

Case Study - Treatment of Produced Water in the Oil/Gas Industries

Produced waters from the extraction process of oil and gas reserves, as well as flow back water from hydraulic fracturing operations must be properly managed in order to mitigate any environmental impacts to existing water supplies caused by the oil drilling/fracturing activities.

Recent research and data indicates that the amount of produced water from these energy exploration and drilling operations ranges from 1.6 to 2.1 million gallons per day in the USA alone.

As energy exploration and extraction continues to grow the volumes of water that will need to be treated will increase along with the requirements of appropriate process treatment solutions to maintain compliance with the environmental impacts on the existing water supplies in these areas of exploration.

The composition and chemistry of produced water is variable and can be complex due to the levels and amounts of pollutants in each of the produced water streams and geographic areas.

Produced Water is generally composed of a brackish solution containing a relatively high level of dissolved minerals, heavy metals, salts and organic compounds.

The high levels of both dissolved organic minerals, chemicals, salts, and heavy metals require the need for appropriate treatment solutions. Through the appropriate treatment process, the produced water from these energy operations can either be re-utilized in the oil/gas exploration process or for other applications including agriculture/irrigation or other non-potable applications.

To treat produced water is a multi-stage treatment process, consisting of a primary treatment process of removing free oil from the water, followed by secondary processes for the treatment of specific suspended particulate and dissolved heavy metals, volatile organic compounds, etc. The tertiary treatment process is typically a polishing process which removes the dissolved salts to levels permissible for reuse or other non potable process water uses.

There is growing interest among energy companies and the regulatory community in the treatment of produced water to be suitable for beneficial use in the areas of surface discharge and/or groundwater recharge, agricultural/irrigation watering or other non potable process water reuse applications.

However, this water is required to meet certain water quality criteria.

In some cases, produced water may be of an acceptable quality to dispose of without treatment,

however, this is rare and may typically be found only in coal bed natural gas fields with typically low total dissolved solids, total suspended solids and/or organic materials.

In the vast majority of cases, treatment of produced water will be required to meet the required effluent water standards according to environmental regulations for reuse in agriculture, irrigation, livestock water supply, ground water recharge or non potable process water reuse.

Challenge

A large oil processing company wanted to reuse their produced water from several oil wells in their energy exploration operations. There is typically 8 or more barrels of water (42 gallon) in each barrel of produced water generated to produce 1 barrel (42gallon) of oil. The produced water generated in the oil production is typically associated with high cost for removal and disposal, as there are several harmful environmentally destructive contaminants in produced water streams.

This particular case study project was a pilot project of 250 m³/day with the results to be used for a potentially larger production capacity of 5000 m³/day and duplicated for the same purposes in different areas to reuse/recycle the oil produced water to be sold/used for agriculture/irrigation or other non potable process water purposes.

The below feed water quality consisted of the following including hydrocarbon (emulsified hydrocarbon), BOD, COD, (all free hydrocarbon was removed via an oil/water separator process first):

TDS 30,000 mg/l
Hardness: 3600 mg/l
NO₃: 67 mg/l
Iron: 97 mg/l
Manganese: 68 mg/l
Color: 74 Pico units
Turbidity: 90 NTU
Sulfate: 50 mg/l

Solution

Genesis Water Technologies requested a water analysis to analyze the composition of the produced water that would need to be treated. This water analysis was reviewed in depth to determine an optimized solution based on the specific type and levels of contamination in the water. There was notably elevated levels of turbidity, specific heavy metals, color, and hardness minerals.

Our local partner consulted with the client and pro-

vided a presentation overview of our customized solution to meet the clients water quality needs.

The customized system solution included an advanced oxidation process followed by specialized backwash filtration systems with final tertiary treatment via a specialized reverse osmosis desalination process including optimized anti-scalant chemical dosing and cartridge filtration.

Results

The system solution was installed and commissioned by our local project management/contractor in 2014 with technical assistance provided by Genesis Water Technologies.

The treated water quality met all the clients parameters. All of the suspended solids were removed, dissolved metals were oxidized, color was removed, and the TDS levels were reduced to less than 500 mg/l.

The treated water was microbiological safe.

This particular process reduced sludge production. The oxidized sludge produced will pass all TCLP tests. The waste brine from the desalination process was disposed in accordance with local regulations.

The system is performing within operating parameters set by the client, reducing their operating and water disposal costs and saving them money.

The picture below indicates the feed water and treated water quality before and after the treatment for an effective comparison reference.



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