DEEP WATER

CASE STUDY

Applied Fluids Optimization Monitoring Prevents Problems Before They Occur

AFO SERVICES AND DFG RT™ SOFTWARE SAVE 96 HOURS OF RIG TIME

BAKU, AZERBAIJAN

CHALLENGES

Solve a history of difficult drilling and constant hole problems due to a narrow pore pressure/fracture gradient window in the area

- Problems included poor hole cleaning, tripping issues, and unsuccessful casing and liner runs

SOLUTION

Baroid recommended AFO services and Drilling Fluids Graphics (DFT™) RT™ hydraulics modeling software in order to provide comprehensive well planning
and execution

RESULTS

Utilization of AFO services resulted in a total of 96 rig hours saved, saving the operator approximately USD 822,000

**A "Green" intervention is the lowest-level intervention and indicates an "information only" communication.*

A "Yellow" intervention is an intermediate-level intervention and indicates a "warning" communication.

A "Red" intervention is a top-level intervention and indicates an "immediate action needed" communication.

CHALLENGES

In 2012, drilling operations in the Baku, Azerbiajan, area have a history of difficult drilling and constant hole problems due to a narrow pore pressure/fracture gradient window. Problems included poor hole cleaning, tripping issues, and unsuccessful casing and liner runs. The operator was dedicated to avoiding issues on the current well, which would be highly deviated. To avert problems experienced on previous wells, the operator asked Halliburton to optimize fluid practices in order to balance equivalent circulating density (ECD) and surge pressure while drilling in the narrow window.

SOLUTION

Halliburton proposed monitoring the well with its Applied Fluids Optimization (AFO) services. This technology brings together experienced AFO specialists and Halliburton Baroid's industry-leading Drilling Fluids Graphics (DFG™) RT™ RTTM hydraulics modeling software to offer comprehensive well planning and execution. AFO services provide real-time monitoring of well pressure regimes, casing runs, and hole cleaning efficiency, as well as simulations of probable scenarios ahead of the bit before problems occur. Collaboration between Halliburton fluid specialists and drilling engineers from Sperry Drilling resulted in a plan that integrated the AFO services into a Remote Operations Center (ROC) onsite at the operator's facility in Baku. They prepared for drilling operations by:

- Ensuring that all necessary data feeds were available through the Halliburton InSite® data management service
- Bringing in a Baroid global technical advisor to oversee execution

AFO specialists monitored four intervals, each using an underreamer: hole sections measuring 14 3/4 inches to 17 inches, 12 1/4 inches to 13 1/2 inches, 8 1/2 inches to 10 1/4 inches, and 6 1/2 inches to 8 inches. During drilling of the 14-3/4-inch section, AFO specialists made two significant interventions*–one Red and one Yellow, resulting in an estimated rig time savings of 36 hours. During the 12-1/4-inch section, two significant Red interventions and one Yellow were made with an estimated time savings of 40 hours. The 8-1/2-inch section had one Red and one Yellow intervention, resulting in 20 hours of rig time saved. Additional interventions were made in each interval, but weren't recognized to have saved significant rig time. In the 14-3/4-inch to 17-inch section, a significant Yellow intervention occurred when the drilling-ahead rate of penetration (ROP) was increased from 25 m/hr to 28–30 m/hr. DFG RT predictions of cuttings loading in the borehole increased from 1.8 percent to 2 percent, up to 2.5 percent to 3 percent, indicating poor hole cleaning in certain wellbore sections, potentially leading to increased cuttings bed buildup. The simulation also showed that ECD would increase to 1.62 specific gravity if drilled with the current parameters.

The potentially increased ECD would coincide with the area of the lowest fracture gradient in the section and could lead to severe losses, wellbore instability, and possibly loss of interval. As a result of the intervention, the ROP was reduced to 25–27 m/hr, which stabilized the situation and enabled better hole cleaning. The cuttings volume was brought back to an acceptable range of 2 percent, and the wellbore was circulated at stand-down to remove any cuttings buildup that may have occurred.

Circulation of the wellbore resulted in a reduction of ECD from 1.6 SG down to 1.58 SG. The expected ECD generated by running the casing was extremely close to the fracture gradient. Real-time monitoring of casing runs of this kind had not been previously available to this region in offshore operations. With AFO services, the client had added assurance that the limits would not be exceeded; it also increased the technical limits in which the customer could execute its drilling program.

RESULTS

The utilization of AFO services resulted in seven interventions being made to the rigsite that were deemed by the operator to have saved a total of 96 rig hours. If these hours were translated into monetary value, assuming a rig day rate of USD 300,000, this equated to a gross saving of USD 1.2 million. AFO services were used on this well for 126 days for 24 hours/day, resulting in a total cost of USD 378,000. The operator's net savings was USD 822,000. The monetary savings did not include any associated costs from the potential issues that were avoided, such as lost drilling fluids or lost bottomhole assemblies (BHAs). To date, AFO services have continued to grow for this operator within Azerbaijan, and now four drilling operations are being monitored by AFO specialists, including wells where Baroid does not provide fluids.

Interval	MD, M (Ft)	Activity	Intervention Importance	Intervention Description	Possible Consequence	Quality Assurance	Rig Hours Saved
14 3/4 in.	3,963 (13,002)	Running 13-3/8-in. liner	Low/Med	Once out of 16-in. liner shoe 13-3/8-in. liner was run at a speed of up to 1 m/min, which was producing 1.67 SG EMW at TD; thus far, surge pressures were kept below 1.61 SG EMW.	Running 13-3/8-in. liner above simulated speed could induce losses	Quality cement bond is maintained due to avoiding fracturing the formation through continuous monitoring and timely prevention of running 13-3/8-in. liner at above-recommended speeds.	16
12 1/4 in.	5,396 (17,703)	Running 9-5/8-in. casing	Med/High	After autofill was converted above 13-3/8-in.casing shoe at 3,934 m (12,907 ft) and proceeded to run in hole (RIH) with 9-5/8-in. casing with closed ended at tripping speeds of 3.5–4 m/min equivalent mud weight (EMW) at shoe reached 1.644–1.646 sg and EMW on bottom reached 1.625–1.627 sg. Rig was informed of this. Tripping speed was lowered to below 3 m/min.	Running 9-5/8-in. casing shoe at above recommended speed could cause losses	Reducing casing run speed allowed to successfully run casing to TD without loss incidents.	10
8 1/2 in.	6,073 (19,925)	Drilling	High	Simulations indicated 48 percent cuttings removal efficiency from 1,300 m (4,265 ft) down to BHA at 120 RPM. Drilling simulations indicated if RPM increases to 150 cuttings removal efficiency would increase to 60 percent. Rig was informed on this, and a Yellow intervention was called. Recommendation was followed.	Poor hole cleaning could lead to ECD increase, beddings accumulations	RPM was increased to 150, and clean hole was maintained while drilling.	10

Seven significant interventions were recognized by the operator. This table shows one intervention from each interval.

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