

KLA-SHIELD System Enhanced with New Sealant Successfully Debuts in Saudi Arabia, Drilling Problem Shales

“The KLA-SHIELD* system and the new enhanced sealant POROSEAL* surpassed all client expectations. The 5 ½-in. expandable liner was run to TD through sensitive shale sections without issue. The 5 ½-in. hole was drilled through depleted sand and shale formations without problem.”

Mohamed Heikal, M-I SWACO Account Manager

Well Information

Location Offshore Al-Khafji, Saudi Arabia
 Date.....February 2010
 Well type Directional @ 86°
 Bit size 6 ⅛-in hole opened to 7 ¼-in by under reamer
 Interval drilled..... Total of 357 ft (109m) drilled from 5,313 to 5,670 ft (1,619 to 1,728 m)

The Situation

Typically, the operator employed a standard KCl/Glycol/Asphalt system to drill the 6 ⅛-in. hole section. Owing to the high mud weight required to stabilize the Burgan Shale and drill the depleted argillaceous limestone/sand formation, the success rate in directional wellbores of 67° to 86° is very low. Offset wells had problems with sloughing shale, packing off, extreme over pull, hard back reaming, and in some instances, bit and stabilizer accretion. The operator was looking for a more resilient fluid performance, but had to look at alternatives to oil or synthetic-based muds, which are not allowed because of environmental concerns.

The targeted well had been temporarily suspended because of problems with hole pack-off and stuck pipe. The client’s new strategy for this well was to drill a 6 ⅛-in directional hole and open it to 7 ¼-in using an under reamer. A 5 ½-in expandable liner would be set in order to cover the problematic shale formation, followed by a 5 ½-in horizontal hole section where a 4 ½-1E;in liner would be set.

The Solution

M-I SWACO proposed the KLA-SHIELD* High Performance Water Based Mud System, incorporating KLASTOP* as the primary inhibitor, and the new POROSEAL* sealant additive. In preliminary cutting inhibition tests with various base fluids, it was discovered that the many natural fractures of the rock actually capture fluids rapidly and destabilize the shale. Lab testing indicated that the KLA-SHIELD total system package displayed better performance, compared to the current system, especially with regards to shale recovery, bulk hardness, accretion, and linear swelling.

The Results

6 1/8-in Section

- The 6 1/8-in directional hole was drilled to TD and no pumping out or back reaming required.
- No fill or obstructions were recorded when RIH, indicating good hole cleaning and wellbore stability.
- The section was opened up to 7 1/4-in using an under reamer where the tool motion mechanically generated cavings. No additional cavings, however, were observed after the hole had been opened completely.
- Highly sensitive shales exhibited excellent stability throughout the entire interval.
- Hole cleaning was very good during the section, as predicted by the M-I SWACO VIRTUAL HYDRAULICS* software.

5 1/2-in Section

- The original plan for this well was to horizontally drill 1,500 ft (457 m) through a sand reservoir.
- Due to the geological uncertainty, the plan was changed to drill only 500 ft (152 m) through the shale and depleted sand formation while dropping the angle from 87° to 83°.
- Upon entering the shale, the mud weight was increased from 10 to 12 lb/gal (1.2 to 1.5 sg).
- The well was completed to the new target trouble-free.
- The performance of the KLA-SHIELD system was excellent with no reports of over pull, drag, or hole pack-off.
- The 4 1/2-in liner was run and cemented in place without any problems recorded.

Overall, the customer was very pleased with the performance of KLA-SHIELD and has agreed to continue using this system for their next series of wells.

The Details

6 1/8-in Section

	Planned	Minimum	Maximum
Density, lb/gal (sg)	12-12.5 (1.5 sg)	12.0 (1.5 sg)	12.5 (1.50 sg)
Plastic Viscosity, cP	ALAP	18	22
Yield Point, lb/100ft ²	22 – 28	28	34
6/3 rpm	10-9	10-9	12-10
API Fluid Loss, cc/30 min	< 3.0	2.5	3.0
pH	10-11	10.0	11.0
MBT, ppb	< 5	2.5	2.5
Drilled Solids, %	< 6	1.6	2.0
KLA-STOP, % v/v	2 – 3	2.5	3.0
IDCAP D, ppb	1.5-2.0	1.5	2.0
POROSEAL, % v/v	2 – 3	2.0	3.0



Cuttings on shale shaker while directional drilling



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Cuttings on shale shaker while directional drilling



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Questions? We'll be glad to answer them.

If you'd like to know more about the KLA-SHIELD and Poroseal products and how it's performing for our other customers, please call the M-I SWACO office nearest you.



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