Clay-free INNOVERT® OBM system helps operator drill deepwater wildcat well with 2,800-m salt sequence

Location: Offshore Angola

Overview

Drilling long salt sequences has always proven to be a challenge for deepwater operators. Some contributing factors include the following:

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- Salt has the potential to be mobile, which can trap the bit/bottomhole assembly, resulting in stuck pipe. To overcome this, the drilling fluid density is increased to exert additional pressure on the wellbore, in this case up to 13.4 ppg (1.61 sg).
- Salt dissolves into the water phase of high-performance INNOVERT® oil-based mud (OBM), and, at the bottom of the well, under pressure and temperature, additional salt can be dissolved into the OBM system, thus super-saturating the fluid. On reaching the surface, this extra salt re-crystalizes and is removed at the shale shakers, taking essential additives with it. This can lead to fluid instability.
- Salt formations can also be composed of more complex salts (e.g., magnesium and potassium chloride) that will destabilize the drilling fluid.

The subject well was located in a remote area, 370 km south of the supply base. There was no direct offset well data, making this a wildcat operation.

Halliburton's Solution

Angola's recently released pre-salt concessions provided both an opportunity and a challenge to the INNOVERT OBM system. The Baroid team applied both technical and "black book" processes at the outset of the project, ensuring that no part of the fluid design was overlooked.

CHALLENGE	SOLUTION	RESULTS
Drill a deviated water injector well through highly depleted sandstones reservoirs.	The clay-free INNOVERT® OBM system was engineered to control salt mobility, prevent barite sag, and withstand extended static periods.	The 2,800-m salt sequence was drilled with zero wellbore stability issues, and the INNOVERT fluid was in good circulating condition after a two-week static period for rig repair.

Although INNOVERT OBM has often been used to drill through salt in other regions, the extent of this 2,800-m (9,186-ft) salt sequence was daunting. Laboratory testing showed the INNOVERT drilling fluid system to be resilient against solids loading through increasing the density of the fluid as well as stable against potential water/brine flows. Testing also confirmed the fluid to be stable under simulated bottomhole conditions for extended static periods.

As indicated by laboratory results, the system remained stable throughout the drilling of the salt, as well as through subsequent intervals. There was no evidence of barite settling or barite sag during the drilling operation, which was one of the operator's concerns. Routine emulsion stress testing was done, along with a daily sag shoe test, to ensure that the system was stable and that solids separation would not occur. Other fluid properties were maintained within the programmed specification with minimal treatments required.

At the end of the salt interval, a rig repair caused the rig to shut down for almost two weeks. The fluid remained static in the wellbore for the entire duration. After the repairs were made, the INNOVERT system was circulated up and exhibited no significant variations in the density or any great deterioration in the properties despite the ± 110°C (230°F) bottomhole temperature. There were no tripping issues and no problems running the casing string to bottom.

Economic Value Created

The stability and functionality of the INNOVERT OBM system allowed the operator to drill the interval without any fluid-related nonproductive time. No wellbore issues occurred.