

# Halliburton Solution Improves Cement Isolation, Saving Significant Costs Per Well

## IMPROVEMENTS HELP OPERATOR SAVE DAYS OF RIG TIME

ROCKIES, NORTHERN U.S.

### CHALLENGES

- » Low, ratty cement tops
- » Poor cement bond and zonal isolation
- » Delays in obtaining permits from regulators
- » Severe lost circulation incidents

### SOLUTION

Baroid and Cementing teams proposed improvements to existing practices, including:

- » Lowering long-term static gel strength to enhance mud removal prior to cementing
- » Reducing high rheological properties that contribute to lost circulation
- » Pumping a STOPPIT® LCM pill in loss zones encountered while drilling

### RESULTS

- » Improved cement isolation scores
- » Decreased cement remediation operations
- » Reduced NPT by 57 percent
- » Reduced days on well by 2.46 days, saving approximately USD 110,000 in rig time per well

### POOR ZONAL ISOLATION AND SEVERE LOST CIRCULATION ADD TO RIG TIME

In 2014, an operator was experiencing low, ratty cement tops, along with subpar cement isolation, which had become an issue with state regulators. The operator was also encountering increased nonproductive time (NPT) with lost circulation in several wells. Cement bond logs indicated poor isolation in many wells, so additional state permits were required before the wells could be completed.

DAYS ON WELL  
**REDUCED BY  
2.46 DAYS**

### HALLIBURTON COMBO SOLUTION IMPROVES WELL CONDITIONS

Halliburton Baroid and Cementing teams recommended a low-solids, non-dispersed (LSND) water-based fluid to: 1) reduce high rheological properties that contribute to lost circulation, and 2) lower long-term static gel strength to enhance mud removal prior to cementing. The teams also kept other critical properties within target to ensure wellbore stability and minimize fluid losses.

The Cementing team utilized its iCem® cement modeling software and static gel strength analyzers to determine the appropriate long-term static gel strength of the drilling fluid. The team also recommended the Tuned® Spacer III cement spacer for successful mud and filter cake removal. Collaboration between Cementing and Baroid teams helped ensure that risks associated with the change were evaluated and mitigated.

By eliminating bentonite/lignosulfates/solids from WPX Energy's current fluid set, and replacing it with an LSND formulation comprising BARAZAN® D PLUS™ viscosifier, asphaltene, and BAROID® 41 weighting agent, the teams were able to reduce plastic viscosity (PV), yield point (YP), and gel strengths within targeted pre-cement parameters. This resulted in successfully removing the drilling fluid prior to pumping cement with the Tuned Spacer III cement spacer. To evaluate the benefit of the drilling fluid changes, all cementing fluids and properties were held constant within normal material variances.

The operator was typically addressing severe losses by bypassing shakers and building 10–30 percent lost circulation material (LCM) while drilling through severe lost circulation formations. This contributed to increased solids content, YP and PV values, and low and ratty cement tops with poor cement scores. Replacing the conventional LCM treatments with a STOPPIT® LCM pill in severe loss zones eliminated the need to bypass shakers and ended the excessive solids loading in the mud system.

The Halliburton solution reduced days on well by 2.46 days, saving approximately USD 110,000 per well.

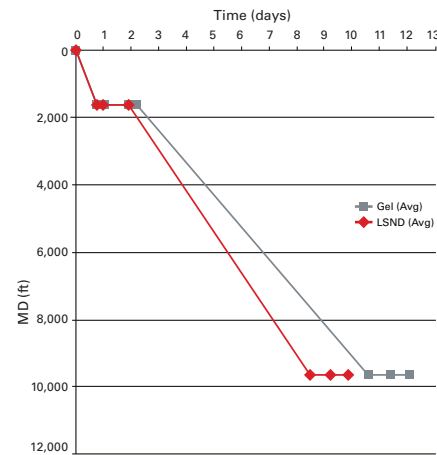
**OPERATOR SAVES DAYS OF RIG TIME AND ACHIEVES GOOD CEMENT BOND**

By switching to an LSND fluid system and implementing STOPPIT LCM to counter lost circulation, the operator realized an increase in average rates of penetration (ROPs), resulting in a reduction of days on well by 2.46 days and savings of approximately USD 110,000 per well. The NPT average decreased from 28.4 hours/well to 12.3 hours/well.

Additionally, with the controlled rheology, overall cement isolation improved, based on the cement bond logs that were run.

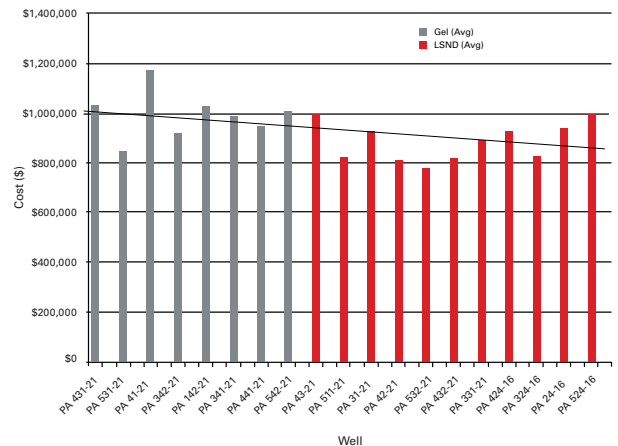
Based on a 0–10 scoring tool used by the operator to evaluate cement job quality, the cement isolation scores improved on average from a 7.44 to an 8.32 in the Mesaverde to Top Gas formations. In the critical pay zone area between Top Gas and target depth, the score increased on average from 9.25 to 9.4, where a cement isolation score of 10 is the maximum score possible. Some cost savings were also realized from a reduction in cement remedial work due to poor cement bond, especially in the Garfield County.

**Days vs. Depth**



*Figure 1 Average ROP using LSND system exceeded average ROP with gel/lignosulfonate system.*

**Total Well Cost**



*Figure 2 Utilizing LSND system reduced overall costs for each well.*

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