

Solutions Improve Water Management

By Danny Boyd
Special Correspondent

Water recycling and reuse is a major part of the oil and gas industry's ongoing efforts to reduce water requirements in hydraulic fracturing operations. In fact, water recycling has become an almost universal best practice for operating companies active in tight oil and shale gas plays from the Marcellus and Utica in the Northeast, to the Eagle Ford and Permian Basin in Texas, to the Niobrara in Colorado and Wyoming.

Because of regional variations in the quality of accessible water supplies, a litany of reservoir-specific factors, and the continuing evolution of treatment technologies, oil and gas companies are leveraging a range of solutions in their water management strategies.

The latest advancements are helping operators conserve resources while cutting costs. Innovations include new treatment systems to remove contaminants found naturally in water as well as remediate produced water, novel applications of proven recycling methods, and new developments that are creating cleaner flowback and produced water volumes that require less treatment.

Oil Recovery System

Each day, the industry produces an aggregate 70 million-80 million barrels of produced water in the United States. The water consumed by fracturing is only a small fraction of this volume, at less than 2 million barrels a day during the peak of the shale boom, points out Mark

Wolf, director of integrated facilities-on-shore at National Oilwell Varco.

NOV unveiled its WaterWolf[™] dynamic oil recovery (DOR) system in February. Designed to improve oil recovery from produced water, the technology also can help operators reduce costs and solve challenging health, safety and environmental issues, he says.

"The vast majority of produced water is from conventional wells that have been producing for years. As wells in conventional reservoirs age, they tend to produce more water and less oil and gas, so the challenge for operators is to economically handle greater water volumes," Wolf observes.

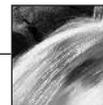
In addition to recovering oil, the system

keeps gases under pressure and entrained in the water while removing suspended solids in a single treatment stage without chemicals, Wolf says. It can process up to 16,000 barrels a day per skid, with effluent water quality equal to or better than that from most conventional gas flotation systems, he details, adding that the WaterWolf also can handle produced water directly from separators and crude treaters with no intermediate oil skimming step.

"The system has demonstrated recovery of one to 10 additional barrels of oil for every 10,000 barrels of water produced," he says. "In addition to extending well life, the system produces less hazardous



The WaterWolf[™] Dynamic Oil Recovery system from National Oilwell Varco is designed to improve oil recovery from produced water while also reducing costs and solving HS&E issues. In addition to recovering oil, the system keeps gases under pressure and entrained in the water while removing suspended solids in a single treatment stage without chemicals. It can process up to 16,000 barrels a day per skid.



waste to treat, store, transport and dispose of.”

It can reduce treatment costs dramatically compared with conventional methods, with savings realized by forgoing chemicals and reducing the amount of equipment associated with sludge movement, storage, transportation and disposal, Wolf says. Devices typically used in the treatment process—such as control valves and pumps—shear oil droplets, but the key to capturing more oil from water is to keep the droplets large, he explains.

The WaterWolf combines deoiling and desanding hydrocyclones with the non-shearing action of NOV Moyno™ pro-

gressing cavity pumps, according to Wolf. “The PCPs pump water without shearing and blending, and also can take the place of the control valve in much the same way that we use the technology to extract pressure energy from mud pumps on the surface to turn drill bits,” he remarks. “We can extract energy from a pressurized fluid source to reduce the pressure instead of using a traditional control valve. That energy is recovered, which helps lower the required pumping power and control the process without breaking up oil droplets.”

In the Rocky Mountains, a well producing since the 1930s was yielding one

barrel of oil for every 95 barrels of water, Wolf conveys. The operator ran an 18-week pilot test focusing on the environmental benefits of eliminating large volumes of carbon dioxide and hydrogen sulfide that were released into the atmosphere when the produced water entered a lease tank.

The WaterWolf system eliminated emissions and associated flaring requirements, and returned an additional 25-100 barrels of oil a day into the production stream while eliminating treatment chemicals, he reports. Total operating costs for water treatment were reduced to less than \$0.01 per barrel of water produced. □