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AllSeal Service with Particulate Gel Shuts Off Water Production Without Leaks, Iraq

Coiled tubing delivery ensures precise spotting and limits fluid volumes, saving 45% of the cost compared with a conventional cement squeeze

CHALLENGE

Permanently shut off water production in two wells in a waterflood.

SOLUTION

Design and deliver an AllSeal* water and gas conformance service with a new particulate gel system.

RESULTS

- Shut off water production in both wells with 0% water leakage.
- Save approximately 45% of the cost of a conventional cement squeeze.

Cement squeezes fail to isolate water zones

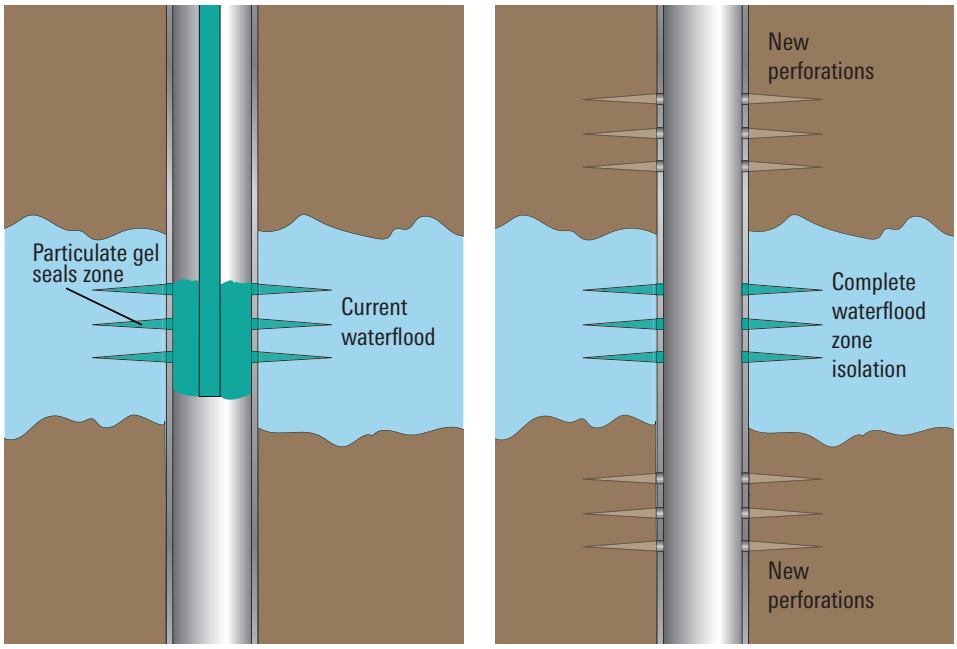
Two wells in Iraq produced oil steadily from a waterflooded reservoir for 5 to 7 years before water breakthrough overloaded the production zone. The conventional remedy for such an overload is a cement squeeze in the watered-out zone and then reperforation in a new oil-bearing zone. Although common, the remedy is less than ideal, and water tends to leak from imperfectly sealed zones.

For these two producer wells, the operator again tried cement squeezes, but perforation and tubing limitations precluded spotting enough cement to achieve any measure of isolation. A new method of water shutoff was required.

Engineered service targets isolation constraints

Schlumberger engineers proposed designing an AllSeal service, which integrates a wide portfolio of water and gas shutoff technologies, from relative permeability modifiers and temporary chemical blocks to permanent cements. Schlumberger engineers select the right solution based on field and operator requirements, reservoir characteristics, economic constraints, logistics, and best practices gathered over decades of work around the world. The result is a fit-for-purpose solution matched to a particular well or situation.

For the Iraq wells, the engineers chose a new particulate gel system comprising just one additive dispersed in water. This option would extend operating time requirements, unlike cement squeezes, which are limited by thickening time. It also simplifies operations and logistics and reduces equipment on location. To deliver the material, the engineers chose coiled tubing to enable precise placement at the leaking perforations and thereby minimize the fluid volume required.



Coiled tubing delivered the particulate gel to the watered-out zone and squeezed until the perforations were sealed. New perforations were then shot above and below the plugged zone to enable further oil production.

Production restored with no water leakage

Each operation began with establishing injectivity using brine at less than 0.3 bbl/min. The particulate gel system was then injected at similar low rates until wellhead pressure increased to the maximum allowable pressure limits—reached upon pumping only 5 and 7 bbl, respectively, for the treated wells. Hesitation squeezes were then performed and confirmed plugging of the targeted zones. Further squeezes were attempted after 1, 2, and 3 h of soaking time. All squeeze attempts verified the plugs.

After treatment, new oil-bearing intervals were perforated, and both wells were activated using nitrogen.

The wells returned to oil production with 0% leakage from the treated zones—the first time the operator achieved 100% zonal isolation for a water shutoff operation. In addition, the operation saved approximately 45% of the cost of the conventional cement squeeze operations.

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