

Case study: Dimmit County, Texas

LATIDRILL water-based drilling fluid provided wellbore stability, lubricity, and high ROP in the Eagle Ford shale

Drilling wells in the Eagle Ford shale near Cotulla, Texas typically call for the use of oil-based mud (OBM) to facilitate directional operations, which require a gauge hole, good lubricity, and excellent wellbore stability. Wells are usually drilled quickly (267 ft/hr) using OBM, making it difficult to maintain mud properties while incorporating the excessive amount of drilled solids associated with the high ROP.

Additionally, the use of OBM has environmental ramifications, particularly the disposal of cuttings. To address the issues of drilling with OBM, the operator chose the Baker Hughes **LATIDRILL™ high-performance water-based fluid system** for use in one of its wells in an effort to determine the

viability of drilling Eagle Ford shale wells with water-based mud (WBM). Because the operator mandated the use of recycled drilling fluid to reduce mud disposal costs, the already environmentally friendly LATIDRILL system was built using recycled fluid.

The LATIDRILL system is based on three key components to achieve rapid and efficient drilling of horizontal wells.

LATIBASE™ multifunctional additive provides basic rheological and filtration control properties.

LATIMAGIC™ wellbore stabilizer and lubricant provides wellbore stability while drilling the curve and lateral portions of the well and **LATIRATE™ ROP enhancer and lubricant** is a multifunctional additive enhancing ROP and increasing lubricity.

Challenges

- Drill to measured depth within time frame and budget using WBM
- Use of recycled WBM
- Solids accretion that could cause hole pack off or stuck pipe
- Incorporation of solids from high-ROP drilling
- Wellbore stability issues
- Lubricity concerns with WBM
- Environmental costs with OBM

Results

- Matched ROP of invert emulsion systems over the entire well
- Reduced the average friction factor to 0.11 in the open hole
- Drilled lateral section with excellent wellbore stability
- Avoided NPT associated with drilling fluid operations
- Reduced drilling fluid costs by \$13K USD
- Eliminated disposal issues

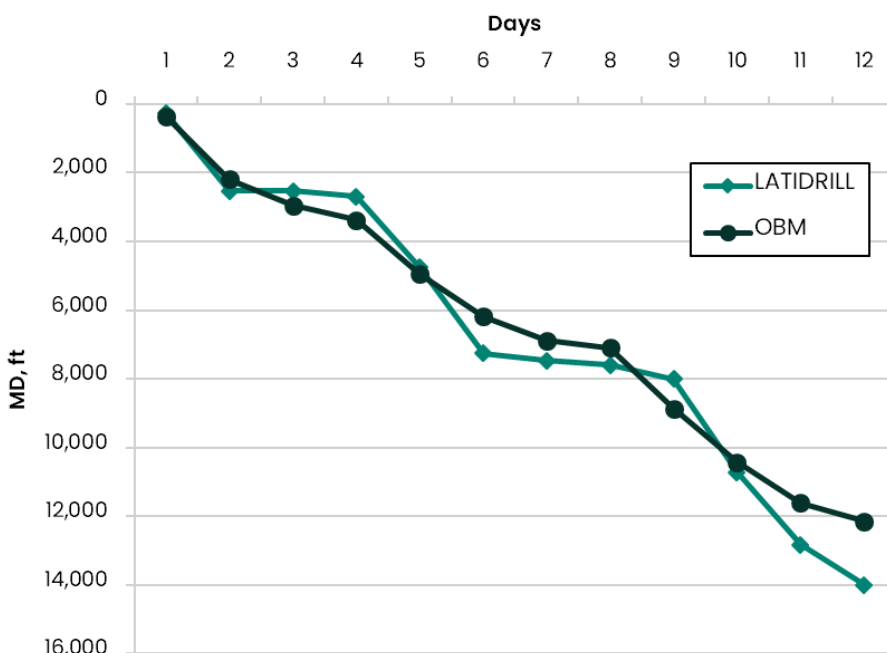


Fig. 1—Drilling days versus depth when using the LATIDRILL system and a typical OBM.

