



## Baroid Lost Circulation Material

### BaraBlend®-665 LCM and BaraLock®-666 LCM halt total losses in fractured limestone, saving 4.8 days of drilling and US\$556,000

Location: Beaver Lodge Field – Williston, North Dakota

#### Challenge

Severe losses and total lost circulation were known to occur in the Rival limestone formation in the Beaver Lodge field. The operator encountered total lost circulation while drilling this interval.

#### Solution

The active 9.8-ppg INVERMUL® oil-based mud (OBM) system had been pretreated with 8.0 ppb of BaraShield®-664 single-sack lost circulation material (LCM) and the shaker screens were changed to API 18s prior to entering the fractured Rival formation. While drilling the Rival formation, the rig lost complete returns and observed a loss rate of 4 bpm while pumping and 3 bpm while static. An 80-bbl pill was mixed as follows:

BaraBlend®-665 premium-granular, high-fluid-loss LCM	100 ppb
BaraLock®-666 reticulated-foam LCM	0.25 ppb (fine) 0.20 ppb (medium)

This LCM mixture is capable of sealing a wide range of fracture widths. It was spotted across the loss zone, and partial returns were achieved. A second LCM pill of the same volume and formulation was spotted. Both pills were pumped through the bit with no issues (6x14 jets). After the second pill was pumped, the drillstring was pulled to just above the loss zone and the mud pumps were turned on to provide equivalent circulating density (ECD) and aid in squeezing the slurry into the fractures. The loss rate dropped to 0.1 bpm while static, and to 0.2 bpm while pumping. After regaining circulation, the Baroid team added a 10-ppb concentration of BaraShield-664 LCM to the active system. The driller returned to bottom and resumed drilling. Minimal to zero losses were observed during the interval remainder and while running and cementing intermediate casing. The operator was able to cure total losses and resume drilling in a timely manner with minimal losses or no further losses observed. This rapid response to the loss issue allowed the operator to beat the average time to drill the intermediate interval by 4.8 days (Fig. 1) and to save 1,443 bbl of oil-based mud valued at US\$172,000 (Figs. 2 and 3). The savings in rig time was estimated at US\$384,000.

CHALLENGE	SOLUTION	RESULT
Total lost circulation was encountered in the Rival fractured limestone formation.	Two LCM pills with engineered composite materials were spotted to seal off medium to large fractures.	The operator regained full circulation, reached interval total depth, and ran and cemented casing – beating the average time to drill the intermediate interval by 4.8 days, and saving US\$556,000.

### Interval Time

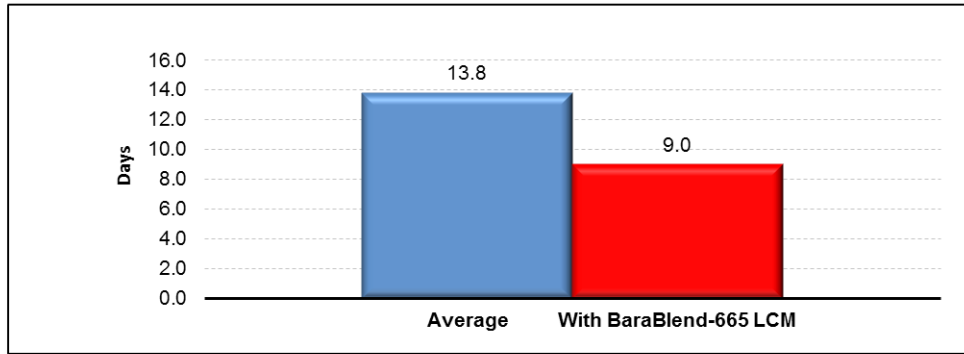


Fig. 1. Using responsive LCM treatments helped reduce interval drilling time by 4.8 days.

### Fluid Cost Comparison

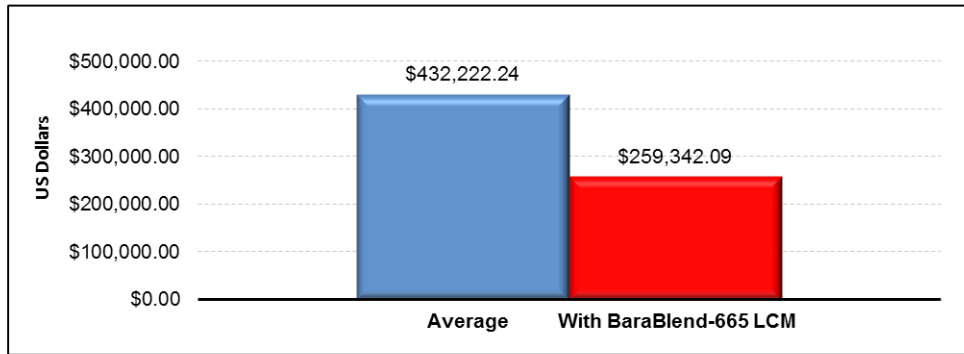


Fig. 2. Mud cost comparison shows that the LCM treatments helped save enough OBM to reduce the total fluid cost on this well.

### Losses

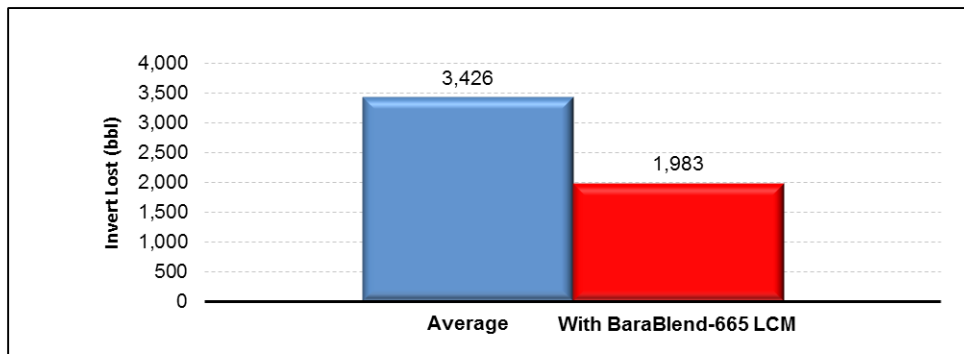


Fig. 3. Mud loss volume was 42 percent lower on the well using rapid LCM treatment strategies.