

UAE Operator Lowers Well Completion Cost with Novel Filter Cake Breaker Technology

CUSTOMIZED, DELAYED-REACTION N-FLOW™ 408 FILTER CAKE BREAKER SYSTEM HELPS REDUCE BRINE LOSS

UNITED ARAB EMIRATES

CHALLENGES

- » Perform ERD well completions in a high-temperature, fractured limestone formation offshore UAE
- » Minimize high losses of sodium bromide brine after spotting a filter cake breaker
- » Maintain well control under difficult drilling conditions, which included drilling to a depth of 17,320 feet (5279 meters), at a pressure of 4,160 psi (287 bar)

SOLUTION

Provide the following fluid technology, customized to specific wellsite conditions:

- » Baroid N-FLOW™ 408 filter cake breaker system, with delayed acid generating material, for efficient filter cake cleanup and mud damage removal

RESULTS

- » Reduced brine losses downhole by 60–70 percent
- » Reduced risk of well control while tripping
- » Reduced wellbore cleanup times
- » Saved the operator approximately USD 380,000 per well

OVERVIEW

While performing extended-reach drilling (ERD) well completions in a high-temperature, fractured limestone formation in the Persian Gulf, a major United Arab Emirates (UAE) operator encountered downhole losses of sodium bromide brine during the completion phase.

This occurred after spotting a filter cake breaker to remove damage that resulted from the drilling fluid. The total loss of brine was significant, at an average of +/- 7,000 bbl per well. In addition to the brine cost, the operator also ran into well control issues from losing the hydrostatic head due to downhole losses. The operator needed to be able to maintain well control under difficult drilling conditions, which included drilling to a depth of 17,320 feet (5279 meters), at a pressure of 4,160 psi (287 bar).

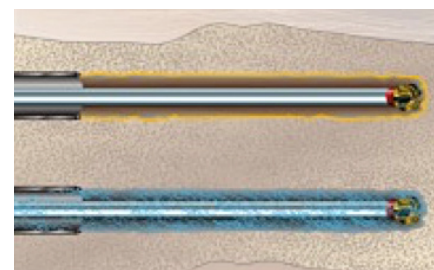
To mitigate such problems, a decision was made to try the Baroid N-FLOW™ 408 filter cake breaker system, known for its slow release of acid in completion operations at elevated temperatures (in this case, as high as 220°F/104°C) and a wide range of pressures (in this case, 4,160 psi/287 bar). It can also be used in limestone formations and in conjunction with a variety of brines, including sodium bromide. Furthermore, this system does not contain any harsh chemicals, so it is safe for the environment. This new method was successful in reducing brine losses by 60–70 percent, resulting in a cost savings of USD 380,000 per well.

DELIVERING INNOVATIVE FLUID TECHNOLOGY

The N-FLOW 408 system was formulated to match the exact well conditions. It was then delivered to the rig in totes, where it was mixed in the rig's tanks in its pure form. The delayed acid generator material was dissolved in the sodium bromide carrier brine and spotted over the downhole interval of interest.

Because the acid liberation action is slow, the solution contains little or no free acid when placed across the zone to be treated, making it a safe solution from an a health, safety, and environmental (HSE) standpoint. Acid was generated over the subsequent 6–16 hours, with the released acid reacting with water and dissolving the calcium carbonate and cellulose in the filter cake, thus destroying the filter cake and removing any mud damage.

**N-FLOW™ SYSTEM
REDUCED TOTAL
COMPLETION COSTS**



Top: Before using N-FLOW™ 408 system to clean up filter cake; Bottom: After using N-FLOW 408 system for filter cake cleanup.

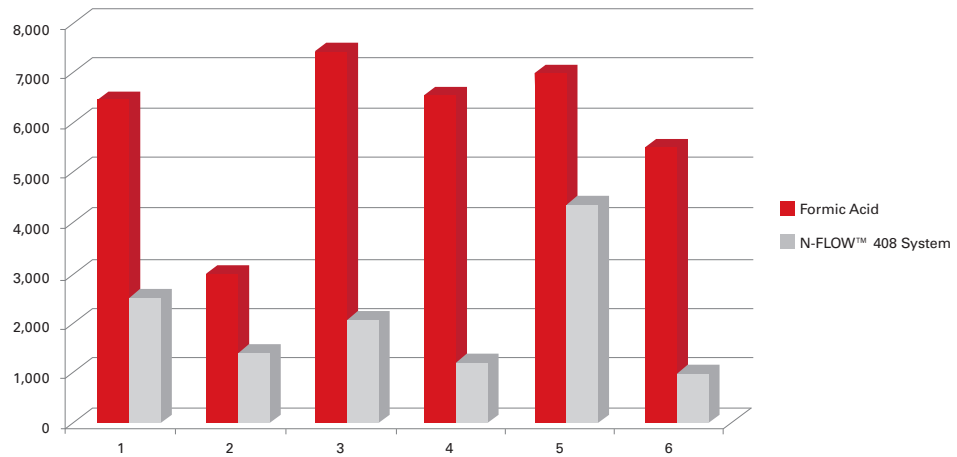
OPTIMIZING FLUID PERFORMANCE

The delayed time provided by the N-FLOW 408 filter cake breaker system allowed the operator to trip out of hole safely without any well control issues, and to reduce the total barrels of brine lost by 60–70 percent compared to previous methods. The N-FLOW 408 system also helped the operator to modify the design of its reservoir completion fluid for future wells, changing from viscous brine to non-viscous brine, which will maximize fluid performance and cause less formation damage, as well as save time while tripping in and out of the well.

ADVANTAGES OF THE N-FLOW 408 SYSTEM

The two primary advantages of this N-FLOW 408 application were: 1) removing the reservoir damage that resulted from drilling fluid, and 2) minimizing the total losses of brine into the formation by 60–70 percent, thus reducing the total cost of the completion phase and minimizing flowback volume before production.

In contrast to competitive breaker systems involving live acids, the N-FLOW 408 system carries much less HSE risk. This system does not require special acid-resistant tanks, pumps, or other equipment, and can be safer for rig personnel to handle at surface than conventional mineral acid breakers. Furthermore, it is ideal for limestone formations like those in the Persian Gulf region, and elsewhere, that may destabilize on contact with strong mineral acid.



Bar graph showing total brine losses, in barrels, for six wells in this mature asset, using the Baroid N-FLOW™ 408 system (gray) vs. the alternative method, using formic acid (red).

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