

Case History

Clay-Free Invert Emulsion

INNOVERT® System Used in Well's Record-Breaking Performance

Location: Caspian Area, Kazakhstan

OPERATOR'S CHALLENGE – An operator working in the Karachaganak field was looking for an innovation that would optimize the incumbent drilling program in an effort to further reduce costs and improve the efficiency of the stimulation process. The operator had previously used the existing ENVIROMUL™ paraffin/mineral oil based system to drill a carbonate reservoir. While no formation or operational issues were experienced, the operator reasoned that there would be greater operational efficiency by achieving the following:

- No significant increase of fluid cost per meter
- No major changes in the operation of the LMP (Karachaganak Field is a remote location)
- Facilitate easy removal of filter cake prior to well stimulation
- Improve overall production efficiencies

HALLIBURTON'S SOLUTION – INNOVERT® clay-free invert emulsion system was recommended to the operator as a solution that would improve drilling efficiency by reducing impact on the reservoir. Specifically, polymer, emulsion technologies could be used to create a thin impermeable filter cake requiring minimal lift-off pressure and robust, yet fragile gel structures to minimize ECD and reservoir intrusion.

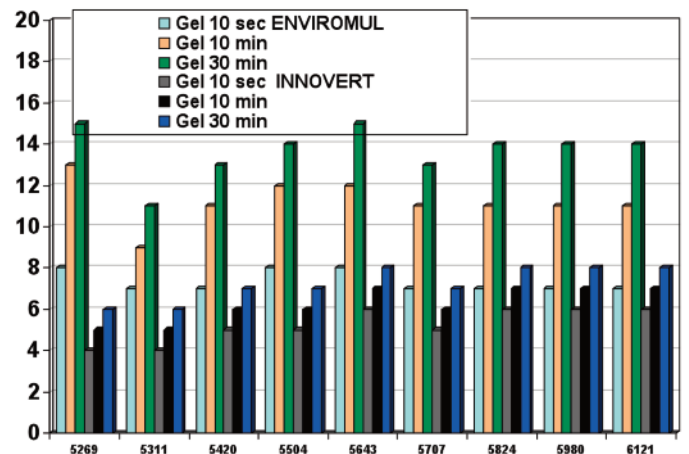
A formation damage study comparing the ENVIROMUL system to the INNOVERT system was conducted at Halliburton's Duncan facility, using Karachaganak native limestone core. Tests confirmed that the INNOVERT system produced less damage than the ENVIROMUL system. A qualification testing program was initiated, optimizing the INNOVERT invert

INNOVERT Formulation (new mud):	
LE SUPERMUL™	34 kg/m3
Lime	30 kg/m3
Brine (CaCl2)	377 kg/m3
ADAPTA®	4 kg/m3
RHEMOD™	6 kg/m3
BARACARB®	128 kg/m3
SOURSCAV®	2 kg/m3
LIQUITONE®	2 kg/m3

emulsion paraffin/mineral oil system formulation to fine tune the fluids rheological profile for good hole cleaning and minimal impact on ECD, swab and surge. After these adjustments were made, the INNOVERT system was mixed and displaced without problems. And, the interval was drilled without difficulty.

Flat gels were recorded; there was minimal swab / surge impact in comparison with the ENVIROMUL system,. The system was very easy to maintain with equivalent 5-6 m3 INNOVERT whole mud additions and running centrifuges 8-10 hrs daily.

K-9828 INNOVERT vs K-9822 ENVIROMUL

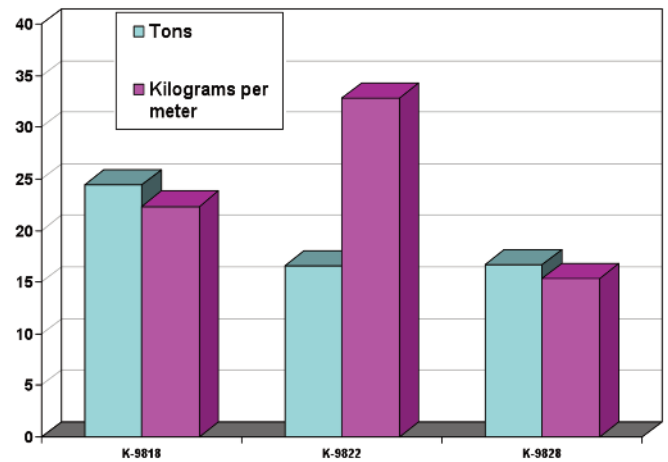


Offset Wells 5 7/8" Hole		Fluid Cost per meter	Surface Losses (m3) per meter	Centrifuges Operation (hrs)	Kg materials per meter
K-9818	744 m	512.79	84.27	287	22.36
K-9822	740 m	470.00	111.21	220	32.81
K-9822	1088 m	408.90	75.63	43	15.35

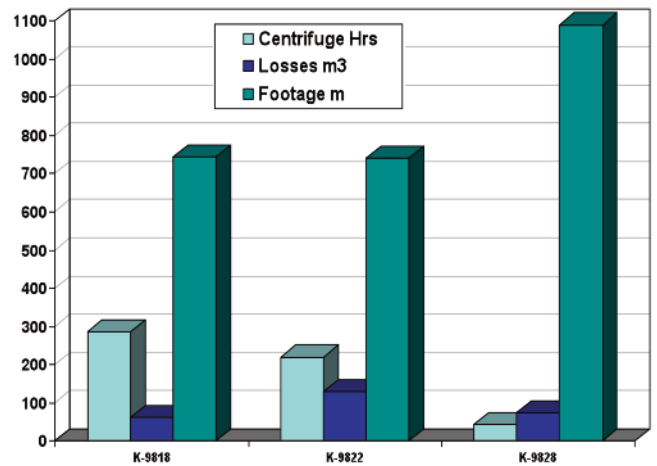
A Sperry slimhole Geo-Pilot® 5200 series rotary steerable system was used to drill the 5 7/8" interval with full suite of LWD tools for formation evaluation while drilling. Hole quality provided by the INNOVERT system allowed optimal performance of the rotary steerable system with LWD logs obtained confirming that reservoir quality objectives have been achieved.

ECONOMIC VALUE CREATED – As stated by the operator: “It was the deepest, fastest, and cheapest well ever drilled by KPO in the Karachaganak Field. We are 12 days ahead of schedule and about \$5.7 million below the AFE.” The INNOVERT application resulted in low cost per meter, less materials handling per meter drilled, less surface losses, had superior hole stability, and less time required to run the centrifuges.

INNOVERT vs ENVIROMUL Materials Handling



INNOVERT vs ENVIROMUL – Solids Control



COST/M drilled

