



## Lost Circulation Materials

# Engineered Combo Pills with BAROFIBRE®, STEELSEAL® and N-SEAL™ LCMs Helped Stop Losses Quickly, Provide Immediate Impact Solution

Location: Burun Field, Turkmenistan

### Operator's Challenge

At a well operated by ENI S.p.A., while drilling the 12-1/4-in. hole section at 1,256 m, seepage losses of INVERMUL® oil-based fluid were detected on Well B-431. The initial loss rate was 0.42 m<sup>3</sup>/hr, with a loss of 10 m<sup>3</sup> over a 24-hour period. ENI supervisors decided to pull out of the hole (POOH) to 459 m, above the casing shoe at 472 m.

Losses (21.6 m<sup>3</sup>) occurred while pulling out of the hole from 1,256 m to inside the 13-3/8"-in. casing. The driller performed a static flow check. The mud level dropped 2 m inside the blowout preventer (BOP) and then stabilized.

The wellbore was filled from the trip tank and, again, the mud level dropped 2 m and stabilized. A further loss of 11.8 m<sup>3</sup> occurred while the driller ran back in the hole from 459 m to 1,245 m.

The operator circulated bottoms up at a pump rate of 119-206 gpm, with a standpipe pressure of 140-290 psi. Losses while circulating were 22 m<sup>3</sup>. Bottoms up was calculated to take 8,500 strokes, but, after only 7,050 strokes, zero mud returns were observed at the flow line.

### Halliburton Solution

To create an Immediate Impact Intervention Solution, engineers at the wellsite analyzed the problem and recommended spotting a series of blended lost circulation material (LCM) pills to cover the open hole from 1,256 m to 929 m (a distance of 327 m). Combining LCMs in the proper concentrations would provide effective hole sealing based on the lithology characteristics. The loss zone was 75-90% sandstone and 10-25% clay. The proposed pills could be mixed and pumped without changing the INVERMUL oil-based fluid properties (as shown on next page). All LCM pills were formulated as follows:

- 50 ppb of BAROFIBRE® cellulosic LCM
- 25 ppb of N-SEAL™ acid-soluble LCM
- 25 ppb of STEELSEAL® 50 size resilient graphitic carbon LCM

CHALLENGE	SOLUTION	RESULT
Losses occurred while drilling in the 12-1/4-in. interval.	Customized pills combining three LCM types were pumped in series across the loss zone.	Full circulation was restored and oil-based fluid loss was less than 70 m <sup>3</sup> .

Pill Sequence / Depth (m)	Volume (m <sup>3</sup> )	Results
#1 / 1,156 to 1,146	8.0	<ul style="list-style-type: none"> <li>No returns observed while pumping.</li> <li>POOH from 1,256 m to top of LCM pill at 1,146 m.</li> </ul>
#2 / 1,146 to 1,036	8.0	<ul style="list-style-type: none"> <li>Returns observed while spotting pill, with 8.0 m<sup>3</sup> mud returned due to ballooning effect.</li> <li>After completing pill placement, there were no further losses and well appeared stable.</li> </ul>
#3 / 1,036 to 926	8.0	<ul style="list-style-type: none"> <li>Full returns observed while pumping pill into place, with 9.0 m<sup>3</sup> mud returned due to ballooning effect.</li> </ul>

After spotting the third and final pill, the driller pulled out of hole above the 13-3/8-in. casing shoe at 459 m. There were no further downhole losses, and the hole remained in good condition. After the LCM treatments were completed and circulation was restored, the total mud losses in hole = 69.6 m<sup>3</sup>.

### Economic Value Created

After the LCM treatments were completed and circulation was restored, the total mud losses in hole = 69.6 m<sup>3</sup> on Well B-431. Further losses were prevented by using an engineered approach to treatment and formulating the pills with high-quality Baroid sealing agents.

The 45-day project created an Immediate Impact Intervention Solution for ENI. Because the pills cured the losses so quickly, ENI was able to preserve 216 m<sup>3</sup> of oil-based fluid in the active system and avoid extended nonproductive time associated with a long battle against lost circulation.

Depth, m	MW (SG)	PV	YP	6 rpm	3 rpm	Gels 10 s/10 min	HT/HP cc/30 min	OWR
1,256	1.30	17	9	7	6	8/14	3	77.4/22.6

*INVERMUL<sup>®</sup> oil-based fluid properties during drilling operations.*