10 tips to improve drilling fluid performance

WHILE DOWNHOLE FLUIDS are often seen as an ancillary aspect of a drilling operation, there is no doubt they can have significant impact on a well's success or failure. As the industry expands further into ever more difficult drilling territories, such as high-pressure, high temperature (HPHT) and extended-reach, it becomes ever more important for drilling personnel to understand the challenges and the potential solutions. Drilling Contractor spoke with **Baroid** and **M&D Industries of Louisiana** on optimizing drilling fluid performance in today's wells.

Allan McCourt, Baroid regional technical manager for Europe and Eurasia, offered 5 pointers for better HPHT operations:

1. HPHT wells generally provide a very narrow window between pore pressure and fracture gradient. It's important to minimize the additional pressure exerted on the wellbore during drilling operations. In terms of drilling fluids, the best way to do that is to use a thin, low-rheology fluid that creates the lowest possible incremental pressure on the wellbore. However, HPHT fluids — especially HP fluids — are high density. The fluid has to support the solids added in, so that tends to drive you away from thin fluids. It's a very delicate balancing act to walk that edge between having a thin, low incremental pressure fluid without creating the problem of poor solids support.

2. Under HPHT conditions, the thermal stability of fluid products and systems can make drilling tricky. The extreme temperatures can push products to their limit and make any contaminants to the system react much more aggressively and rapidly, causing destabilization of the fluid. Personnel must understand how the temperature and pressure profile of the well will affect the proposed fluids.

The entire drilling team also needs to understand that, for HPHT wells, more time and effort may be required to keep drilling fluids in optimum condition. The nature of the well means fluid properties can't be changed rapidly. Treatment of the mud system may need to be done by arrangement rather than on-the-fly due to well control issues. The crew must make allowances for this.

3. Drilling fluids costs typically run 5% to 10% of total well cost. However, the mud's ability to influence final well cost is significantly greater than this. Misapplied or incorrectly run fluid systems can lead to a substantial overrun to planned AFE. In HPHT wells, the margin for error is further reduced. In such demanding environments, the technical performance of the fluid should be the main driver, not the cost.

4. A fluid product may be stable for an hour at 400° F, but will it still be stable if it's exposed to that temperature for 1-3 days? When planning HPHT wells, it's imperative to make sure the fluid and fluid additives will be stable for the maximum expected time under the most extreme conditions anticipated. If the product breaks down thermally, there will be different chemistries acting within the fluid system and you no longer know what the outcome of those chemical reactions will be.

5. With conventional wells, field experience can tell you what fluid systems and products perform satisfactorily under the specific conditions of your project. However, every day the industry is pushing technical boundaries. With HPHT projects, there may not be many similar drilled wells to assist in fluid selection and design. In this case, thorough laboratory work must be completed, and detailed drilling, well and mud programs become more critical. It's also wise to have 1-2 robust backup plans. HPHT wells can very quickly go from a smooth-running to a very difficult operation, so it's important to know what you are going to do if things don't go 100% as planned.

Robert Copeland, M&D Industries operations manager, offered 5 pieces of advice to optimize fluid performance:

6. Every hole is different. Fluid design should be specific to that particular well. At the same time, both the operator and the drilling fluid company must exhibit the ability to think "out of the box" when solving major calamitous situations.

7. For friction relief in extended-reach drilling, artificial lubricants in both solid and liquid form can be used. Additionally, proper geological analysis of the formation is needed so the expected frictional problems inherent with this kind of drilling isn't amplified by the use of the wrong type of drilling fluid. Water-sensitive clays, depleted zones, salt stringers are a few considerations. The right drilling fluid will help minimize much of this.

8. Differential sticking can occur in any kind of well. Controlling filtrate loss and reduction of the fluid wall cake are the first steps in solving this. Pay close attention to the use of the available solids control equipment, particularly in the reduction of low-gravity solids of the active system fluid. If the problem grows, a different mud system may be needed.

9. I believe lost-circulation incidents are proportional to the number of wells being drilled. It goes with the territory. Depleted sands, unknown fault lines, under or overpressured zones, as well as unusual or unpredictable clay chemistry, are all indicative of Mother Nature not wanting to give up her secrets easily. The challenge is being ready for the loss event. Unfortunately, many operators try to combat it from the perspective of the cost of the LCM material. It's fine to pump large volumes of cheap LCM material down the hole — if it works. If it doesn't, however, the cost has been amplified with the lost rig time and the LCM material cost.

10. Rather than preventing formation damage, we should be asking how we can limit it, or better yet, what can we do to maintain and strengthen formation integrity? Selection of a proper drilling fluids is only part of that equation. Actual drilling practices from controlled drilling rates to a proper and efficient hydraulics program, coupled with the right type of drilling fluid, is the catalyst for reducing formation damage.