World's First Application of BaraXtreme™ Fluid in HTHP Gas Well

CUSTOMIZED BARAXTREME DRILLING FLUID SYSTEM HELPS SUCCESSFULLY DELIVER WELL WITH 7" LINER INSTALLED TO TARGET DEPTH RESULTING IN PROJECT COST SAVINGS

MALAYSIA

CHALLENGE

- Predicted bottomhole static temperature of 360° F (182° C)
- Need to protect the reservoir from damage and minimize fluid gelation due to high temperature
- Challenging carbonate reservoir with potential for high downhole losses

SOLUTION

- BaraXtreme™ drilling fluid system — customized to deliver optimum fluid properties
- DFG™ software with DrillAhead® hydraulics module — to ensure adequate hole cleaning, using planned drilling parameters
- BaraLogix™ real-time fluids measurement equipment — to monitor properties (density and rheology) at frequent intervals
- BaraVis® W-637 additive — to control viscosity and filtration

RESULTS

- Provided sufficient volume for drilling from onshore liquid mud plant facility
- Drilled the well successfully and ran 7-in. liner to target depth (TD) with no hole issues
- Accomplished the world's first application of BaraXtreme fluid in an HTHP gas well

OVERVIEW

Several offshore basins in the Asia-Pacific region are characterized by high-temperature/high-pressure (HTHP) carbonate gas reservoirs. The sections for offset wells previously drilled in one particular area used THERMA-DRIL™ fluid, which often led to total losses. When this occurred, the operator simply switched to light, annular mud and seawater to continue drilling. What was actually needed is a high-performance, water-based mud (HPWBM) with a high degree of thermal stability for these HTHP conditions.

Halliburton's BaraXtreme high-performance, water-based drilling fluid system was designed using new synthetic polymer technology, enabling it to function as a clay-free HPWBM, which avoids high-temperature gelation at elevated static temperatures. This fluid composition also serves to minimize wellbore damage that could arise as a result of clay or bentonite-laden products in the formulation.

CHALLENGE

The operator requested that Halliburton Baroid provide a more advanced, water-based fluid with optimum properties for wellbore stability and drilling, plus favorable economics relative to the fluid sets used previously. Based on past experience, good solids control equipment and practices were also necessary to enhance well productivity by minimizing drilled solids content in the fluid system.

SOLUTION

The Baroid team proposed the customization of BaraXtreme HPWBM, based on the prognosed downhole requirements of the carbonate reservoirs. This would be the first worldwide application of the customized fluid, which has been rated to thermal stability limits of around 425° F (218° C).

An extensive laboratory testing matrix was carried out to build an adequate formulation. This took into consideration the presence of acid gas, the projected bottomhole static temperature at 360° F (182° C), and the potential static time duration of 72 hours under these conditions, with a mud weight of 15.3 ppg. To avoid pressure-related issues and non-productive time (NPT), the fluid also had to exhibit strong resistance to barite sag, as indicated by measurements after aging tests were conducted.

The required fluid volume was prepared onshore in a mixing facility. To ensure good control of initial properties, specific mixing procedures were put in place for component additions; particularly, BaraVis® W-637, a dual function, high-temperature polymer that provides optimum viscosity and filtration control.

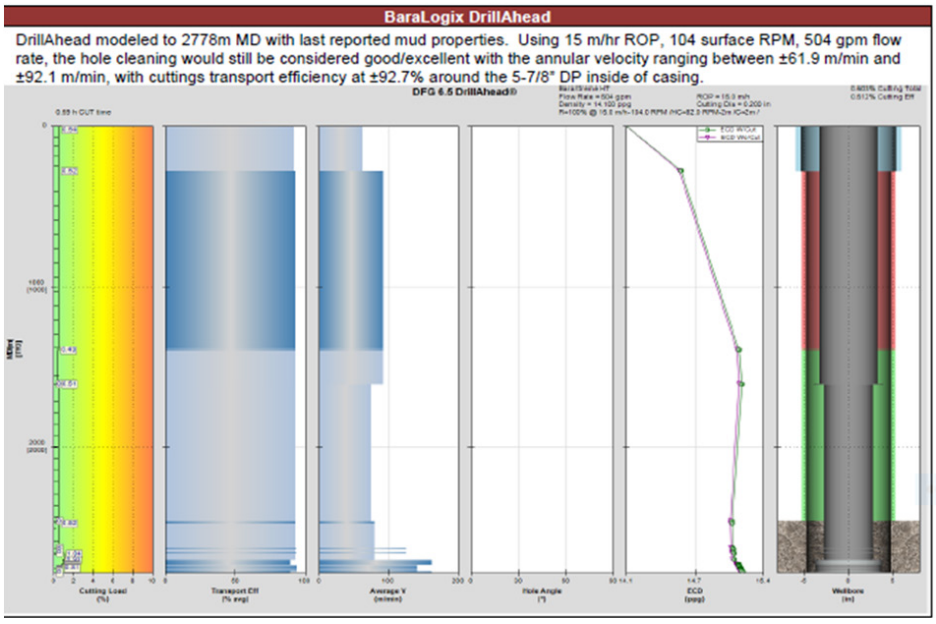
The fluid exhibited stable rheological properties and pH while drilling with 14 ppg mud weight and with no torque or drag issues experienced. The vertical reservoir section was drilled to TD of 2,778 m as measured from the drill floor, and the wellbore was then exposed to BaraXtreme fluid for three days without any indications of barite sag.

The API fluid loss remained below 3 cc throughout drilling, while the HPHT fluid loss tested at 350° F (177° C) also remained stable below 14 cc. There were no indications of barite sag or weight variation during completion operations as had been experienced in the offset wells. Cuttings remained fine-grained and did not stick to the shakers.

The drilling project was also supported by DFG DrillAhead real-time hydraulics modeling and BaraLogix real-time fluid property measurement equipment. While drilling the 8.5-in. reservoir section with BaraXtreme, annular cuttings volume remained less than 1%, by automatically updating the drilling parameters and fluid properties generated from the BaraLogix unit. This performance matched actual hole cleaning, which was excellent during drilling at controlled rates. The integrated approach of BaraXtreme fluid and DFG-RT software provided additional assurance of a stable and clean borehole for tripping and quickly running the 7-in. production liner to bottom.

RESULTS

The first application of BaraXtreme HTWBM in this field enabled smooth drilling to well TD and reliable stability at elevated temperatures. No extra time was required for mud conditioning before tripping, and the liner was run to planned depth without any hindrance. Due to this successful project, several additional applications of the same fluid formulation are planned over the next months to support other wells in the area.



Example of DFG DrillAhead modeling results.

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