CASE STUDY

HALLIBURTON

United States

Non-aqueous fluid system helps Marcellus operator achieve new depths

High-performance fluid and solids control systems reduce pump pressures, decrease low gravity solids, and help operator drill 12,118 ft in 24 hours

CHALLENGE

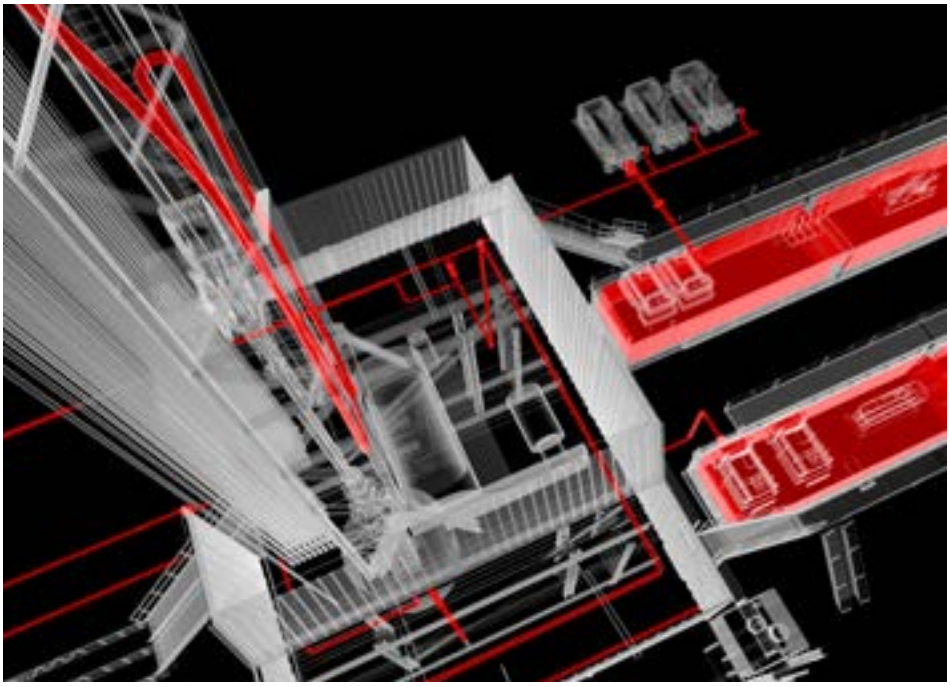
- Achieve effective hole cleaning in extended laterals
- Maintain lower pump pressures throughout drilling
- Reduce percent low gravity solids while increasing rate of penetration
- Decrease haul-off waste volumes and the use of drying agents

SOLUTION

- Drill with BaraXcel® high-performance non-aqueous fluid system to reduce pump pressures and minimize cleanup time to total depth
- Integrate solids control equipment to keep up with required flow rates

RESULT

- Reduced pump pressures by up to 1,000 psi
- Decreased low gravity solids concentration by 30%
- Drilled 12,118 ft in 24 hours
- Saved more than $50,000 per well with the elimination of drying agents



The integrated fluid performance solution was designed to improve rate of penetration and hole cleaning.

Overview

An operator had drilled numerous extended laterals in the Marcellus shale play in West Virginia. Horizontal displacements averaged 9,500 ft (2,895 m). However, efforts to increase the rate of penetration (ROP) often led to hole-cleaning challenges. The operator encountered problems with excessive concentrations of low-gravity solids (LGS) in the active mud system.

The high solids content affected standpipe pressures, and the pump rate had to be reduced to avoid risk with the pump's pressure limitations. This resulted in slower ROPs and added hours of circulating time at total depth (TD) to ensure the wellbore was clean before pipe was pulled out of the hole.

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Challenge

The wells were drilled with a conventional organophilic clay-based mineral non-aqueous fluid (NAF) system. The incorporation of 10-15% LGS made the fluid difficult to pump at safe operating pressures. Rheological properties were elevated and oftentimes out of specifications. As noted above, pump pressures had to be reduced (by up to 1,000 psi). This meant the reduction of flow rates from 650 gpm to as low as 500 gpm. The adjustments resulted in high equivalent circulating density (ECD), poor drilling efficiency, and up to 14 hours of circulating time at TD.

Solids control equipment (SCE) was also inefficient on several rigs. Centrifuges were in use, but not as optimized SCE systems. Small-bowl centrifuges lacked sufficient capacity. Their use along or with large-bowl centrifuges did not provide optimal LGS control. The addition of drying agents added $50,000 per well for disposal costs.

Solution

The Halliburton Baroid team designed an integrated fluids and separation solution that increased rate of penetration, reduced the LGS concentration to less than 8%, and resulted in dryer cuttings to lower disposal costs. Baroid recommended the BaraXcel® high-performance non-aqueous fluid system. This system contains no organophilic clay. Advanced emulsion and polymer technologies help provide a superior rheological profile and robust, yet fragile, gels to ensure excellent suspension properties. This results in improved hole cleaning at lower pump pressures. With the use of our proprietary DFG™ hydraulics modeling software to design the fluid and optimize it while drilling, the Baroid team clearly identified the optimal balance of flow rate, ROP, rheological profile, and rotation speed to ensure effective hole cleaning at the fastest safe drilling speed.

The operator wanted to extend the lateral lengths, based on current fluid performance, so the DFG analysis was again applied to confirm this could be done without the reduction of drilling performance. The Baroid team designed the SCE configuration to maximize the flow rate to process the fluid and reduce haul-off volumes. Three large-bowl centrifuges were installed for simultaneous operations to maximize solids removal and help maintain the desired rheological properties. A BaraG-Force™ VacVCD vertical cuttings dryer was recommended to reduce or eliminate the use of drying agents to solidify cuttings for disposal. As an additional safety benefit, the cuttings would be conveyed to the dryer via a pneumatic vacuum system, as compared to auger conveyance systems. The complete processing circuit was configured to fit in the small amount of allowable space on location. This allowed the Baroid team to mobilize and avoid rig modifications.

Results

Before the implementation of these recommendations, pump pressures limited drilling operations. The fast ROPs required to accomplish this typically resulted in hole-cleaning issues that slowed down operations and negated the gain in rig time. After the establishment of Baroid fluid and separation services on the first pad, the operator was able to drill more than 6,000 ft (1,829 m) in 24 hours on every well. Pump pressures were immediately reduced by up to 1,000 psi at higher flow rates. As the drilling program continued, the operator set a series of records based on the 24-hour footage achieved.

The average LGS concentration was held at 5-7% throughout the campaign, and, following a record 12,118-ft (3,596 m) performance, the LGS concentration was less than 8.5%. The cleanup time at TD was lowered by 30% with the maintenance of the customized rheological profile. With the elimination of drying agents, the operator was able to save more than $50,000 per well.

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