INDUSTRIAL WWTP CASE STUDY

Pilot Treatment System Effectively Removes Suspended Solids from Oil-filled Water

In response to the enormous amount of process water created by hydraulic fracking, IFM was engaged to develop a treatment process for the owner of several disposal wells. These wells are approximately 5,000 feet deep, cased to more than 1,500 feet. The operator of these wells currently uses a simple process of settling and floating of the materials brought to them from the frack sites.

The liquids IFM tested were flow back, drilling muds, and produced waters. The loads contained various levels of dissolved solids, and normally extremely high suspended solids. The owner felt that if the total suspended solids could be reduced, he could protect his wells.

It was agreed that more than just a bench study of treatment was necessary. IFM was engaged to erect and run a scaled pilot on site, with the owner providing real loads of the water to test. He, of course, brought as bad as he had.

All of the tested streams exhibited various levels of total suspended solids (TSS), hydrocarbons and some oil that can make chemical feed and adjustment very difficult to control effectively. In spite of these challenges, IFM was able to clarify and dewater these materials successfully. From the pilot, we realized that consistent oil removal and total suspended solids reduction will require a two-step approach.

These are typical raw samples that were brought to pilot.

From analytical pulled during the pilot, the horizontal clarifier with the aid of chemical coagulants and flocculants, on average, removed 98% of TSS. However, based on incoming concentrations averaging nearly 14,000 mg/l, there is substantial residual TSS remaining that suggested employing a polishing treatment.

Primary treatment would be very similar to what IFM piloted at the well field facility with the main components being designed around the horizontal clarifier and filter press. Options are available with clarification unit being either mobile or fixed.

The proposed mobile option is unique in itself plus it offers built in equalization of various loads. It is estimated that every third load would be homogenized with the previous two loads received providing.

Dewatering would be required to take clarified / concentrated solids from the clarifier bottom and dewatering further into a cake. Precoat of the filter cloth material with diatomaceous earth or perlite with additional flocculants to produce good dry cake is recommended. Sludge storage to be slightly oversized to account for loads that may not be suitable for direct clarification.

From field operations and piloting, for consistent clean water produced from the variable incoming loads, secondary treatment is recommended. The secondary components would provide additional treatment of high total suspended solids water that gets through the horizontal clarifier. The secondary equipment consists of robust filtration technology (ultrafiltration) that can serve as additional solids / liquid separation and thickening prior to dewatering.

Ultrafiltration provides a very strong and resilient barrier to varying solids concentrations and settling characteristics for consistent production of clean water. Separation of solids from liquids occurs regardless of settling characteristics of waste streams received. UF does require the removal of free oils prior for proper operation.

Excellent separation in the clarifier

Pilot system in use at the well site

The horizontal clarifier is a perfect complement to ultrafiltration as the UF cannot tolerate the presence of free oil. IFM would recommend inline monitoring equipment to direct clarified water to the clean water treatment or to the UF System during times of floating solids, upset or other problems.

Ultrafiltration offers the benefits of liquid / solids separation and thickening in one step without additional chemicals. It is expected that TSS may be concentrated as high as 40-50% content while producing excellent filtered water quality. It can be reasonably expected that UF permeate will be much higher quality than current filtered water being rejected. This would be another positive of UF over standard physical / chemical separation.

IFM's full scale design was for a 2,000 BBL / day treatment process. We included an inline sampling station at the off-loading area to ascertain TSS levels and directly accommodate the following:

Primary settling, clarification and thickening system
A large sludge dewatering station
Secondary TSS removal via membranes
Complete explosion proof design and controls

The budget pricing for the entire package came in at less than $1,500,000.00 including redundancy, installation, startup and training. Operational costs came in at less than $5.00 / BBL

Please call for more details or a personal consultation.

Frack tanks were used for equalization to the feed system.

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Chemical feed systems and mixers were required to be explosion proof