

Cohesive Drilling Solution Overcomes Instability Events in Challenging Shale

Integrated modeling, monitoring, and fluids maintain wellbores to reduce days-on-well and costs

Using an integrated solutions package that included drilling fluids management and solids control from M-I SWACO and K&M Technology Group, a Schlumberger company, the operator drilled all wells without a single wellbore instability incident. The solution reduced drilling time by 51% on the intermediate casing to production runs. The operator saved USD 650,000 on fluid costs compared with offset wells on the same pad.

Avoid stuck pipe and NPT

An operator faced challenges while drilling in a highly fractured area of Marcellus Shale. The wells included 9 $\frac{5}{8}$ -in casing set at ~3,000 ft and a monobore 8 $\frac{3}{4}$ -in hole drilled to TD prior to running and cementing 5 $\frac{1}{2}$ -in production casing. Wellbore instability and stuck pipe caused some BHA components to be lost in hole, leading to NPT. The operator abandoned drilling from the pad after five wells.

Reduce wellbore instability

A bridging agent proved inefficient in enabling easier tripping. Tight-hole and stuck-pipe incidents occurred frequently in the production interval. When the operator was able to reach TD, tripping out of the hole was difficult. Attempts to run casing through the production interval often ended off bottom.

As the operator tried to reduce wellbore instability, there was uncertainty about equivalent circulating density (ECD), maintaining desirable mud properties, and whether the previously used fluid properties were good for this pad.

Optimize drilling practices and parameters

An integrated approach was taken to optimize drilling practices and parameters. M-I SWACO monitored the fluid properties and made sure they remained within the specifications of the drilling program.

Schlumberger provided three strategies to minimize or eliminate the series of problems caused by wellbore instability. A pressure-while-drilling tool was used to monitor ECD in real time and stream data. This enabled better control of fluid properties, more accurate modeling, and better identification and mitigation of troublesome areas.

Extended-reach architect software was used to gain a better understanding of the loads, stresses, and pressures encountered during the well construction process.

To improve ECD management and minimize solids content, M-I SWACO implemented the MEGADRIL P* paraffin-base system. This high-performance nonaqueous fluid is ideal for use in naturally fractured formations where ECD is a constant concern. VIRTUAL HYDRAULICS* drilling fluid simulation software was used to evaluate and model critical drilling hydraulics under simulated downhole conditions. By monitoring and predicting ECD, equivalent static density, temperature, hole cleaning, and tripping profiles, the software helped achieve a high-quality wellbore while reducing rig time and lowering costs.

The third part of the integrated approach to fluid management focused on improving solids control efficiency and reducing the low-gravity-solids (LGS) concentration. M-I SWACO used a high-performance large-bowl CD-518 centrifuge for barite recovery and CD-500 HV* high-volume, high-speed precision-balanced centrifuge for polishing.

Model and monitor drilling properties to enable informed decisions

Modeling and monitoring of drilling properties enabled critical adjustment throughout the drilling operation. The integrated solution provided better control of weight on bit to eliminate helical buckling of the drillpipe. Periodic backreaming decreased the friction factor. Adjustment of solids control and the rheological profile minimized the friction factor and enabled easier sliding and faster tripping and running casing times.

The operator was able to trip out of hole on all wells drilled with this approach with no issues and zero NPT.

Drilling time  **51%**
reduced by

USD 650,000 fluid cost savings