TORP Tests
Chemical Floods For Mature Fields

Researchers at the University of Kansas Tertiary Oil Recovery Program this fall will wrap up a four-year project aimed at helping small operators and the industry at large improve their production by applying chemical floods in mature fields.

Chemical flooding for enhanced oil recovery involves using:
- Surfactants that reduce the interfacial tension to mobilize trapped oil;
- Polymers that reduce mobility of injected fluids for a more efficient sweep of the reservoir;
- Alkali to reduce surfactant adsorption and generate in situ soaps;
- Co-solvents that reduce micro-emulsion viscosity and improve surfactant solubility; and
- Electrolytes, which are used to vary the affinity of surfactants to solubilize oil and water phases.

Although this sounds complicated, one purpose of TORP’s project is to simplify chemical flood operations.

Using Department of Energy funds from the Research Partnership to Secure Energy for America, which now is managed by DOE’s National Energy Technology Laboratory, TORP researchers began with the objective of designing and implementing a chemical flood that would produce useful data that operators—specifically smaller operators—could use to evaluate the potential of the chemical flooding process.

After careful evaluation of multiple fields in Kansas, TORP Senior Scientist Stan McCool selected the Trembley Field in Reno County as the site for this study. Reno County has had a long history of oil and gas production. This production has been largely flat since the 1990s, but saw a spike from 2011 to 2015. Production levels have since dropped, but McCool believes chemical flooding may be a way for operators to improve production from mature wells and produce oil that otherwise would be left behind.

The project began with laboratory work that identified chemical formulations appropriate for the crude that was being produced in the Trembley Field. Various formulations were tested and the oil recovery performance of each was evaluated. Eventually, a formula was selected for the field test.

Researchers then measured the chemical formula’s adsorption values, or how it adhered to the surface of actual Trembley rock material. Waterflood reservoir simulations were history-matched using primary and secondary production data from the field. Chemical floods were then simulated in preparation for field trials.

Once researchers and industry partners selected a candidate well, a workover rig was brought out to clean the wellbore to improve injectivity and reduce shearing of the injected fluids. The activities of two polymer solutions—each with different molecular weight—were tested in the injection well selected. A field injection facility was designed to meet the needs of the chemical delivery logistics.

After careful evaluation of laboratory work and collaboration with industry partners, researchers agreed to move ahead with field implementation.

Soon after the injection unit was delivered and installed, the researchers began injecting low-salinity brine into the reservoir to condition it and prepare for surfactant delivery. Tanks were set for the surfactant mix, after which tankers delivered the mix to the field. Injection of the mix into the Trembley Field began May 4.

The chemical slug continued to be injected as of mid-June as researchers monitored and collected data. Researchers initially were concerned that they were not injecting at high enough rates. Since May, they have been working to make sure the injection rate is as high as possible without causing damage.

To accomplish the highest injection rates possible, researchers are monitoring injection and making adjustments as needed. During this process, researchers have been able to keep project costs below budget, and are eager to begin sharing results as the program concludes.

TORP has been actively researching enhanced oil recovery technology for more than 40 years. It conducts research and development designed to create new processes that are applicable to Kansas as well as to the industry at large.

One of the ways KU has been serving industry is by investigating and applying reservoir engineering and geology to characterize regional oil reservoirs and then disseminating this information as well as additional information about tertiary oil recovery and reservoir management.

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