Wichita Workshop Focuses On Advancements In Waterflooding

More than 50 oil and gas operators and service companies gathered in June at the Wichita, Ks., Petroleum Club to learn more about the established technology of waterflooding for improved oil recovery through a workshop presented by the University of Kansas Tertiary Oil Recovery Program in conjunction with the Petroleum Technology Transfer Council.

There have been many innovations aimed at improving this secondary recovery process by which water is injected into the reservoir to displace the oil trapped in the pores of the rock and to drive or sweep this oil toward production wells.

Waterflooding was designed to produce the additional two-thirds of oil left behind after conventional recovery, and in its more than 70-year history, it has proven to recover an additional 10-20 percent of the original oil in place in a given reservoir.

However, much of the waterflooding process is unchanged and rooted in experience. As one might expect, case studies and old stories carried the day in Wichita.

The single day event brought together regional experts to present on various components of the waterflooding process, including design, rules of thumb, operations, unitization, surveillance, and the use of polymers. Two presenters who really showcased their experience were Randy Koudele and Dwayne McCune.

Koudele, who is a local staple in the area of waterflooding with more than 40 years of experience in the oil and gas industry, opened the day with a presentation focused primarily on waterflooding design. He highlighted how the process of waterflooding likely began in the area as a result of dump-flooding, and developed into formal waterflooding in the 1950s with Lansing-Kansas City limestone reservoirs as the most common waterflooding projects. Other reservoirs successfully flooded in the area include the Topeka, Simpson, Morrow, and Chester.

Among the successful area waterfloods that Koudele cited was the Wellington Unit, a Mississippian field discovered in 1929. The Wellington Unit was unitized in 1953 for waterflooding the Upper Mississippian formation. More than 100 wells were drilled in this unit, which still is producing. Koudele highlighted this as a rare example of a successful Mississippian waterflood.

Koudele later offered some tips for designing a waterflood in the area. First, he said to try to unitize the field if possible, and to not inject until the unit had been approved. Make sure all usable water zones are protected, and install cartridge filters upstream of injection wellheads. Make sure to monitor pressure drops across the filters, and replace them as necessary. Also, monitor injection rates on a daily basis.

Koudele also suggests running step-rate tests if there is any evidence of fracturing in the injection wells, and to perform monthly tests on all producing wells. Additionally, he suggests operators keep producers pumped off, and run injection profiles after the first six months, and then every two to three years. If an operator is having conformance problems, he says to make sure to work over injection wells and get water analyses on all producers prior to starting injection. Finally, Koudele suggests checking the compatibility of produced water with that of the supply water, and treat for scale as necessary.

Next up was Dwayne McCune from Cedar Technical Services, who like Koudele, has been a regional fixture in the area of waterflooding. McCune added to Koudele’s thoughts about waterflood design with some rules of thumb that had proven useful for him during his career.

He began by showcasing what particular reservoir characteristics an operator should evaluate when screening potential waterflood sites. These include adequate mobile oil in place, solution-gas drive or limited water drive, moderate to low oil viscosity, sufficient permeability, low to moderate permeability variation, low gas saturation, and an ability to inject and produce large volumes of liquid.

McCune also illustrated that sometimes adequate screening data were not available, and that applying analog data from similar wells was the most reliable method of evaluation and design. When considering analog fields, McCune encouraged the group to look for reservoirs that were similar in primary performance, and to make sure the crude oil had similar gravity and viscosity. He encouraged the group to look for similar structural configuration, lithology, and heterogeneity. Finally, McCune encouraged operators to make sure both formations had similar porosity, permeability and initial saturations, as well as depth and initial reservoir pressures.

Waterflooding continues to be a viable option for many operators. Water is still inexpensive and readily available. Although much work has been done in this area, good, old-fashioned experience combined with emerging technology seems to be the recipe for success in modern waterflood design.

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Jeremy Viscoli is the director of technology transfer for the University of Kansas Tertiary Oil Recovery Program and the PTTC Midcontinent Region office. He has more than a decade of experience in developing and organizing technical conferences and special events.