Using the LATIDRILL fluid, the well was drilled at an average rate of penetration (ROP) of 268 ft/hr, matching the performance of OBMs in the area. The 6,350-ft (1,936-m) horizontal section was drilled at an average ROP of 329 ft/hr. There were no issues with hole cleaning, bit or stabilizer balling, tight hole, pack offs, or stuck pipe over the course of the entire well. There was also no nonproductive time associated with the drilling fluid operation.

The well was drilled to its total measured depth of 13,944 ft (4,250 m) with a maximum mud weight of 12.0 ppg (1.44 sg) within the allotted time frame and under budget. When compared to the programmed cost, the LATIDRILL drilling fluid saved the operator \$13,000 USD.

The calculated average friction factor of 0.11 was 50% lower than with conventional WBM and similar to OBM, resulting in lower off bottom and drilling torque. Typical friction factors range from 0.13 to 0.26 for OBM and 0.23 to 0.44 for WBM in the open hole. Friction factors for this well were derived using the proprietary Baker Hughes **Advantage™ Engineering software**.

Friction factors vs. MD (ft)

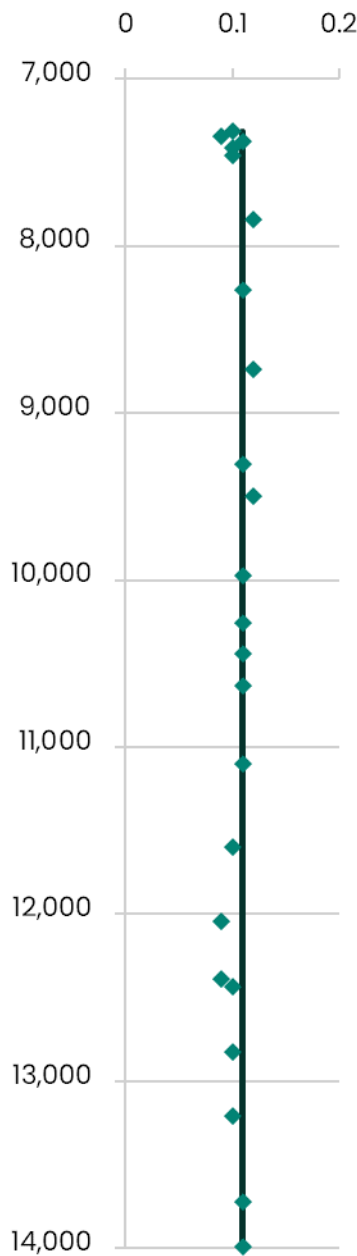


Fig. 2 The dark teal dots show actual friction factors for this well that were obtained using Advantage software. The dark green indicates average friction factors while using the LATIDRILL system.

ROP (ft/hr) vs. MD

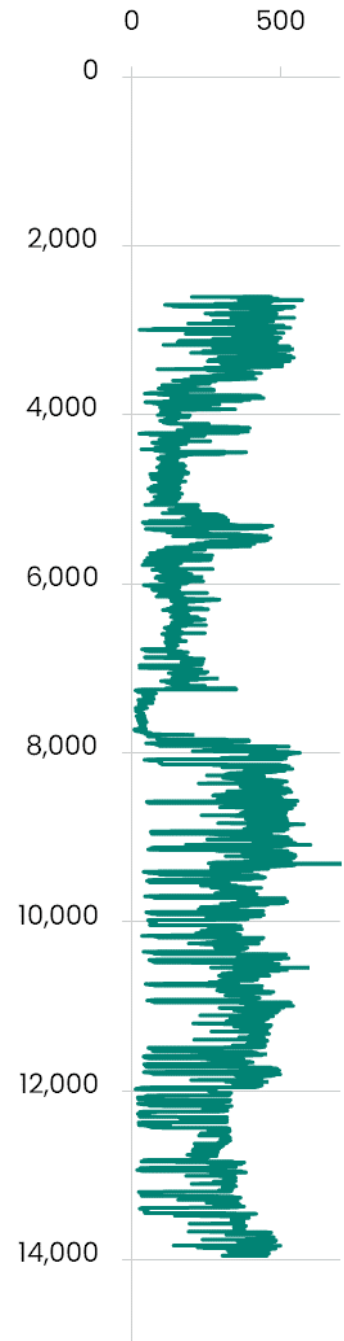


Fig. 3 The use of conventional WBMs can result in low ROP, but the LATIDRILL system shows an excellent ROP.