Produced & Reused

Treating water from energy exploration & drilling operations

By Nick Nicholas

Produced water from the extraction process of oil and gas reserves, as well as flowback 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 indicate that the amount of produced water from these energy exploration and drilling operations ranges from 1.6 to 2.1 million gal per day in the U.S. alone.

As energy exploration and extraction continue to grow, the volume 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 amounts of pollutants in each of the produced water streams and geographic areas.

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

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

Treatment Processes

Treating produced water is a multi-stage process consisting of a primary treatment process of removing free oil from the water, followed by secondary processes for the treatment of specific suspended particulates, dissolved heavy metals, volatile organic compounds, etc. The tertiary treatment stage typically is a polishing process that removes 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 to treat produced water to make it suitable for beneficial use in the areas of surface discharge and/or groundwater recharge, agricultural/irrigation or other non-potable process water reuse applications.

This water, however, is required to meet certain water quality criteria.

In some cases, produced water may be of an acceptable quality to dispose of without treatment, but this is rare and typically is found only in coal bed natural gas fields with low total dissolved solids (TDS), total suspended solids and/or organic materials.

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

Pilot Project

A large oil processing company wanted to reuse the produced water from several oil wells in its energy exploration operations. There typically are 8 or more barrels (42 gal) of water in each barrel of produced water generated to produce 1 barrel of oil. The produced water generated

Feedwater and treated water from an oil processing company before and after undergoing its customized treatment process.

in the oil production typically is associated with high cost for removal and disposal, as there are several harmful environmentally destructive contaminants in produced water streams.

This particular case was a pilot project of 250 cu meters per day with the results to be used for a potentially larger production capacity of 5,000 cu meters per day and duplicated for the same purposes in different areas to reuse/recycle the produced water to be sold/used for agriculture/irrigation or other non-potable process water purposes.

The below feedwater consisted of the following, including hydrocarbon (emulsified hydrocarbon), biological oxygen demand and chemical oxygen demand. (All free hydrocarbon was removed via an oil/water separator process first.):

- TDS: 30,000 mg/L;
- Hardness: 3,600 mg/L;
- Nitrate: 67 mg/L;
- Iron: 97 mg/L;
- Manganese: 68 mg/L;
- Color: 74 Pico units;
- Turbidity: 90 ntu; and
- Sulfate: 50 mg/L.

Genesis Water Technologies (GWT), which was hired by the oil processing company to develop a solution, 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 were notably elevated levels of turbidity, specific heavy metals, color and hardness minerals.

The company's local partner consulted with the client and provided a presentation overview of its custom solution to meet the client's water quality needs.

The 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.

Performing Within Parameters

The system was installed and commissioned by GWT's local project management/contractor.

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

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

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

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