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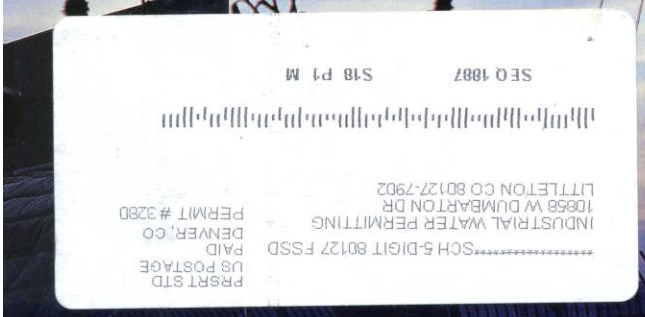

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TECH TALK

Can 100% of flowback be reused in hydraulic fracturing?

BY GARY BEERS • FOR ENERGY PIPELINE

Slickwater fracturing is the common method for hydraulic fracturing oil or gas wells. A key component of this method is adding friction-reducing chemicals to the water to increase the fluid flow (Friction Reducer as Water Management Aids in Hydraulic Fracturing, Onepetro; Paper SPE-164493, 2013). Without using these chemicals the top pumping rate would be about 60 barrels per minute (bbls/min), but with these chemicals this rate increases to 100 bbls/min. This significant saving to the cost of fracturing.

Many companies in Colorado employ slickwater fracturing and have shifted from extensive use of freshwater to focusing on the reuse of flowback and produced waters. Typically, flowback water is routed to a nearby, portable-treatment system, which removes the organics but not the salts, and then is routed back to the fracturing site for injection. To make up for water retained by the formation, freshwater or produced water from active nearby wells is added to the flowback before the treatment process.

This is an important first step in improving their water management practices and lessening an environment impact (i.e., reducing the demand on local freshwater resources).

However, the waters in the reuse cycle must be periodically discarded (i.e., routed to injection well) due to build-up of total dissolved solids (TDS). Typically, the performance of the conventional friction-reducing chemicals decrease as the dissolved solids concentration increases. When the TDS concentration in the reused water approaches 60,000 mg/l, the effectiveness of the friction-reducing chemicals is very low (Case Study: A Two-Part Salt-Tolerant Friction Reducer System Enables the Reuse of Produced Water in Hydraulic Fracturing, OnePetro, Paper SPE-184508, 2017).

An important second step is needed in improving the water management practices by providing friction-reducing chemicals that perform when the TDS concentrations are above 60,000 mg/l. This advancement would reduce the volume of the discarded water to disposal in the injection well.

EMERGING SALT-TOLERANT FRICTION REDUCERS

Technical staff of Halliburton Services have developed a new salt-tolerant friction reducer that can perform when the TDS concentrations range up to 300,000 mg/l (Case Study: A New Salt-Tolerant Friction Reducer System Enables 100% Reuse of Produced Water in Marcellus Shale, OnePetro, Paper SPE-184052, 2016). Key features of this new friction-reducer are:

» effective at low concentrations 0.25 to 1 gallon/1,000 gallons).

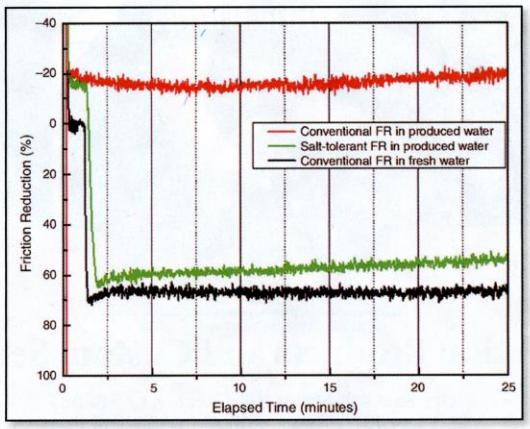
» consist of an water-in-oil cationic polymer with an inverter.

» key advantage is ratio of polymer to inverter can be adjusted during operation to achieve increased friction reduction.

» no other concurrent friction-reducers are needed; thus, onsite storage and quality assurance are simplified.

The friction-reduction method used for waters with TDS levels below 60,000 mg/l generally involved several types of chemicals, including anionic chemicals and inverse-emulsion polymers (Water-based Environmentally Preferred Friction Reducer in Ultrahigh-TDS Produced Water for Slickwater Fracturing in Shale Reservoir, SPE/EAGE European Unconventional Resources Conference, Technical Session 26, February 2014).

The key results of the flow-loop tests in the laboratory are shown in Figure 1.



For over 50 years **GARY BEERS** has worked in numerous fields of environmental science as a consultant, regulator and educator. This career included senior management position with major consulting, nonprofit and public organizations. He has founded several successful firms to capture emerging resource management markets. One of his latest ventures, EnviroScienceINFO, provides content for public media.

The salt-tolerant friction reducer was tested under laboratory and under field conditions.

The key results of the flow-loop tests in the laboratory are shown in Figure 1. The conclusion is the new salt-tolerant friction-reducer displayed superior performance, when compared with conventional chemical, and should enable the reuse of undiluted flowback water in fracturing operations. Importantly, a consequence is a reduction in the need for expenses for handling water (under conventional method) that would be routed to disposal in an injection well.

A three-well, field trial program was conducted in the Marcellus Shale Region. The water use by hydraulic fracturing in this northeast region of the U.S. is high (Figure 2) and the TDS concentrations in flowback and produced waters are commonly above 100,000 mg/l. A water use of 10,001 to 36,620 cubic meters per well when converted is 2.6 million to 9.7 million gallons per well. The test involved pumping for 10 to 14 stages with a conventional friction reducer, then switching to use of the salt-toleration friction reducer. During the use of the conventional friction reducer the average treating pressure ranged from 8,700 to 9,100 psi, and after the chemical switch was made the pressure dropped immediately and ranged from 8,100 to 8,700 psi – a lower and more desirable range. As a result of the testing, the researchers concluded, "The salt-tolerant friction-reducing system is customizable through independent inverter dosage, which results in improved friction reduction performance for use in 100 percent produced water conditions."

The water use by hydraulic fracturing in this northeast region of the U.S. is high as seen here in Figure 2.