

# Customized LCM Squeeze Pill Cures Losses in Depleted Sandstones and Eliminates Additional Trips

## STOPPIT® LCM ENABLES EXCEPTIONAL FRACTURE PLUGGING, SAVING OPERATOR TIME AND MONEY

WESTERN SIBERIA, RUSSIA

### CHALLENGES

- » Stop partial to severe losses in pay zone
- » Pump through the BHA and bit to eliminate extra trips
- » Decrease overall well construction costs

### SOLUTION

Customized STOPPIT® LCM pill was applied with gentle squeeze pressure in the loss zone, ultimately curing losses and allowing Novatek to continue drilling to the planned total depth.

### RESULTS

- » Customized LCM pill cured losses while drilling within two hours
- » LCM treatment enabled operator to avoid further interval abandonments
- » Average cost of LCM pills was about 10 times lower than the cost of previous interval abandonment operations

### OPERATOR SEEKS SOLUTION TO STOP SEVERE LOSSES AND AVOID EXTRA TRIPS

Novatek approached Halliburton with a request to develop economical solutions to effectively combat losses while drilling in the partially depleted Achimov formation in Western Siberia. The proposed lost circulation material (LCM) squeeze pill had to be capable of being spotted downhole without additional trips. The LCM would be used while drilling the reservoir, so it would also need to enhance the cement job on the production liner. Lastly, Novatek wanted to see a reduction in total well construction time resulting from the proposed solutions.

The Achimov formation belongs to the Sortymysky suite. Clays and sandstone occur near the end of the interval. Partial to severe mud losses are often encountered while drilling through the Achimov formation and the formations situated above them. In particular, massive losses can occur in the Tangalovskaya suite. The interval is known to be depleted and is normally drilled with 1.21-SG drilling fluids.

On previous wells, LCM pills containing inert materials like nut shells, mica, various fibers, and sized marble were used with varied success. These normally required an additional trip to run in the hole with an open-ended bottomhole assembly (BHA). Some intervals were abandoned as a result of the inability to seal loss zones effectively.

### CUSTOMIZED PILL CONTAINING INERT LCM ENSURES REMEDIATION OF LOSSES

Baroid personnel recommended an engineered, customized pill containing STOPPIT® composite LCM. This LCM is inert, so it is compatible with all drilling fluids. The multimodal particle size distribution greatly enhances its efficiency as a fracture plugging additive. The Baroid team demonstrated that the STOPPIT material would be easily pumpable through the BHA and drill bit nozzles (with a minimum diameter of 8 mm), eliminating the need for additional trips. This material was determined to be the perfect candidate to ensure efficient remediation of losses while matching the operator's additional requirements.

The average cost of the LCM pills was approximately 10 times lower than the cost of previous interval abandonment operations.

**Case 1**

For this application, a 9-m<sup>3</sup> pill was pumped through the existing BHA and bit nozzles (8 mm, 11 mm) directly into the loss zone (80 percent sandstone, 20 percent clay). The pill was formulated as follows:

Polymer-lignosulfonate fluid	(viscosity = 70 sec/qt)
Bentonite	10.5 ppb
Ground nut shells (medium)	10.5 ppb
STOPPIT LCM	8.8 ppb

The pill was gently squeezed into the loss zone and left for two hours at 10 Atm pressure. Upon resuming circulation, 100 percent returns were observed. The interval was drilled to planned total depth (TD).

**Case 2**

Another well in the field experienced a loss rate of 1.1 m<sup>3</sup>/hr, which increased to 5.0 m<sup>3</sup>/hr as drilling continued. The operator decided to apply a high-filtration squeeze treatment as shown below:

BOREMAX® II fluid	(viscosity = 55 sec/qt)
BARACARB® 150 ground marble	70 ppb
BARACARB 600 ground marble	17.5 ppb
Mica (fine)	5.2 ppb
Ground nut shells (medium)	5.2 ppb
BAROFIBRE® LCM	5.2 ppb
STOPPIT LCM	7.0 ppb

After this treatment, the interval was drilled to the planned TD. Further losses occurred while running the production liner, but they did not halt the completion of the well.

**LCM PILL ENABLES OPERATOR TO REACH TOTAL DEPTH AT LOWER COST**

The LCM treatment was able to meet the operator’s requirements to 1) avoid additional trips to modify the BHA 2) decrease time spent fighting lost circulation, and 3) achieve an overall decrease in well construction time. The average cost of the LCM pills was approximately 10 times lower than the cost of previous interval abandonment operations.

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