

# Operator Drills Offshore Exploratory Well in Unstable Formation and HPHT Environment

INNOVERT® FLUID SYSTEM WITH SPECIALIZED CHEMICAL PACKAGE PROVIDED SUPERIOR CAPABILITIES TO WITHSTAND 416°F (213°C) BOTTOMHOLE TEMPERATURE

RED SEA

## CHALLENGE

- » Maintain wellbore stability in carbonate, sandstone, and siltstone formation
- » Limit High Pressure High Temperature (HPHT) fluid loss to less than 3 ml while drilling with BHT of 416° F
- » Prevent barite sag while logging
- » Achieve required mud properties with effective chemical treatment plan
- » Minimize NPT

## SOLUTION

Halliburton Baroid implemented an engineered solution, centering around the INNOVERT® fluid system, including:

- » Chemicals with higher thermal stability – to overcome the elevated BHT
- » BaraFLC®-IE 513 high-temperature fluid loss control agent – to minimize filtrate invasion and differential stuck pipe events
- » TAU-MOD® viscosifier – to improve suspension and minimize filtration into the rock matrix
- » Management of chemical concentrations – to eliminate overtreatment and achieve target properties

## RESULTS

- » Provided fluid stability at 416° F with no thermal degradation
- » Kept HPHT fluid loss below 3 ml, as required
- » Experienced no wellbore issues while drilling and tripping
- » Conducted three days of logging without any recorded barite sag
- » Required no additional time to condition fluid after logging phase
- » Avoided reduction in mud weight and/or modification in mud specifications
- » Reduced chemical mixing time
- » Lessened amount of chemical stock due to reduced fluid treatment

## OVERVIEW

The operator planned to drill an offshore exploratory gas well in the Red Sea, targeting a stratigraphic trap in an unstable carbonate, sandstone, and siltstone formation with expected high bottomhole temperature (BHT). Such conditions would require the use of a superior fluid system, allowing the operator to efficiently drill the reservoir without incurring wellbore stability problems or thermal degradation of the chemical package. In drilling to a total vertical depth of 19,050 ft MD in this environment, the main concerns were with regards to fluid stability during logging operations, fluid loss, chemical treatment plans and avoiding conditioning trips or extra circulation that would lead to non-productive time (NPT).

## CHALLENGE

Given the uncertainties they faced, the operator had to be prepared for potential washouts and mitigating issues of equivalent circulating density (ECD), tight spots, stick and slip, torque and drag, barite sag, overtreatment, and conditioning time. Halliburton Baroid was commissioned to deliver a single solution capable of overcoming these multiple challenges. The client authorized the design of a customized fluid system along with extensive lab testing to withstand BHT as high as 416° F, while reducing the thermal degradation of the chemical package, and with all the characteristics needed to execute the drilling and logging phases with no downhole problems or excessive NPT.

## SOLUTION

The INNOVERT fluid system with a high-temperature fluid loss reducer and an improved suspension package was validated prior to drilling the section. The unique chemistry of this HPHT fluid system allowed the operator to reach TD without thermal degradation. It was specially designed for superior solids suspension and extremely tight fluid loss, even in high temperatures, which minimized barite sag and prevented differential stuck pipe events while drilling or logging. The chemical package, consisting of the BaraFLC®-IE 513 fluid loss control agent and TAU-MOD® viscosifier further guaranteed tight fluid loss and proper emulsion, respectively.

## RESULTS

The INNOVERT fluid system and high-temperature chemical package was the right solution, as it enabled vertical drilling of the well to a total depth of 19,050 ft MD without any downhole problems or NPT. The capability of the fluid system to overcome all the well challenges was translated into a saving of three days and USD 450k. Some specific accomplishments of this project were:

- » The clay-free, non-aqueous fluid (NAF) delivered low ECD, which led to improving the drilling parameters and reaching the reservoir safely in less time.
- » The improved suspension package delivered superior sag prevention over an extended period of time, which allowed the operator to perform the logging phase without additional conditioning trips.
- » The chemical package, compared to conventional NAFs, reduced fluid treatment amount and, consequently, lowered cost.

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