CASE STUDY

HALLIBURTON

Location: Colombia

Wellbore sealant strategy improves drilling efficiency in dispersive formations

Drilling fluid formulated with copolymer sealant reduces tripping times and cement volumes for casing operations

CHALLENGE(S)

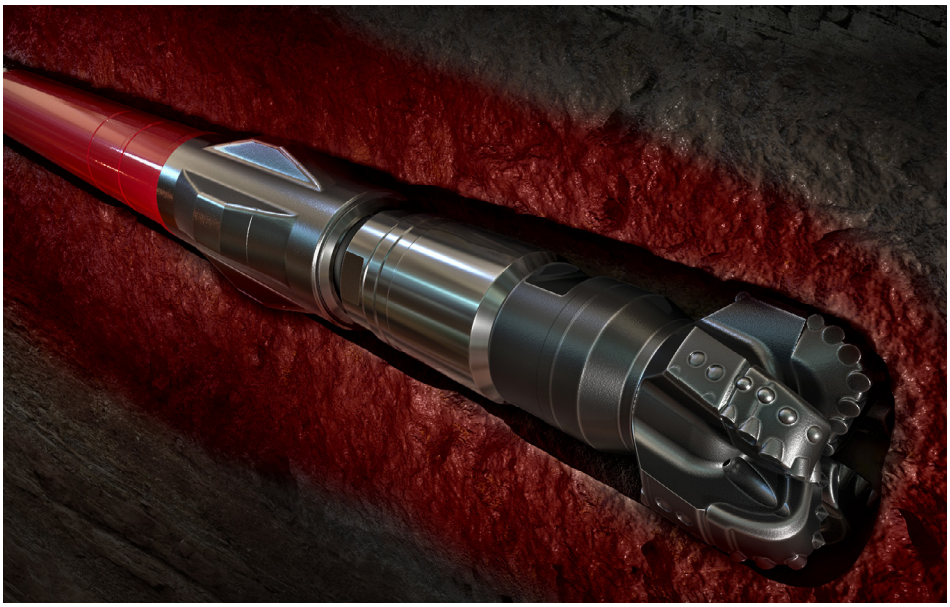
- Drill Carbonera formation efficiently with S-shaped directional profile
- Minimize washout in unstable fractured sections during drilling
- Reduce tripping times and backreaming while optimizing cement volumes to ensure complete isolation

SOLUTION(S)

- Implement sealing strategy with copolymer nanoparticles to reduce fluid invasion
- Generate more cohesive filter-cakes that can efficiently seal permeable formations, microfractures and pore throats
- Monitor the fluid filtration control properties frequently to ensure optimum performance

RESULTS

- Reduction of average hole washout by 24%
- Reduced tripping times in open hole, lowering overall well costs
- Reduced cement volumes to cover the 8 ¾" intervals
- Similar fluid viscosity compared to systems without sealant added



Traditional filtration control additives are designed to protect near wellbore formation against strength-reducing filtrate invasion in permeable formations.

Background

Modern development wells in the Llanos field of Colombia are designed with S-shaped directional geometry to avoid major fault hazards and existing wells. This approach, combined with overburden complexity from intermixed layers of shales and sandstones, often leads to wellbore restrictions and severe washout.

Water-based fluids (WBFs) have been used in the area to reduce environmental impact. This limits the available options for providing optimum clay and shale inhibition. These fluids typically have relatively high rates of filtration, which can hydrate some formations and reduce wellbore stability. Traditional filtration control additives can reduce fluid invasion in permeable formations. They can also increase viscosity, which can slow drilling activity and increase the likelihood of downhole losses in weak zones.

CASE STUDY

Challenge

The wells to be drilled in the Ilanos field have two main intervals: 12¼ inches and 8¾ inches. In lower depths, a polymeric inhibited system has been used to contend with reactive shale formations. Only limited information on the formations was available, which meant that the fluids Design of Service could not precisely address two major aspects of the wellbore. Pore sizes, permeability, and fractures could only be estimated to engineer a proper bridging and sealing design. In addition, the mechanical properties were only known in wide ranges.

The Carbonera formation is roughly 3,000 feet and contains multiple layers of alternating sandstone with clay-rich shale. This combination of low/high permeability and dispersive character often leads to uneven hole enlargement. This is especially the case when directional S-shaped well geometry programs are used. As hole conditions deteriorate, ledges become apparent and tripping times elongate due to torque and drag concerns.

Remedial actions include backreaming to free up the drilling assembly and assist in running casing to target depth. This action helps carve away tight spots and ledges. However, it also increases operational time and expense, and worsens the amount of hole washout. Since the resulting hole volume was uncertain, several past cement jobs failed to achieve the program's targets, requiring remedial top-up to meet regulatory mandates.

Solution

The Baroid team designed and tested a revised polymeric fluid system including the BaraSeal™ W-1040 additive. This copolymer latex additive was specifically engineered to produce an extremely thin filter cake and provide a more effective seal across the wellbore face and microfractures. Several laboratory tests were conducted to evaluate the effects on filtration properties for a range of formation permeabilities.

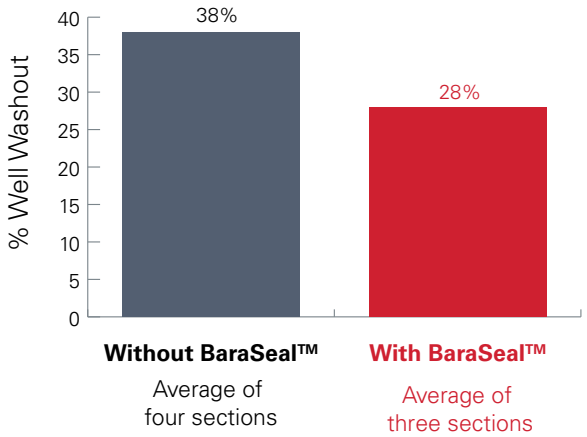
Spurt loss and total particle plugging test filtrates after 30 minutes were drastically reduced, which suggested the new fluid would have less invasion with improved sealing properties. The new fluid system was accepted for trial by the operator, and the team prepared the Design of Service for the well.

Results

Despite past wellbore instability and known restriction issues in offset wells, the trial wells were successfully drilled, tripped and cemented – obtaining all desired benefits. Hole quality was improved, reducing the time to make trips and run casing. The cement volume to fill the annular space was reduced by an estimated 5% based on offset information.

From the success of the new design, the operator was able to standardize an average hole diameter and volume of cement for adequate coverage. This improved their ability to plan and conduct drilling activities with greater consistency and certainty in their cost, and supply estimates for upcoming wells.

WASHOUT COMPARISON



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