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ACTive Services Improve Oil Production by 26% and Water Injection by 50%

Real-time measurement and selective perforation systems save time without compromising job quality in complex operations, North Sea

CHALLENGE

Increase oil production in a mature field by improving water injection rate and efficiency.

SOLUTION

- Clean sliding sleeves in an injector well with Jet Blaster* engineered high-pressure jetting service on CT.
- Close sliding sleeves while monitoring shifting tool parameters with ACTive Xtreme* CT real-time rugged downhole measurement tool.
- Optimize solids cleanout with systematic returns monitoring.
- Monitor operations with the ACTive Xtreme tool as a safeguard, enabling early detection of tagging, losses, solids loading, and other events.
- Add perforations at the toe using ACTive OptiFIRE* CT real-time selective perforating and activation system.

RESULTS

- Increased water injection rate by 50%.
- Improved oil production in neighboring wells by 26%.
- Expedited perforating by combining runs, saving approximately 100 hours compared with conventional CT perforating.
- Eliminated the need for an expensive sidetrack.

Water injector well is unable to maintain pressure support

Production was declining in a mature field in the Norwegian sector of the North Sea because a water injector well was unable to deliver enough rate at the depth required to effectively sweep oil through the reservoir.

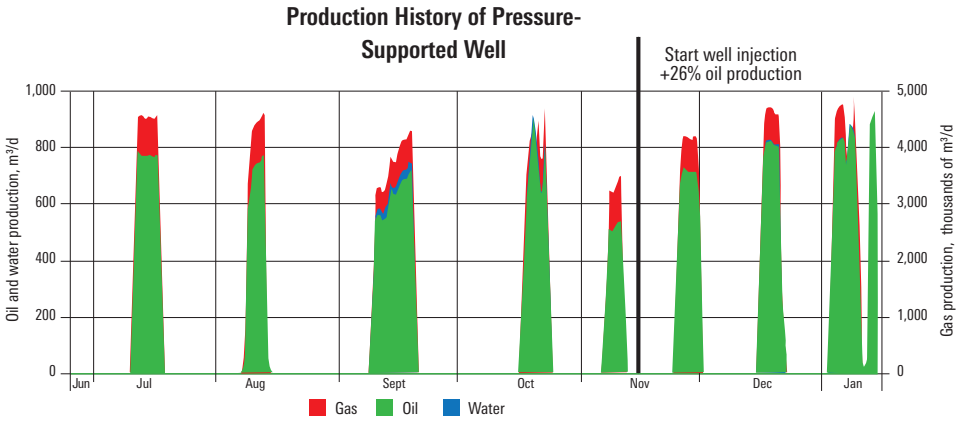
The injector well was believed to have two problems. First, as the field aged, the injection point for efficient pressure support moved deeper into the reservoir, but high-permeability upper zones continued to take the bulk of the injected fluid. Second, sand and debris hampered injectivity in the lower zones. Although injector wells do not usually experience sand influx, the operator believed that rapid injection shutdowns destabilized the sand, and subsequent crossflow allowed sand to enter the injector.

The operator considered sidetracking the injector to restore sweep efficiency with more reservoir contact but asked Schlumberger for a faster, less costly option.

Close old injection sleeves and shoot new perforations

The injector well had been completed with sliding sleeves, so engineers developed a plan to close the upper sleeves, clean out accumulated sand, and add new perforations near the toe.

Because the sleeves had not been shifted in more than 15 years, the first step was to remove debris and scale that might prevent shifting. The Jet Blaster service was run to highly energize the cleaning fluids, and the ACTive Xtreme tool to optimize solids removal at flow rates as high as 420 l/min [2.6 bbl/min].



After the ACTive system operations improved the efficiency of an injector well, oil production in nearby wells increased by 26%.

The upper sleeves were then closed with a bottomhole assembly that included the ACTive Xtreme tool and distributed temperature sensors to confirm sealing.

A cleanout toolstring and milling sub were then run to remove sand and debris bridges. Because the operation was conducted underbalanced (with mission-critical lower sleeves still open), the ACTive Xtreme tool was used to monitor pressures and milling parameters and enable efficient operations at flow rates as high as 700 l/min [4.4 bbl/min].

Finally, the ACTive OptiFIRE system was used to perforate 14 intervals ranging from 3.1 to 12.4 m [10.2 to 40.7 ft] in length. All of the intervals were perforated in just 9 runs using the system's selective firing technology for the combined zones. (Surface height restrictions limited bottomhole assembly length, which precluded further combinations to reduce CT runs and improve efficiency.) Further enhancing the operational efficiency, the system enabled real-time depth correlation and confirmation of detonation.

Injectivity and oil production increase

Combining perforating runs saved more than 100 hours compared with a conventional CT perforating operation, enabling the operator to restore injection and field production more rapidly.

After the operation, the water injection rate rose by 50% and swept deeper into the reservoir, resulting in 26% oil production increases in neighboring wells.

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