Case study: Santos Basin, Brazil

PERF*FLOW* CM fluid delivered well stability, excellent production rates in challenging horizontal well

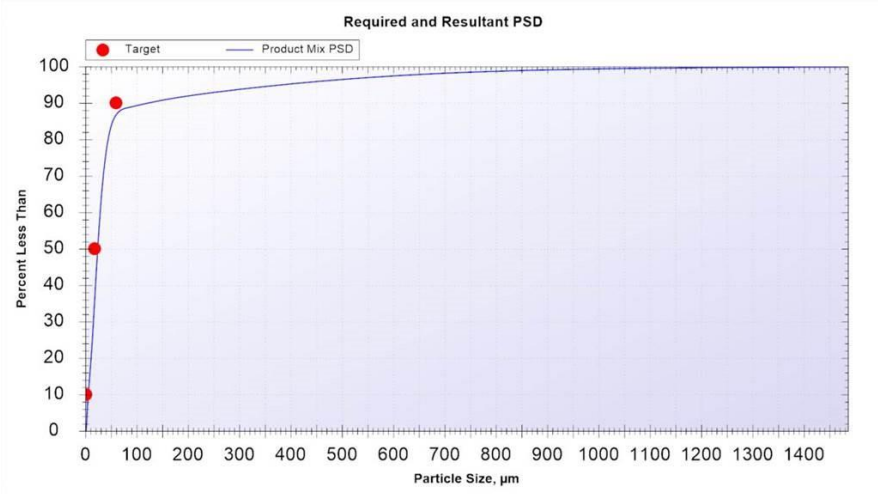
An oil company drilled a well located in the post-salt Atlanta field in Brazil's Santos Basin at a water depth of 5,082 ft (1549 m). The combination of ultra deepwater, heavy and viscous oil (14 API), unconsolidated sandstones and argillites, and a long 2,637-ft (804-m) horizontal section created significant challenges for the operator.

Baker Hughes recommended an intelligent fluids solution using the **PERF*FLOW*™ CM water-based drill-in fluid** in the 8 ½-in. reservoir section. **SOLUFLAKE™ series flaked calcium carbonate** was added to the PERF*FLOW* CM fluid to promote the optimal sealing of the unconsolidated formation. Also, the addition of the **MUL-FREE™ RS emulsion preventer** to the PERF*FLOW* CM formulation ensured reservoir compatibility and avoided damage resulting from unwanted emulsions formation.

Baker Hughes fluids experts used the **BRIDGEWISE™ engineering software** to analyze the best combination options of calcium carbonate to promote wellbore stability and avoid circulation losses. Laboratory analyses were run to define the optimal product concentrations that would provide the performance needed on this job.

Because of the anticipated low flow rate, field personnel constantly monitored hole cleaning while drilling and viscous sweeps were periodically circulated to ensure proper cuttings transportation. After a leakoff test, the drilling continued with constant parameters of 60 rpm, 350 gpm, and an instantaneous rate of penetration (ROP) limited to 65.6 ft/hr (20 m/h) until all stabilizers left the casing.

The narrow operating window was a critical factor to be controlled during the drilling. Keeping the equivalent



The BRIDGEWISE engineering software was used to identify the best product mix for promoting wellbore stability and avoiding circulation losses.

Challenges

- Ultra deepwater (5,082 ft/1549 m) horizontal well
- Complex reservoir composed of unconsolidated sandstones and argillites
- Multiple issues including wellbore stability, hole cleaning, and directional control in the long 8 ½-in. horizontal section
- Narrow (0.75 ppg) operating window
- Strict control in the ECD values
- Optimization of bridging and spurt loss/leakoff control to minimize formation damage

Results

- Ensured hole cleaning with proper planning and custom fluids
- Optimized ROP and minimized washout
- Maintained maximum 9.55 ppg ECD maximum, below leakoff test of 9.85 ppg
- Decreased operational risk with superior control of mud weight and rheology
- Improved wellbore stability
- Avoided health, safety and environmental (HSE) issues and nonproductive time (NPT)

circulating density (ECD) below the upper limit was the primary factor in the selection of the fluid as the PERF*FLOW* CM system allowed field personnel to reduce the fluid weight by 0.1 ppg—from 9.3 ppg (offsets) to 9.2 ppg. The PERF*FLOW* CM system also helped achieve ECD values lower than ones achieved in the offset wells.

The decision to decrease the mud weight by 0.1 ppg, in addition to a reduction of 30 to 40% in rheological properties, provided a maximum ECD of 9.55 ppg, well below the leakoff test value of 9.85 ppg. The maximum ECD observed in the offset wells was 9.9 ppg.

Choosing an intelligent fluids solution featuring the PERF*FLOW* CM water-based drill-in fluid boosted overall performance, improved wellbore stability, and effectively cleaned the hole in the horizontal well—lowering risks and exceeding the operator's expectations.