced Maintenance, Lower Media Attrition**

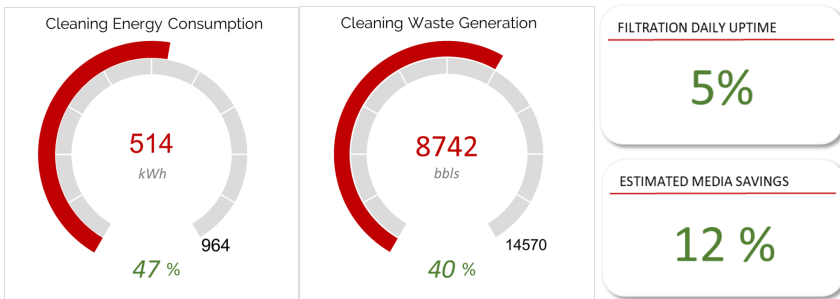
PERFORMANCE

Plant Digitalization Profile Enhancement

IntelliFlux improved the digitalization profile of the plant by implementing a digital twin and AI based Decision Support and Automation layer, while improving the PLC/SCADA/IIoT level system integration and performance. It was the least cost and quickest retrofit digitalization for the plant. IntelliFlux adhered to IEC-27002 security framework, and implemented an ISMS

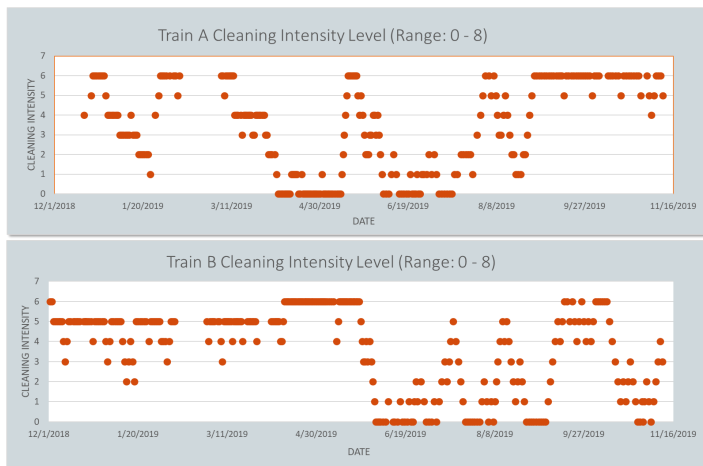
Plant Performance Enhancement

IntelliFlux increased the cleaning interval to 20 hours when the feed produced water quality was within design specifications. However, during intermittent oil content excursions, the cleaning interval was reduced to 8 hours. The average cleaning intensity was reduced by 40%. These led to the following overall monthly direct OpEx benefits:



Dynamic Optimization of Performance

The AI and ML based cleaning optimization of IntelliFlux operates autonomously and continually. Compared to the baseline cleaning intensity (level 6) and interval (12 hours), IntelliFlux monitors and adjusts these maintenance setpoints without operator intervention.



Cleaning intensity variation for the two nutshell filtration trains over one year of operation.

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