

Case study: Deepwater Gulf of Mexico

First NANOSHIELD deployment for deepwater operator ensures efficient liner placement in complex reservoir

A deepwater operator faced significant drilling challenges in a reservoir characterized by unstable formations. Previous offset wells in the field had encountered wellbore instability in a highly unstable shale formation located in the upper section of the reservoir. Additional risks included the presence of tar beneath a salt interval—raising the likelihood of stuck pipe and tools—and depleted zones that could further compromise wellbore stability. These challenges raised the risk that liners could not be effectively run and cemented to bottom.

To address these concerns, the operator approached the Baker Hughes Drilling Fluids (DF) team to design a fluid system capable of minimizing instability risks and getting the casing string to the target depth (TD). The DF team proposed the **NANOSHIELD™ wellbore sealing polymer**, a specially designed nanotechnology formulation added to drilling fluid that seals microfractures in reactive, fractured, and depleted formations—providing superior wellbore integrity when drilling. The team further optimized the formulation with **MIL-CARB™ calcium carbonates** and **LC-LUBE™ synthetic graphite particulates** to combat potential fluid losses.

While the operator had used similar nanotechnology-based additives in drilling fluids supplied by a third party, this application would mark the first use of NANOSHIELD in their field. The DF team collaborated with the operator in laboratory testing of the drilling fluid containing NANOSHIELD, MIL-CARB, and LC-LUBE.

The operator was pleased with the results—low fluid losses and no adverse effects on the drilling fluid—which indicated that the NANOSHIELD formulation would enhance the drilling fluid to ensure successful liner running to bottom. Confident in these results, the operator approved the use of NANOSHIELD in an upcoming offshore operation.

Executing efficiently in the field

The drilling plan called for a 16.5-in. X 19-in. section through the unstable shale formation and into the salt interval, followed by running a 16-in. liner. The subsequent section—a 14.5-in. X 16.5-in. wellbore—would extend through 4,000 ft (1,219 m) of salt and continue into a zone containing tar and potential loss intervals.

The DF team prepared the fluid system with 3 pounds-per-barrel (ppb) of NANOSHIELD, 7 ppb each of MIL-CARB 150 and MIL-CARB 600, and 7 ppb of LC-LUBE. Additives were pre-mixed at an onshore liquid mud plant due to the offshore platform's limited mixing capacity, with additional quantities shipped offshore to maintain dosage concentrations at the desired levels.

The DF team closely monitored additive levels to maintain the required concentration, ensuring protection ahead of drilling the most unstable intervals.

Exceeding expectations

The fluid solution containing NANOSHIELD delivered exceptional results. Both target sections—spanning from 7,092 ft to 12,400 ft (2,162 m to 3,780 m), and from 12,400 ft to

Challenges

- Drill a 16.5-in. X 19-in. section through a mudstone/sandstone and reach TD in salt formation with a subsequent 16-in. liner run
- Drill next section through 4,000 ft of salt, with a challenging exit
- Mitigate tar and loss zone risks below the salt to ensure successful drilling and completion to TD

Results

- Reduced risks of drilling through the salt exit, avoided significant mud losses and rig time dealing with losses
- Avoided wellbore instability, saving time and averting potential sidetrack
- Saved 22 drilling days compared to AFE
- Ensured exceptional performance from the AutoTrak RSS and Kymera bit
- Prevented any health, safety, and environmental issues

18,428 ft (3,780 m to 5,617 m)—were drilled to TD without incident. Liners were run to bottom and cemented on the first attempt, with little resistance and minimal fluid losses observed.

Key achievements included:

- Zero health, safety, and environmental (HSE) events throughout the operation
- 22 drilling days saved compared to the AFE
- Successful liner deployments and cementing on the first attempt
- Exceptional drilling performance with the **AutoTrak™ rotary steerable system**, **Kymera™ hybrid drill bit**, and **DELTA-TEQ™ XT mud system**
- 100% sealing efficiency as confirmed by formation pressure testing with **TesTrak™ LWD formation-pressure testing service**

Recognizing collaboration and performance

The operator commended the project's seamless execution, noting that close collaboration with Baker Hughes played a critical role in overcoming complex formation challenges.

The effective application of NANOSHIELD not only prevented instability, enabling successful deployment and cementing of the liners to TD, but also delivered re-sults ahead of schedule and has strong potential for repeat application in future wells.



Reduced risk of drilling through



22 saved drilling days



Avoided wellbore instability



Exceptional performance



Prevented HSE issues

Baker Hughes 

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