CASE STUDY

WARP Fluids Technology Addresses ERDChallenges Offshore Eastern Canada

"WARP* technology has demonstrated a number of technical benefits for drilling challenging ERD wells and has proved its economic value for future wells."

Todd Reid, Project Engineer

Well Information

Location	Offshore Eastern Canada
Spud	March 2006
Hole size	8½-in. (216 mm)
Interval drilled	18,678-20,472 ft (5,693-6,240m)
Interval length	1,794 ft (547 m)
Maximum Bottom Hole Temperature	250°F (121°C)
Bottom Hole Pressure	6,092 psi (420 bar)
Maximum Angle	29°
Mud Weight	11.25 lb/gal (1350 kg/m^3)

The Situation

An operator drilling extended-reach (ERD) wells offshore Atlantic Canada experienced a number of problems related to the operational limitations of the synthetic-base mud (SBM) used. Increased rheology due to low-gravity solids (LGS) in the SBM resulted in dramatically reduced flow rates and increases in equivalent circulating density (ECD) and stand-pipe pressure (SPP). Dilution was drastically increased as a result of high colloidal buildup (increased cuttings lag time and mechanical degradation resulting from a reduced flow rate). And barite sag created long stage protocols, requiring extensive circulation to even out density profiles. Plans to drill future wells to even greater depths required a drilling fluid that could provide higher performance.

The Solution

M-I SWACO elected to use a PARADRIL* system incorporating WARP technology to drill an 8½-in. reservoir section to demonstrate the benefits and the value of WARP technology for some extreme ERD wells the operator planned in the area. The unique low rheology of the PARADRIL/WARP system yielded the optimal suspension of barite as well as ECD and SPP management at high flow rates for drilling.

The Results

- At a flow rate 10% higher than when using a conventional SBM system, the ECD was 10% lower, and pump pressures were 16% lower.
- Displacement of the conventional SBM with the PARADRIL/WARP system gave an immediate ECD reduction of 0.35 lb/gal (42 kg/m^3), and the pump pressures dropped by 1,700 lb/in^2 at a 528 gal/min (1,999 L/min) flow rate. Rotary torque also decreased by 20%.
- Prototype 400 XR MESH* shaker screens were successfully deployed to control drilling fluid rheology at flow rates between 530 and 580 gal/min (2,006-2,196 L/min).
- By using 325 XR* and 400 XR MESH shaker screens, solids-control efficiencies increased from an average of 40% with conventional SBM to 64% with the PARADRIL/WARP system, and consequently, consumption factors were reduced from 8 to 2.8 bbl/bbl.
- Volume sent for cuttings re-injection was reduced by more than 50%.
- A better cementing job was possible because of the low-rheology fluid, giving a 0.4 lb/gal (48 kg/m^3) reduction in ECD.
- A more efficient clean-up was observed.
- The rig crew involved in the various operations using this fluid saw improved personnel HSE from less dusting and mixing; logistical benefits resulting from a lower requirement for additives; reduced wear on drill pipe protectors; improved signal with logging-while-drilling (LWD) activities.

The Details

The 54-m-long reservoir section was drilled to a total depth (TD) of 20,472 ft (6,240 m) in two bit runs, circulating at 581-594 gal/min (2,200-2,250 L/min) and an SPP between 25,000 and 28,000 kPa with an average ECD of 12.9 lb/gal (1,550 kg/m^3) (compared to 11.25 lb/gal (1,350 kg/m^3) surface density). During displacement, the conventional SBM system was circulated with a torque in the range of 44-49 kNm where, after displacement of the PARADRIL/WARP system, the torque decreased to the range of 28-30 kNm, a reduction of 32-43%.

The dilution rate from drilling the complete 8½-in. section was reduced by a factor of three compared to similar offset wells drilled with conventional SBM. One trip was made out of the hole for a drill bit change at 20,276 ft (6,180 m). There was no observed mud weight variation after 52 hrs static in the hole and after two times bottoms-up at the casing shoe and at TD.

The fluid properties remained stable throughout the section drilled, requiring no treatment with mud additives. There were no indications of poor hole cleaning for the complete section. The lack of barite recovered on the shaker screens resulted in 20 m^3/day for cuttings re-injection compared to 1,766-2,649 ft^3/day (50-75 m^3/day) when drilling with conventional SBM.

There was also a cost saving from the reduced number of pails of liquid xanthan biopolymer required to suspend the recovered cuttings/barite.

Typical PARADRIL/WARP formulation and properties are shown below:

Product	Function	lb/bbl
PARADRIL	Base Fluid	155
NOVAMUL* L	Emulsifier	10
TRUVIS*	Viscosifier	5
Lime	Alkalinity	5
$CaCl_2$	Brine	71
Sulphonated asphalt	Fluid Loss	4
WARP	Density	247

RHEOLOGY	50°C
600/300 rpm	49/29
200/100 rpm	22/14
6/3 rpm	3/2
PV (cP)	20
YP (lb/100 ft^2)	5
Gel Strengths	2/4/6
SWR	79/21

Questions? We'll be glad to answer them.

If you'd like to know more about WARP ADVANCED FLUIDS TECHNOLOGY and how it's performing for our other customers, please call the M-I SWACO office nearest you.

M-I SWACO
A Schlumberger Company

P.O. Box 42842
Houston, Texas 77242-2842
www.miswaco.slb.com
Email: questions@miswaco.slb.com

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