InSite AFR™ Sensor Delivers High-Resolution Images for Reservoir Fracture Characterization
Location: Offshore, West Africa

OPERATOR’S CHALLENGE – The operator of an offshore field in West Africa was expecting water losses in deviated water injection wells located in a depleted reservoir. They needed to acquire high-resolution borehole images while drilling the wells to characterize the fractures and rock texture in order to predict injector performance.

HALLIBURTON’S SOLUTION – Halliburton’s Sperry Drilling services deployed the InSite AFR™ azimuthal focused resistivity sensor for high-resolution structural and stratigraphic borehole images to precisely identify the fractures, and the MRIL-WD™ Magnetic Resonance Imaging logging-while-drilling sensor to contribute reliable porosity data.

ECONOMIC VALUE CREATED – The high-resolution borehole images delivered by the InSite AFR sensor provided accurate identification of fractures, indicating fewer fractures than expected. The MRIL-WD sensor proved to be a successful replacement for nuclear density and porosity tools, as it supplied reliable porosity data and also precisely displayed the location of the permeability barriers, that could not be determined from conventional logs.

The high-resolution resistivity images were acquired in one bit run while drilling the 8-1/2” section with the 6-3/4” InSite AFR sensor. The InSite AFR sensor was able to precisely identify two open fractures. On a second well the sensor delivered a high-resolution 64-bin resistivity image of another open fracture where significant mud losses had been experienced.

The high resolution AFR images were outstanding and although the formation logged presented fewer fractures than expected, the resolution was very impressive. Very small vugs were identified from the resistivity image, which confirmed the expected rock texture previously observed from cores. The operator expressed great satisfaction using the InSite AFR and MRIL-WD sensors for the first time, and after this successful outcome, is likely to utilize this technology again in the future.
**INSITE AFR SENSOR** – Capable of providing high-resolution images to the standard of any wireline electric imaging tools, the InSite AFR sensor can also pick dips and fractures while drilling. The high-resolution images of structural and stratigraphic features are acquired at three different depths of investigation and in 64 discrete azimuthal sectors around the borehole enabling real-time analysis and drilling optimization. By reducing uncertainties in structure and formation properties, this advanced formation evaluation technology can help deliver more accurate reservoir models, superior reserves estimation and optimum well placement for maximum oil recovery.

**MRIL-WD TOOL** – The MRIL-WD sensor is a magnetic resonance imaging logging-while-drilling tool that provides a direct measurement of the reservoir's total porosity while drilling, identifying bound fluid, free fluid (oil, gas and water) and total porosity in real time.

It provides this important reservoir fluid information prior to significant drilling mud filtrate invasion. Unlike traditional porosity devices, which are affected by rock matrix changes, the MRIL-WD tool provides a mineralogy-independent porosity measurement. In applications that require real-time data or when economic considerations favour LWD logging, the MRIL-WD service provides the same high-quality information as the wireline services.

*MRIL-WD™ sensor screen capture indicating ‘real-time’ and ‘memory’ data. The results allowed the precise determination of permeability barriers not possible using conventional logs.*