

Treatment Technologies Improve Efficiencies Of Water Recycling

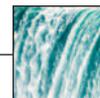
Editor's Note: Standing alongside a dusty lease road looking out across an arid landscape that envelops the horizon in all four directions, it can be hard to believe West Texas and Southeast New Mexico once were submerged beneath an inland sea. Water was everywhere in the Permian Basin 250 million years ago.

Today, oil and gas is seemingly everywhere, generated by a series of source rocks stacked one on top of the other in the subsurface. But producing the hydrocarbons requires injecting, producing and handling a lot of water, which is why an almost countless number of temporary ponds, pits and holding tanks are scattered among all the rigs, frac spreads, pump jacks and pipelines on the basin's surface.

Consequently, water management has become a multibillion-dollar annual business in the Permian and other basins. A key part of the market is treating low-quality waters for hydraulic fracturing operations, including capturing and reusing flowback and produced waters. Why has recycling quickly emerged as a best practice for operators? Where is the industry on the produced water treatment learning curve? How are technological solutions being deployed to cost-effectively treat and manage water on site?

To find out, AOGR presented a series of questions to a panel of water management technology and service experts, including Dean Fanguy, director of business development, Western Hemisphere, at TETRA Technologies.

Questions are in italics, followed by Mr. Fanguy's responses.



CLOSING THE LOOP

Q: *How does closed-loop water management improve economics for oil and gas operators? How much of the process can be automated? How can operators plan and manage their project needs?*

FANGUY: A closed-loop water management system provides greater simplicity and control over blending and fluid quality because it lends itself to more seamless integration and computer-controlled automation.

In terms of the economics, the dramatic increase in unconventional shale development means operators now are confronted with higher water management costs and more environmental and operational risks than ever before. The challenges are sourcing freshwater and incurring higher volumes of produced water and sand flowback. Scaling up services to meet these challenges and trucking produced water from the well fracturing site to another site for disposal further compounds the cost and exposure to risk.

We address these challenges with our closed-loop solution to provide the lowest-cost-per-barrel water management solution. Using this solution, we can fully integrate and automate every step in the process, from water transfer to desanding, treatment and recycling, blending, storage, and distribution.

This approach yields several benefits, including more efficient job planning, reduced personnel costs (often as much as 30 percent), greater transparency of the process, enhanced quality control, and reduced risk of safety and environmental incidents. Additionally, the TETRA solution is scalable, allows for remote monitoring and control of water management, and provides valuable data for planning.

Q: *What sourcing challenges will operators face as they focus on full-field development in existing core areas of resource plays and extend development into new areas and even new basins? How can they better manage the supply for just-in-*

time use when using multiple sources, including treated and recycled water?

FANGUY: If operators continue development in the same manner, increased activity in and around existing shale basins or in new basins will present three logistical challenges: trucking high volumes of freshwater to job sites; trucking produced water from job sites to other sites for disposal, and coordinating these two phases of transportation so they are properly timed and consistently reliable. The problem is that increased truck traffic increases both operational costs and the potential for incidents, and few communities actually welcome more trucks on their roads.

The solution is to recycle more of the produced water on the fly to reduce the volumes of freshwater needed for an optimal frac fluid, integrate the steps of the water management process for more efficiency, and automate these steps for greater control and better allocation of personnel.

Our closed-loop water management solution addresses these needs. Automated water recycling systems can process different types of produced water on the fly, with blending and treatment technologies that eliminate bacteria, sulfides and other suspended solids, and can ensure a consistently high-quality frac fluid throughout completion operations.

Q: *What kinds of technologies do you see being used to deliver supplies of water from multiple sources with varying qualities and constituencies? How can technology be leveraged at every step in the process to optimize water quality regardless of source for consistent frac fluid performance?*

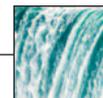
FANGUY: We have developed a number of innovative technologies to address the challenges of recycling diverse types of water, from produced to brackish waters and flowback with sand. First, our Oil Recovery after Production Technology (ORAPT™) separation units pretreat produced water prior to



Dean Fanguy is director of business development, Western Hemisphere, at TETRA Technologies Inc. Before joining the company in 2013 as director of North American sales, he was director of sales for U.S. operations at Tervita. Prior to that, Fanguy had worked for 32 years in business development and product line management positions at Baker Hughes, a GE company.

DEAN FANGUY

Director of business development, Western Hemisphere
TETRA Technologies



recycling and recover residual hydrocarbons, which are then returned to the operator for sale to the market. The SwiftWater Automated Treatment (SWAT™) system chemically treats produced water and provides accurate ongoing chemical dosage to ensure the water is treated to exact specifications. Its web-based, real-time monitoring and control gives operators on-demand access to treatment and recycling operations 24 hours a day, with a transparent view of the chemistry and its efficacy.

Our on-the-fly water treatment system for both produced and freshwater contains EPA-approved biocides to prevent or eliminate 100 percent of the bacteria and remove sulfides prior to fracturing. The system uses the flow of water in the transfer line to generate the biocides and automatically stops when flow is interrupted to ensure a safe work environment. The automated blending solution can treat diverse types of water with an automated blending controller and a patented, on-the-fly blending manifold. The system measures input and outbound fluid conductivity and automatically adjusts flow rates in real time to achieve the specified blend, thereby minimizing variation in frac fluid quality while maximizing the use of produced water.

TETRA Steel™ double-jacket, flexible lay-flat hose and patented Rapid Deployment and Retrieval Vehicle are revolutionizing onsite water transfer. The hose includes zero-discharge couplings and allows for higher operating pressures than a single-jacket hose. These products improve operational efficiency, reduce risk to the environment and to personnel, and lessen the impact on landowner properties.

Finally, our Automated Distribution Manifold (ADM) facilitates more efficient and predictable management of frac water buffer

volumes in real time, with computer control of tank levels to ensure a steady supply of frac fluid while preventing tank overflow. It can independently control and monitor up to 10 frac tanks, and it can be configured for varying output levels depending on operational needs, reducing the uncertainty of water provision and helping to ensure continuous operation. Additional ADM systems can be linked to manage more frac tanks seamlessly.

Q: *With per-well fluid and proppant and volumes continuing to climb, how do you see water supply challenges shaping up going forward? Will more water come from alternative sources such as brine reservoirs? Will greater volumes of produced and flowback water be treated and reused in fracturing?*

FANGUY: The demand for water will grow exponentially over the next few decades, so formations with brine and nonpotable water may indeed become more integral to unconventional strategies. Down the road, municipal wastewater might be another source as well. Obviously, the more dissolved solids and other impurities in the sourced water, the more it will have to be treated. Capturing and treating such waters must be cost-effective.

Treating and reusing produced water at the frac site is very economical. In fact, it is a win-win for operators. The more produced water they can use, the less freshwater they will need to source, and the less produced water they will need to then haul and dispose of. That reduces both costs and risks, and makes operations more efficient. Where the water management solution recovers residual hydrocarbons that can be sold, the captured product actually can offset the cost of the water system. □
