SAGD Produced Water Treatment

Oil & Gas Industry | Case Study

Oilsands Producer

Northern Alberta, Canada – This project featured produced water deoiling and evaporation systems as well as raw water treatment.

All major process vessels were delivered fully built up and the balance of the system supplied as modules to the greatest extent possible.

The Client's Needs

Water treatment and steam generation are critical to in situ oil production. An oil sands producer in Northern Alberta, developing a new central process facility, required that the water treatment system use water efficiently to meet operational and sustainability objectives.

The system supplied would need to maximize reuse of the treated produced water and minimize waste generated while providing quality water to the boilers for steaming.

The Solution

Veolia Water Technologies was selected to supply the produced water system based on a unique, robust process that met the performance objectives of the central processing facility. The overall system consisted of deoling equipment and a produced water evaporation and crystallization system. Veolia was also contracted to provide raw water treatment comprised of ultrafiltration (UF), SAC Ion Exchange, and Reverse Osmosis (RO). This system will treat well water for startup activities and will be transitioned to providing utility water for non-steaming use for the rest of the plant after startup.

This producer had strict requirements for the water treatment plant in order to meet the sustainability goals of the project. The system must achieve a recycle rate of at least 95% of the produced water treated from production. The solution must also include the utilization of a brackish underground water source as the majority supply of makeup water to the plant.

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Technology Solutions

The integrated produced water system supplied by Veolia consisted of the following treatment technologies, supplied as modules, with these features:

AUTOFLOT® IGF (Induced Gas Flotation) for deoiling:

- Flow rate: 5,880 m^3/d
- Inlet oil content: 320 mg/l
- Outlet oil content: 20 mg/l (>90% removal)

HPD® Evaporation and Crystallization System:

- 5,601 m^3/d boiler feed water supplied to steam generation
- Utilizes Silica Sorption™ seeded process:
  - Evaporator concentrate/blowdown suitable for deepwell disposal without chemical treatment
  - Tolerance of high-hardness produced water and brackish makeup water
- Use of crystallizer recovers 100 m^3/d of additional water and reduces solid waste volume by 50%

Results

The produced water treatment system started up in July of 2012 and has run continuously. It has met operation parameters for Veolia's deoiling equipment and exceeded water recycle targets with reuse rates exceeding 98%.

The HPD produced water evaporation system also demonstrated its unique design features by managing high-hardness water and experiencing an oil spike without effecting operational stability or distillate quality to the boiler.

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System Performance

Produced Water Hardness

In the first ten months of operation, the produced water evaporation system experienced several challenges treating the produced water.

The produced water had hardness concentration as high as 70 ppm. The Silica Sorption process, as designed, was able to tolerate the high hardness with no scaling of the heat transfer surfaces nor affected distillate quality to the boiler.

Handles Oil Upset

The produced water evaporators also experienced a major oil spike during the first year of operation. More than 200 ppm of oil entered with the produced water feed, which then increased with concentration. The design parameter for oil and grease was specified as 15 ppm.

However, the combination of Veolia's proprietary Vapor Washer technology integrated with the HPD produced water evaporation system and use of the Silica Sorption Process, was able to withstand this upset condition and performed as designed.

The Vapor Washer, an external vessel integral with the evaporators, acted as a barrier from the resulting foaming in the evaporator sump caused by the oil carryover. This protected the compressor and more importantly, the distillate quality was unaffected and met the specification for feed to the steam generator.

Operating with the Silica Sorption seeded process allowed the evaporators to continue to operate with no fouling of the heat exchanger tubes with the high oil concentration.