

AVAFULFLOW Non-damaging Drill-In Fluid



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INTRODUCTION

This case study reports the performances of AVAFULFLOW, a new generation, non-damaging fluid system specifically designed as a pay zone drill-in fluid. This case study refers to the drilling of the 8½" interval in a Libyan offshore well during December 1998. The location was approximately 60 km Southwest of the Bouri Field (Libya).

The well built angle to 30° during the 17½" interval (KOP 530m). Based upon experience gained in the nearby Bouri field, a raw stratigraphy was developed, and a mud program designed.

This phase was drilled in the pay-zone; formation was Bioclastic Limestone, friable and fractured, thus requiring the use of a non-damaging drill-in fluid.

The correct mud program design made it possible to manage drilling fluid costs while maintaining a stable system.

OBJECTIVES

The operator's primary interest during the drilling of the production zone was to minimise reservoir formation damage.

In very permeable formations, during drilling or completion operations, losses often occur, especially when the drilling fluid has a relevant overbalance. Conventional WBM with LCM acid soluble calcium carbonate can be used. But to recover initial permeability the operator is forced to do an acid job because the backpressure of the formation fluids is insufficient to remove plugging particles. The ability to avoid this operation results in cost and time savings. Moreover it contributes to reduce environmental impact of drilling activities, a significant aspect in offshore activities.

ACTIONS

AVA formulated its AVAFULFLOW drilling fluid system in order to reach these goals.

In this system the bridging agent is calcium carbonate at selected sizes, and pure grade polymers to provide the necessary rheological properties. These polymers have high temperature resistance characteristics to avoid calcium carbonate compaction and reduce fluid filtrate. The formation damage is very low and no acid job is required to gain initial permeability. A very thin, impermeable, elastic cake is formed which is easily removable when a very low backpressure is applied (5 – 10 psi).

AVAFULFLOW is a unique product, and preparation of the drilling fluid is easy and fast by simply adding to AVAFULFLOW a small quantity of biocide to preserve polymers and calcium carbonate to reach the required mud weight. For example, the programmed concentrations for this well were as follows:

AVAFULFLOW	160 kg/m ³
AVACID F25	2 kg/m ³
CALCIUM CARBONATE	as needed

RESULTS

This phase was mainly performed with coring and reaming from 2553 m to 2888 m. Final drilling time was 41 hours with an average rate of penetration >8m/hr. 7" casing was successfully run to bottom and cement was pumped without problems.

Actual concentrations were the following:

AVAFULFLOW	120 kg/m ³
AVACID F25	2 kg/m ³
CALCIUM CARBONATE	106 kg/m ³

No significant problems were reported during this interval with the exception of a stuck logging tool that was quickly recovered with a fishing operation. The quality of mud contributed to a gauge open hole very close to nominal bit diameter which was confirmed by a caliper log that reported only 2.5 m3 of cavings just below the shoe. The cement job



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was thus optimized.

CHARACTERISTICS	Programmed	Actual
MW (sg)	1.15	1.15
Funnel Viscosity (sec.)	40-45	43
PV (cps @ 120°F)	As low as possible	13
YP (lb/100 ft ² @ 120°F)	18-22	18
Gels 10" (lb/100 ft ² @49°C)	3-4	4
Gels 10' (lb/100 ft ² @ 49°C)	12-18	6
API Filtrate (cc. 30 min.)	<3	3
HP-HT Filtrate (cc. 30 min.)	<12	13
pH	9.5-10	9.5
Pm	1-1.2	0.7
Pf/Mf	0.25-0.35/0.6-0.8	0.13/0.8
Solids content (% vol.)	8-12	8
Sand content (% vol.)	0.5	Tr.
MBT (ppb)	15-30	7.6

The mud system performed well and rheological characteristics were maintained (see table above). Effectiveness of the AVAFULFLOW system in the pay zone minimized formation damage and moreover did not require the use of expensive, high temperature fluid loss reducers to maintain API filtrate and HP-HT filtrate at low values despite the high bottom hole temperature (over 120°C).

CASE STUDY