ASP Technology Increases Production from Depleted U.S. Oil Field

Successful Pilot Project Improves Recovery by more than 300 Percent in Mature Illinois Oilfield

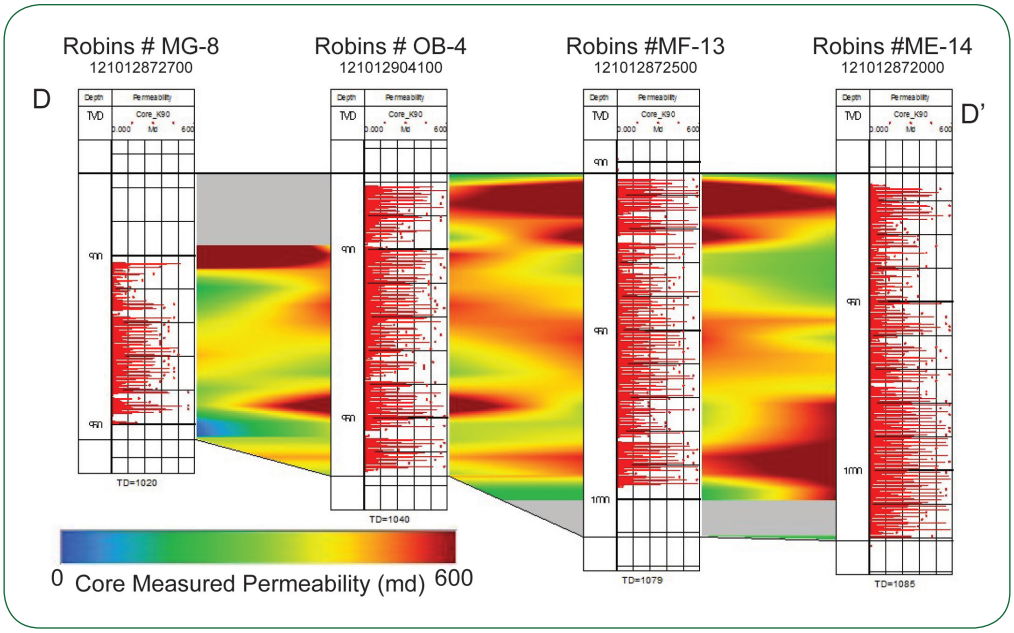
The Lawrence field in Lawrence County, Illinois, has yielded more that 410 million barrels of oil under different operators since it began production in 1906. Yet, like many mature oil fields, despite the significant amount of oil remaining in its formations, Lawrence is approaching the limit of economically feasible oil recovery through traditional recovery techniques. Although this field is no longer at peak production, an innovative recovery technique could help procure nearly 130 million additional barrels of oil.

Using an alkaline-surfactant-polymer (ASP) flooding technique, the oil yield from the 15-acre Middagh pilot at the Lawrence oil field has increased from 16 barrels to between 65–75 barrels of oil per day through a demonstration supported by the National Energy Technology Laboratory (NETL) and operated by Rex Energy Corporation: impressive results.

The ASP flooding technology being implemented uses two different interfacial tension (IFT) reduction agents—alkali and surfactant—and a mobility control agent—polymer. The use of two interfacial tension reduction agents greatly magnifies their reduction property, increasing their efficacy 10,000-fold. The alkali reduces surfactant adsorption (mainly) and IFT (secondarily). Blending surfactants and alkalis reduces IFT for a wide variety of reservoir conditions. Rex Energy is conducting the ASP field testing as part of a larger project by the Illinois State Geological Survey (ISGS), which is being supported by the Department of Energy's (DOE) office of Fossil Energy and the Prairie Research Institute. The ISGS is characterizing the Illinois sandstone reservoirs to determine the remaining oil reserves, but to do so, a clear picture of the changing porosity and permeability of the reservoir must be formed. Recognizing and understanding changes in permeability and porosity throughout the reservoir is important in delineating flow units, understanding channeling of reservoir fluids, and determining remaining recoverable oil.

In addition to a geological model, a geo-cellular model of the sandstone deposits was developed using reservoir geometries and geological data. 3-D modeling increases the capacity to evaluate reservoir characteristics by visually illustrating porosity, permeability, and compartmentalization. This elaborated reservoir characterization allowed 3-D reservoir simulation of the Middagh pilot.

The depositional environment of the reservoir sands impacts the structure and properties of the resulting formations. The sandstone deposits found in the basin were created first by the sediment left by rivers and streams, but repeated coastal flooding altered the formation. The tide-influenced costal sandstone deposits are fine-grained, which causes them to become more compact and less permeable. The 15-acre reservoir used in the Rex Energy ASP pilot is being targeted for this reason—to minimize injection losses. Due to its formation, the sandstone deposits are compartmentalized, requiring an accurate assessment of ASP flood design in the confined area.



In the 15-acre Middagh project area,

the overall oil cut increased from 1 percent to 12 percent through the use of ASP flooding. Due to this demonstrated success, Rex Energy has plans to expand testing to a 58-acre portion of the field. Further, in 2013, Rex Energy will continue the project, utilizing ASP technology in a 351-acre parcel immediately south of the current operation. With continued success and private investment in these ASP pilots, the entire Lawrence field may once again be revitalized.

Ultimately, if ASP technology lives up to its potential, it could be used to increase domestic oil production in similar fields throughout the United States, bringing with it both job creation and expanded economic activity.