Successful N-FLOW™ 325 filter cake breaker treatment achieves high production rates for Statoil

Customer: Statoil
Location: North Sea

OPERATOR’S CHALLENGE – Statoil’s challenge in the A-14H well in the Visund Field was to drill the long 8 ½ in x 9 ½ in hole section for the first time through the reservoir at high angle. They wanted to ensure that maximum communication between the reservoir formation water and the wellbore could be achieved. This required that the filter cake deposited would not be a barrier to high rates of water production. It also required that the whole reservoir section would contribute, rather than in specific areas, such as close to the heel where the risk of point in-flow would be increased, leading to screen erosion. This water-producer was planned to secure production of sulphate-free injectionwater. Effective and maximum reservoir communication was therefore fundamental to the success of the well, both to achieve the target production rate of 3,000 m³/day and to avoid early well failure due to screen erosion and sand production.

HALLIBURTON’S SOLUTION – Baroid recognized the need to design a drill-in fluid (DIF) that was capable of performing the functions necessary to enable a successful drilling operation. These included the ability to:

- Drill to TD successfully (>700 m at high angle)
- Avoid hole cleaning problems
- Minimize the risk of differential sticking
- Inhibit any shale encountered
- Minimize formation damage
- Permit the well to be completed with a sand control completion
- Ensure the fluids and procedures were non-damaging to the completion
- Lay down a filter cake susceptible to attack/removal by suitable treatment(s)

Following extensive lab testing and based on the client’s preference towards the SOLUDRIL-N system, the SOLUDRIL-N DIF system was selected and optimized further for this well. Reservoir information was analyzed and the bridging particle package was optimized using Baroid’s DFG™ software. In addition to the saturated sodium chloride base brine, potassium chloride and glycol (GEM GP) fluid were included in the formulation as inhibitors in case shale was encountered in the reservoir.
The second part of the study involved creating a solution to help ensure that maximum reservoir communication would be achieved at the end of the drilling operation. The desired treatment and application should be able to ensure:

- Even and maximum contribution from the whole reservoir section
- Effective removal of filter cake from the whole reservoir section
- Avoidance of formation collapse onto screens with filter cake intact
- Minimal risk of breaker treatment hot spots or worm holes

The solution provided by Baroid Completion Fluids was N-FLOW 325 delayed action filter-cake breaker based on an organic acid precursor. This solution fulfilled ALL of the above requirements. In addition, N-FLOW breaker is neutral on surface when mixed and therefore can lessen HSE issues that can be associated with the handling of live acids. Low reservoir temperature is one of the design parameters that highly influence degradation of the filtercake. To ensure an effective degradation, N-FLOW was chosen as a preventive breaker. Filter cake degradation tests indicated the susceptibility to attack by N-FLOW breaker on the filter cake laid down by the SOLUDRIL-N DIF system. Suitable delay times, which would allow placement along the whole of the reservoir section, were also demonstrated in the lab.

The SOLUDRIL-N system was displaced into the wellbore with a clean-up pill “train” in front of it consisting of BARAKLEAN® DUAL and BARAKLEAN® GOLD displacement/cleaning pills. The section was drilled without any fluid related incidents (average ROP of 25.5 m/hr). At TD the open hole was displaced to solids-free SOLUDRIL-N fluid (flow-through-cell-tested) and the cased hole was displaced to saturated sodium chloride brine following a casing clean-up. The screens were run without issue to TD and the hanger set.

The N-FLOW treatment was spotted both outside and inside the 6 5/8” sand control screens with a 3 ½” work string without premature losses being incurred.

**ECONOMIC VALUE CREATED** – The well was produced and quickly demonstrated the value that Baroid’s customized and engineered fluid solution had provided to Statoil.

Testimonial from Statoil:

A short summary from the Visund A-14 H water producer start up:

- The pump rate was gradually increased to max 8000 m³/d
- Good productivity, 1500 – 2000 m³/d/bar
- The well has produced at approximately 3500 m³/d

“From the clean-up point of view, we are happy with the fluid selection for this well, SOLUDRIL-N 1.25sg system. In combination with the operation procedures, including the displacement to the breaker fluid and the clean-up, the N-FLOW breaker system seems to have "done the job".

- Principal Engineer Drilling & Completion Fluids, Statoil