Proper reservoir characterization is fundamental to all aspects of reservoir management. Samples of representative formation fluids are analyzed to determine the bulk fluid properties, fluid phase behavior, and chemical properties. This information is then used to design production strategies, identify and mitigate flow assurance issues, and is used as a key parameter in determining the value and economic viability of a play. Capturing high-quality reservoir samples is thus one of the most important factors for reservoir characterization. This also brings the biggest challenges, which are the additional steps of acquiring, transporting, and analyzing physical fluid samples in the laboratory. Depending on the location and the workload of the labs, the PVT analysis of downhole fluid samples can take a long time. In that time, samples can be lost, contaminated, or experience phase changes. Should that occur, it is cost-prohibitive to retrieve new samples. This dilemma can escalate costs and uncertainty. The risk of making bad assumptions is enormous.

Halliburton now has the technology to quickly and effectively analyze formation fluid properties downhole and in real time. The ICE Core® technology was executed in 37 wells (over 200 pump-out stations) in the Middle East.

Consistent sampling increases confidence for field development decision making.
SOLUTION

The solution to avoid those challenges is the prompt availability of in-situ fluid compositional data. The Halliburton ICE Core service offers chemical composition of fluids in real time. It provides a quick preview of results, a valuable backup, and a reliable cross check. Additionally, samples can be taken from representative zones, and ICE Core sensors can be used to take readings throughout the well, yielding more data about fluid stratification without extra costs or additional trips.

Collecting the ICE Core results out of 37 wells (over 200 pump-out stations), different fields, and different reservoirs was planned in three different phases. Each phase had its own goals and data collection strategy. Phase 1 was for tool operational integrity and data collection in different environments. Phase 2 was for optimum tool configuration within the WFT flowline to alleviate the flow regime effect on the measurement. Having the ICE Core measurements before the pump will subject the fluid to reservoir-flowing pressure during cleanup and fluid characterization. This drawdown pressure varies considerably depending on the fluid nature and rock permeability. If the fluid analyzer is on the outlet side of the pump, the fluid is under a constant flowing pressure (hydrostatic pressure), which is predictable and more consistent. Phase 3 was for select reservoir fluids to be used for final tool validation and comparison with lab results. Also, in this phase, a real-time answer product was fully developed to provide a simple interpretation and fluid characterization in an integrated plot in real time.

RESULT

The extensive field testing of the ICE Core downhole optical fluid analyzer in the Middle East Arabian Gulf reservoirs proved to be highly consistent among different wells, reservoirs, and fields, and was in general agreement with laboratory compositional analyses. The data enabled confident decision making.

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