CASE STUDY

VDA Acid and Jet Blaster Service Increase Gas Production by 243% in Carbonate Well, Pakistan

Integrating two services improves production and cleanup time in challenging mature well after third-party services failed to stimulate significant increases

CHALLENGE
Improve gas production from a hot, mature carbonate well.

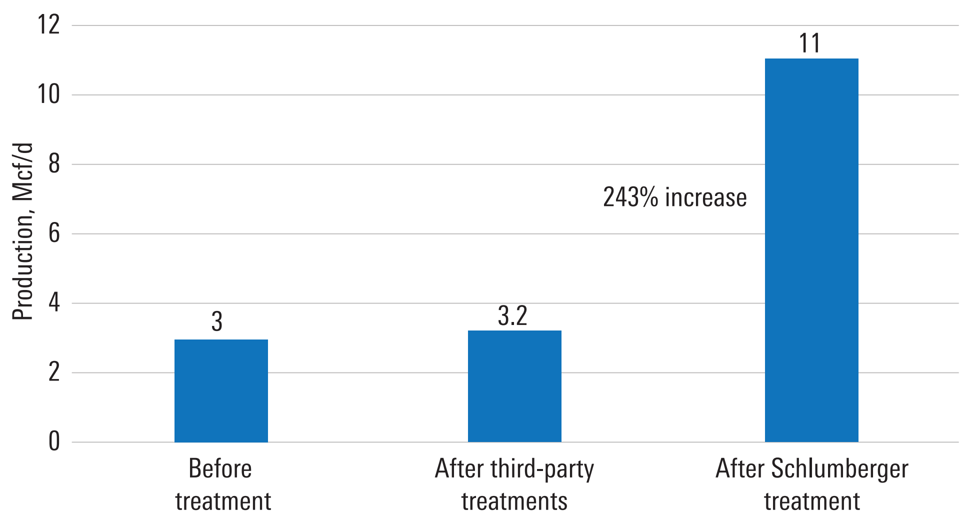
SOLUTION
- Wash the perforations using Jet Blaster* engineered high-pressure jetting service on CT.
- Stimulate the reservoir with VDA* viscoelastic diverting acid.

RESULTS
- Increased the well's gas production from 3.2 to 11 Mcf/d [90 to 311 m^3/d].
- Cleaned up 20% faster compared with the average cleanup of nearby wells.

Third-party services fail to improve gas production
An operator in Pakistan was producing approximately 3 Mcf/d of gas from a deep, hot well through a naturally fractured carbonate reservoir. The mature well was already producing water, which led to calcite scale deposition, as is common in the area.

A third-party service company tried to stimulate the well twice: first with with 15% hydrochloric acid (HCl) through a rotating nozzle deployed on CT and then with a polymer-based diverting acid system through a simple CT nozzle. However, gas production did not increase significantly after these operations.

Integrated services open perforations and reservoir
Schlumberger recommended a two-part operation beginning with the Jet Blaster service to open the perforations and following with bullheaded, high-rate sequences of 15% HCl and polymer-free VDA acid for thorough matrix stimulation without polymer formation damage.



Cleaning the perforations and stimulating with polymer-free VDA acid improved the well's production response by 243%—a significant increase compared with the small increment from previous third-party treatments.

The Jet Blaster service uses precise CT deployment to deliver stimulation and cleanout fluids through large engineered high-pressure, long-throw nozzles that produce a stable, coherent fluid stream over a large, efficient jetting radius. For the Pakistan well, engineers designed an operation to deliver 15% HCl to dissolve scale that was plugging the perforations.

For the main matrix treatment, polymer-free VDA acid was chosen as a diverting agent to minimize the risk of formation damage (compared with polymer-based diverters). The acid system has low viscosity and good friction properties when pumped, so it flows into the area of highest permeability. As the acid reacts with formation carbonates, it stimulates the formation and rapidly builds viscosity to seal the treated section and limit leakoff, which reduces overall fluid requirements to maximize efficiency. Subsequent fluid is then diverted to an area of lower permeability, where it reacts to stimulate the formation, build viscosity, and divert fluid to the area of next highest permeability. As the pH of the spent acid rises, the fluid breaks, and the surfactants help expedite cleanup and flowback. It is also an appropriate choice for the well's expected bottomhole temperature (285 degF [140 degC]).

To maximize cleanup efficiency and prepare the well for gas production, the engineered job design also included a postflush with flowback surfactant in NH_4Cl brine and displacement with nitrogen.

Cleanup rate and gas production improve

The treatments were pumped as designed, with four HCl stages and three VDA acid stages pumped at 5 bbl/min [0.79 m^3/min] to maximize formation penetration and wormhole length.

After the treatment, the well cleaned up 20% faster compared with the average cleanup time of nearby wells. In addition, gas production increased 243% from 3.2 to 11 Mcf/d. As a result, the operator has increased use of the VDA acid for stimulating carbonate wells.

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