UNCONVENTIONALS

CASE STUDY

BaraXcel™ NAF and DFG™ Modeling Software Help Operator Eliminate Casing String on Permian Basin Wells

FLUID SYSTEM SAVES SIGNIFICANT COSTS, BECOMING BEST PRACTICE FOR FUTURE OPERATIONS

PERMIAN BASIN, REAGAN COUNTY, TEXAS

CHALLENGES

- Eliminate total losses while cementing 9-5/8-inch intermediate casing
- Minimize equivalent circulating density
- Control water influxes
- Eliminate casing string

SOLUTION

Organophilic clay-free BaraXcel™ HP NAF system and DFG™ hydraulics modeling software for drilling optimization

RESULTS

- Controlled water influxes
- Eliminated intermediate casing string, saving operator USD 660,000 per well

CHALLENGES

33 PERCENT LOWER FLUID COSTS THAN ON PREVIOUS WELLS

In 2015, Baroid was providing services on two wells drilled consecutively in the same area and under the same conditions.

The 12-1/4-inch intermediate interval exhibited a very narrow pore pressure/fracture gradient (PP/FG) window – therefore, minimizing the equivalent circulating density (ECD) was critical.

Seepage losses were expected while drilling, running casing, and circulating casing prior to cementing. However, after cementing commenced and the lead cement entered the annulus, operators experienced severe losses, ranging from 500 bbl to over 2,000 bbl. Setting and cementing the intermediate casing was typically a three-day operation.

As a further complication, water influxes were known to occur about halfway through the 12-1/4-inch interval. The volumes were significant and could potentially disrupt fluid properties. The narrow PP/FG window limited the ability to control the water flow by weighting up. Using water-based fluid was not a viable option because of the problematic presence of multiple salt stringers in this section.

This interval was typically a vertical section drilled out from approximately 700 feet (213 meters) of surface casing to a true vertical depth (TVD) of about 6,500 feet (1,981 meters) to 7,200 feet (2,195 meters). Standard drilling practice in the area was to set 9-5/8-inch casing at interval total depth (TD), begin drilling the 8-3/4-inch section to the kickoff point (KOP), and then continue 6,000 to 7,000 feet (1,829 meters to 2,134 meters) to the lateral TD.

SOLUTION

To tackle the total losses during cementing and gain maximum control over the ECD of the drilling fluid, the Baroid team took a dual approach on both wells, which was to:

- Recommend the organophilic clay-free BaraXcel™ high-performance (HP) non-aqueous fluid (NAF) system, known for its shear thinning characteristics and ECD management performance
- Optimize certain drilling parameters for greater efficiency and reduced stress on the wellbore

These parameters and their ideal values were identified by the Baroid Technical Professional, who performed extensive analysis with proprietary Drilling Fluids Graphics (DFG™) simulation software. The Baroid team assessed the following critical factors to determine the optimal combinations needed to stay within the narrow drilling window:

- Mud density
- Pump flow rates
- Specific rheological properties
- Wellbore geometry
- Rates of penetration

RESULTS

Casing String Eliminated

The exhaustive work by the collaboration between the Baroid team and the client was successful.

The results showed that, given the right fluid system and optimization of drilling parameters, the troublesome 12-1/4-inch interval could be drilled to TD. At this point, instead of running casing, the operator was able to trip for an 8-3/4-inch bit and drill the rest of the well. The hydraulics and ECD values improved with the two openhole geometries, diminishing the risk of lost circulation.

The operator was able to drill to TD in the production lateral, set 5-1/2-inch production casing, and cement to the surface with returns.

Water Influxes Under Control

The other reason for setting intermediate casing had been the battle with high-volume water influxes that threatened to "flip" any conventional NAF used in the area. Again, the BaraXcel HP NAF system proved its worth. Designed to run at comparatively low oil-water ratios (OWRs), such as 70:30 to 60:40, the system used on these Wolfcamp wells was routinely run at a 60:40 OWR.

When the 700-bbl influx occurred on the second well, the OWR fell dramatically to 41:59, and the water-phase salinity, normally 245,000 chlorides, dropped to 130,000. These would be fatal numbers for any conventional NAF, but not for the BaraXcel HP NAF system. The Baroid rigsite personnel increased the diesel stream going into the mud pits and stepped up chemical additions to overcome the potential effects of the water flow.

Meanwhile, the operator continued drilling. The mud treatment and recovery from the influx took place entirely on the fly, with no disruption to operations. Within 24 hours, the BaraXcel HP NAF system had returned to specified properties.

ECONOMIC VALUE CREATED

The ability to eliminate a 9-5/8-inch intermediate casing string from a multi-well drilling program, which was proven here to be successful on two back-to-back wells, was valued at USD 660,000 per well. That amount included the cost of the casing, the casing crew and tools required to run the casing, and the cement job.

Conservatively estimated, about three days of rig time would be needed to run and cement a casing string at that depth. Under current market conditions in the region, this would be valued at USD 50,000 per day, for a total of USD 150,000.

The water influx and resulting restoration of the BaraXcel HP NAF system properties would normally be expected to adversely impact total mud costs on that specific well. However, both wells were drilled so efficiently that their respective fluid costs were approximately 33 percent lower than fluid costs on previous wells.

Overall, the operator realized significant savings in casing, cementing, rig time, and drilling fluid on two wells. As a result, the BaraXcel HP NAF system and DFG analysis approach has been adopted as a best practice for future operations.

HALLIBURTON