SHIELD BOND®

Wellbore Shielding® Technology

Environmentally Friendly Fluid System Cures Losses During Primary Cementing Operations in a Fractured Reservoir

CHALLENGE

An operator drilled a number of wells in Northern Iraq, where the target carbonate reservoirs are naturally fractured and highly permeable. Partial losses during the drilling phase were partially cured using conventional loss circulation material (LCM). These losses ranged from a peak of 150 bph to zero losses at static condition prior to cementing. Due to an increase in the equivalent circulating density (ECD) during primary cementing, it was expected that the cementing operation would induce losses at an increased rate. This would not only jeopardize the successful isolation of the target reservoirs, but also increase well construction costs as remedial cementing would likely be required. The operator sought a technical solution that would mitigate formation damage to shorten the target reservoir testing period and ultimately maximize hydrocarbon production.

SOLUTION

A cement service company provided the operator with an engineered solution that began with pumping a chemical wash to decrease the hydrostatic column. This wash was circulated in turbulent flow in the annular space to weaken the mud filter cake. For a second pre-flush, the cement service company deployed an environmentally friendly weighted fluid composed of SHIELD BOND® Wellbore Shielding® spacer paired with an LCM capable of plugging natural fractures up to 3 mm—both provided by Impact Fluid Solutions. This fluid was designed to create an impermeable barrier on the face of the open hole, activated by differential pressure, which would easily lift off once the well started producing. Best practices for cementing were taken into consideration; the top of cement and fluids placement were designed to ensure at least 80% cement coverage in the casing-to-casing section and at the top of the liner. To test the capabilities of the SHIELD BOND® Wellbore Shielding® spacer, a sand bed test using 100 mesh silica sand was performed at 1,000 psi differential pressure. Conventional spacer fluid and neat cement flowed through the sand matrix in less than 20 seconds, while the SHIELD BOND® Wellbore Shielding® spacer saw a maximum penetration of 4 inches in one hour. The neat cement was tested against the filtrate created by the SHIELD BOND® Wellbore Shielding® spacer, with 0.1-inch penetration after one hour at 1,000 psi differential pressure.

RESULTS

In each cementing operation executed, 50 bbl of chemical wash was pumped, followed by the SHIELD BOND® Wellbore Shielding® spacer/LCM mixture in volumes sufficient to guarantee 10 minutes of contact time with the formation in the annulus. The cementing operations were executed without any service quality or Health, Safety, and Environmental (HSE) incidents. In all cases where losses were present prior to—or expected during—cementing operations, a substantial reduction in dynamic loss rates was observed once the SHIELD BOND® Wellbore Shielding® spacer entered the annular space, allowing the target reservoirs to be isolated successfully. On the liner cementing jobs, SHIELD BOND® Wellbore Shielding® spacer and good cement slurry were reverse circulated to the surface. All liners showed good cement at the top of the liner. On the casing jobs, the reservoir section showed zonal isolation on the sonic and ultrasonic cement bond logs. On the well that presented the highest losses (around 150 bph) prior to the cementing operation, the top of cement was found 50 m below the previous casing shoe—around 300 m below the designed top of cement but sufficient to cover the hydrocarbon-bearing formation. No annular pressure was encountered after the cementing operation.

Impact

SHIELD BOND®

Wellbore Shielding® Technology

FIGURE 1

USIT, CBL and VDL of two cemented sections where the SHIELD BOND® Wellbore Shielding® spacer was used across the reservoir sections.

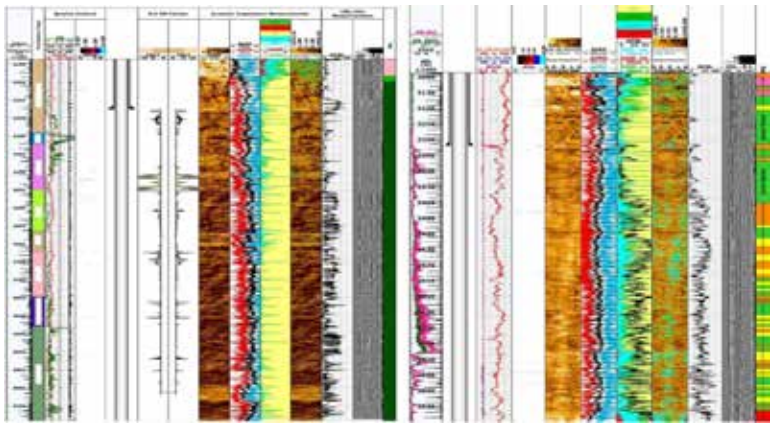
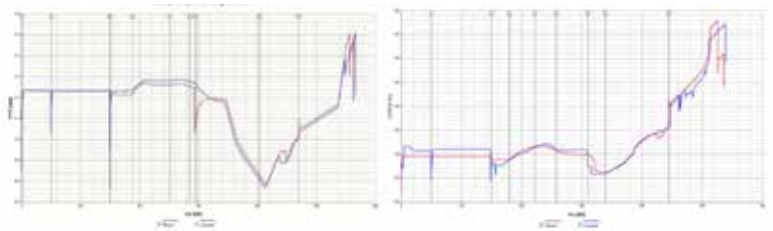


FIGURE 2

ECDs of two cemented sections where the SHIELD BOND® Wellbore Shielding® spacer was used. The red line represents the simulated ECDs and the blue line the actual ECDs during the cementing operations.



LESSONS LEARNED

This solution proved to be effective wherever losses were present prior to—or during—cementing operations across the reservoir section. By successfully reducing losses prior to the cement entering the annulus, the Wellbore Shielding® spacer: :

- Mitigated cement dehydration that can lead to cracks in the cement sheath, diminishing the set cement mechanical properties.
- Enhanced the cement coverage, achieving higher top of cement when compared with conventional spacers.

The cement bond logs showed zonal isolation of the interest zones, allowing the operator to successfully perform well testing operations in the target reservoirs.

POWERED BY IMPACT

SHIELD BOND® NXT