

OpenPath Stimulation Services Increase Production 250% in Long, Hot Well with Slotted Liner

Engineered composite pill penetrates liner slots without plugging to ensure thorough fluid distribution along the lateral, Kazakhstan

CHALLENGE

Economically stimulate production from the full length of a long, hot well interval in a naturally fractured carbonate reservoir without plugging the slotted liner.

SOLUTION

Design and deliver an engineered operation comprising OpenPath Reach* extended-contact stimulation service and OpenPath Sequence* diversion stimulation service.

RESULTS

Increase production 250% from 20 to 70 m³/d [126 to 440 bbl/d]—higher than the well's initial production.



Stimulate production in a long, slotted liner completion

An operator in Kazakhstan completed a well with a long (335-m [1,100-ft]) interval through a hot (132 degC [270 degF]), naturally fractured carbonate formation. The operator completed the well with a slotted liner because the permeability contrast posed a high risk of cementing failure, and an openhole completion was inadvisable because of the risk of formation softening over time.

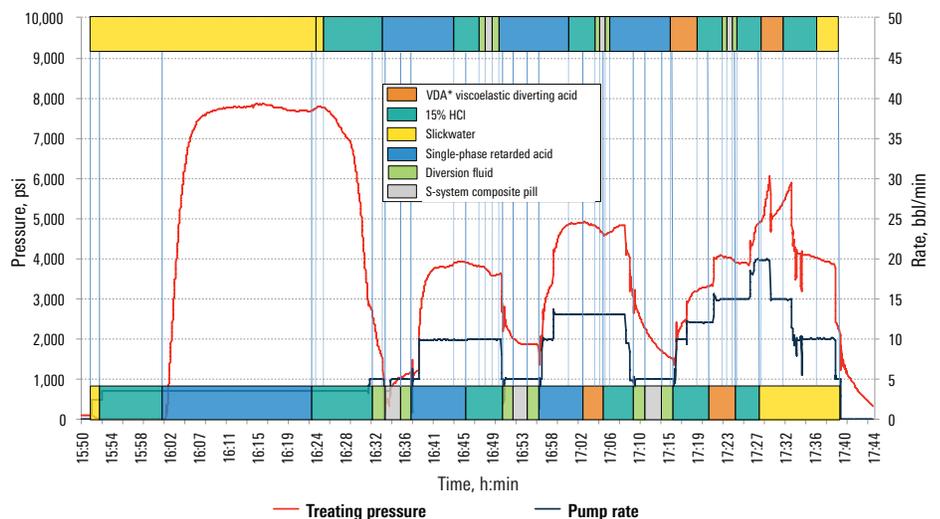
The well initially produced at about 40 m³/d [252 bbl/d] with an ESP, but after about 18 months, production declined to 20 m³/d [126 bbl/d], most likely attributable to skin increase from scale deposition, fines migration, and formation sloughing. Based on the trend, the well was about to reach its economic limit.

To improve the economics, the operator wanted to revive production with a stimulation operation. The long lateral would need diversion to ensure thorough stimulation fluid distribution, but the slotted liner eliminated the use of mechanical technology or conventional diversion particles and viscous acid systems that would likely plug the slots. In addition, the downhole temperature would limit the penetration of conventional acid stimulation fluids. For a new option, the operator turned to Schlumberger.

Optimize acid penetration and diversion technology

The Schlumberger engineers designed a stimulation treatment combining OpenPath Reach service with single-phase retarded acid system and OpenPath Sequence service with an S-system engineered composite pill.

OpenPath Reach service maximizes matrix or fracture stimulation penetration with engineered acid system selection to ensure compatibility with reservoir conditions and chemistry. The main acid system chosen for this well was the single-phase retarded acid system, which penetrates deeply into the reservoir before beginning to spend, even in high-temperature limestone reservoirs.



By combining OpenPath Reach and OpenPath Sequence services in a single operation, the engineers delivered a deep-penetrating acid system and diversion technology to ensure thorough wellbore stimulation.

To limit the problem of permeability contrast, engineers added stages of VDA acid. This acid has low viscosity when pumped—so it will flow through a slotted liner or screen—but gains viscosity as it spends, making it an effective and economical diverter within fractures or wormholes.

To maximize distribution of the acid systems across the long lateral, engineers turned to the OpenPath Sequence service, which uses engineered composite pill systems to temporarily block high-permeability areas and divert fluid into areas of lower permeability. The S-system composite pill chosen for this well comprises unimodal particles in a carrier fluid that degrades in the presence of hydrocarbon. The particles are designed to pass through slotted liners, gravel packs, and other complex completions to accumulate in a perforation or along an open formation face to address medium permeability contrasts.

Restore economic production after three-stage treatment

During the stimulation operation, the composite pills split the treatment into three matrix acidizing stages to ensure maximum reservoir contact.

After stimulation, the operator started to produce the well at 70 m³/d [440 bbl/d], an increase that was 2.5 times the well's prestimulation production.

slb.com/openpath