Performance Report

Navigate™ Direct-Emulsion WBM Fluid System Prevents Stuck Pipe at Low Mud Weights while Providing Predictable & Consistent Results

"The [Navigate] system performed great and provided the desired results." – East Texas customer since 2021

CHALLENGE	SOLUTION	RESULT
• **Depleted zones in the production lateral caused differential sticking with 8.5-9.0 ppg mud weight (MW)** • **Continue to use water-based system while reducing mud weight to less than weight of water** • **Reduce overall cost of operations associated with differentially stuck pipe including days on rig**	• **Optimized Navigate Direct-Emulsion WBM system at <8.3 ppg to avoid differential sticking** • **Newpark Service Advantage providing reliable action plan to mitigate risks to customer** • **Navigate system was readily prepared on-the-fly by converting the current polymer system to an oil-in-water fluid system**	• **Achieved 8.1 ppg Navigate Direct-Emulsion WBM system with 8.2-8.3 ppg MW while drilling** • **No further stuck pipe incidents** • **After being stuck and drilling delayed, switching to the Navigate system saved the day by finishing the well within the programmed timeframe**

CHALLENGE

The Cotton Valley Lime basin in East Texas is a well-known oil and gas region characterized by complex drilling conditions, including depleted zones within production laterals. A customer operating in this area faced significant challenges with differential sticking while drilling with mud weights (MW) of 8.5 – 9.0 ppg. These stuck pipe incidents required costly remediation efforts, including spotting stuck pipe additives, production oil, acid procedures, and nitrogen treatments, all of which extended well construction timelines and increased overall project costs. The objective was to continue drilling with a water-based mud (WBM) system while reducing the MW to less than the weight of water (<8.3 ppg) to mitigate differential sticking and improve operational efficiency.

SOLUTION

After evaluating multiple alternatives, including oil-based mud (OBM) and Aphron systems, Newpark recommended its **Navigate Direct-Emulsion WBM** system to meet the project's unique requirements. The customer was already using an Evolution system, making the transition to Navigate seamless with the addition of two key components: increased **EvoCon II** and **Diesel (~20% vol.)**.

The Navigate Direct-Emulsion WBM system was implemented with a **Water:Oil Ratio (WOR) of ~80:20**, reducing the MW to 8.1–8.3 ppg. The conversion was executed **on-the-fly** while circulating and returning to bottom at 12,299'. To accommodate the diesel addition, the active pit system volume was reduced before any product or diesel was introduced. The initial conversion required 82 buckets of EvoCon II and 200 bbls of diesel, successfully achieving the targeted WOR and MW range. Throughout the drilling process, maintenance treatments of EvoCon II, combined with precise water and oil dilution

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management, ensured MW control and prevented differential sticking incidents.

To further optimize performance, **Ntegral I & Ntegral V polymers** were utilized to enhance rheology and reduce fluid loss without increasing normal treatment concentrations. **Centrifuge usage** played a crucial role in controlling drill solids and maintaining the low MW without increasing the oil percentage. The fluid loss remained stable at **<2 mL/30 min**, contributing to overall system stability.

RESULTS

The implementation of Navigate Direct-Emulsion WBM resulted in significant operational improvements:

- **MW control achieved:** Drilling was maintained at **8.2-8.3 ppg**, preventing differential sticking.
- **Successful integration of EvoCon II:** 2-3 ppb concentrations effectively encapsulated the oil content and prevented separation.
- **No stuck pipe incidents during drilling:** The well was drilled to TD without requiring additional remedial measures, maintaining or improving ROP compared to offset wells.
- **Cost stabilization:** Fluid costs followed historical Cost Per Foot trends after the conversion.
- **Efficient casing run:** Although a brief period of differentially stuck pipe occurred near TD, the issue was resolved without additional interventions, enabling the successful running of casing.
- **Enhanced fluid performance:** The Ntegral polymers yielded increased rheology and decreased fluid loss without increasing standard concentrations, contributing to better overall fluid performance.

By leveraging the **Navigate Direct-Emulsion WBM system**, the operator successfully **drilled and ran casing through depleted zones** while avoiding costly and time-consuming differential sticking incidents. This project demonstrated the effectiveness of the Navigate Direct-Emulsion WBM in addressing underbalanced fluid challenges and provided a cost-effective solution for future wells in the Cotton Valley Lime basin.