



BaraECD® Fluid System and WellSET® Wellbore Strengthening Treatment Solve Deepwater Subsalt Drilling Challenges

SOLUTION SAVES OPERATOR SIGNIFICANT TIME AND MONEY WHEN COMPARED TO PROBLEMATIC OFFSET WELLS

GULF OF MEXICO

CHALLENGES

With offset wells, operator encountered trouble drilling adjacent high-pressured and sub-pressured sands:

- » Gas influx
- » Lost circulation
- » Stuck pipe

SOLUTIONS

Effective ECD management coupled with a wellbore strengthening treatment.

- » BaraECD® NAF system for delivering lower ECDs while maintaining reliable sag resistance and reliable sag resistance
- » WellSET® engineered LCM treatment for creating a stress cage specifically for drilling this sand

RESULTS

With this solution, operator drilled high-risk sands with zero NPT:

- » Two days to drill from base of salt to TD
- » Saved three rig days valued at \$1 million per day in spread costs

DEEPWATER SUBSALT CHALLENGE: ADJACENT HIGH- AND SUB-PRESSURED SANDS

Offset well data indicated that an operator would encounter a high-pressure subsalt sand between the base of salt at 19,200 feet (5,852 meters) and 19,700 feet (6,005 meters) measured depth (MD). A severely depleted sand was known to follow at 19,797 feet (6,034 meters) MD. Controlling equivalent circulating density (ECD) while drilling these sands would be critical to avoiding significant down time.

Records from previous wells showed gas influxes, lost circulation, and stuck pipe incidents within the depth range of 19,200 feet (5,852 meters) to 19,900 feet (6,066 meters) MD.

NON-AQUEOUS FLUID SYSTEM AND LCM TREATMENT PROVIDE DUAL APPROACH FOR SAFELY DRILLING DEPLETED SANDS

The Baroid technical team recommended a dual approach to ensure that both sands could be drilled safely and efficiently. The plan included using the BaraECD® high-performance non-aqueous fluid (NAF) system and a WellSET® wellbore strengthening treatment to lower risk of lost circulation.

The BaraECD system is designed to improve ECD management in wells with a narrow margin between the pore pressure (PP) and fracture gradient (FG). It incorporates Baroid's award-winning clay-free technology and also includes unique additives that deliver lower ECDs while maintaining reliable sag resistance.

The team also applied a WellSET wellbore strengthening treatment, based on the results of an accurate WellSET analysis of pore throat size in the depleted sand. The WellSET software module determined the correct selection and particle size of lost circulation material (LCM) products to create a stress cage specifically for drilling this sand. The formulation is shown below:

DEPLETED SANDS
**SAFELY
DRILLED**
WITH
**3.5-PPG
OVERBALANCE**

Without the use of BaraECD® NAF and the WellSET® wellbore strengthening application, the well most certainly would have experienced losses and stuck pipe incidents.

Formulation

LCM	Concentration (ppb)
STEELSEAL® 1000™ resilient graphitic carbon (RGC)	8.0
STEELSEAL® 400™ RGC	2.0
STEELSEAL® 100™ RGC	5.0
BARACARB® 600 sized ground marble	4.0

Shale shakers were equipped with low-mesh screens to handle large particle sizes from the wellbore strengthening LCM treatment.

OPERATOR DRILLS HIGH-RISK PRODUCTION ZONE IN TWO DAYS WITH ZERO NPT

The operator was able to drill successfully from the base of salt at 19,200 feet (5,852 meters) to total depth (TD) at 19,965 feet (6,085 meters) MD. Pressure measurements taken while drilling indicated that the pore pressure of the depleted sand was 12.6 lb/gal of equivalent mud weight. Despite this sub-normal pressure, the sand was safely drilled with a 16.1-lb/gal BaraECD fluid system and a pressure differential of 4,039 psi (equivalent to 3.5-lb/gal overbalance).

Without the use of BaraECD NAF and the WellSET wellbore strengthening application, the well most certainly would have experienced losses and stuck pipe incidents. Since this was the production zone, severe problems could result in costly sidetracks and/or well abandonment.

Daily operation costs on a deepwater drilling rig are estimated at USD 1 million per day. The high-risk production interval was drilled in two days with zero nonproductive time (NPT), saving the operator three rig days and approximately \$3 million in daily spread costs when compared to problematic offset wells.

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