Matrix Treatment for Efficient Stimulation in Qatar’s North Field

Case study: Effective diversion achieves uniform stimulation in carbonate reservoir with large permeability contrasts between zones

**Challenge**

Effectively and uniformly stimulate zones in a thick carbonate reservoir characterized by large permeability contrasts.

**Solution**

Use MaxCO$_3$ Acid* degradable diversion acid system to achieve superior diversion and uniform stimulation of zones.

**Results**

Achieved uniform stimulation of zones while reducing rig and operational times by 30% and reducing treatment volumes by 50%, which shortened cleanup time and reduced flaring.

**Stimulating Qatar’s North field**

The Khuff carbonate formation is the main reservoir in Qatar’s North field, which is the largest gas field in the world. Wells drilled in this thick heterogenic reservoir are susceptible to large variations in transmissibility. In addition, permeability contrasts between zones are common—up to a factor of 100—and the hydrostatic column of stimulation fluids tends to stimulate the bottom zones at the expense of the upper reservoir layers in the long gas wells that are typical of the North field. Effectively and uniformly stimulating all zones in one treatment without using conventional mechanical diversion techniques (e.g., packers, sliding sleeves, ball sealers, etc.) is extremely challenging. In addition, the operational risks are higher because multiple interventions are required.

MaxCO$_3$ Acid treatment was pumped at 5 bbl/min, minimizing the pump horsepower requirement.
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**Engineering a fit-for-purpose solution**
Based on extensive stimulation work in the North field, the Schlumberger WellBook® software application for treatment design, execution, and evaluation has a calibrated carbonates stimulation model for regular and viscoelastic acid fluid systems. Additional work was done to include a model for the MaxCO₃ Acid degradable diversion system in the existing simulator to

- provide a tool for the prejob planning and postjob evaluation
- better understand the reservoir response
- optimize subsequent treatments.

During the initial campaign, 11 treatments were performed in the North field. Post-stimulation production logs on three of the wells confirmed the diversion efficiency. Treatment intervals ranged from 195 to 580 ft of perforated casing. The treatment was distributed over four distinct zones with varying permeabilities using alternating stages of 28% HCl and the MaxCO₃ Acid system.

**Achieving efficient and uniform stimulation results**
The actual data, post-treatment pressure, and production log were matched using the WellBook software, which indicated that stimulation of the lower-permeability zones was only possible using the MaxCO₃ Acid system. Post-treatment production logs reflected the same results and showed a more uniform distribution using the MaxCO₃ Acid system.

The MaxCO₃ Acid system significantly improved the efficiency of the operation. Treatment volumes were reduced by up to 50%, resulting in shorter well cleanup times and less flaring. Because multiple interventions were not needed to perforate and stimulate the zones individually, rig time and operational time were reduced by 30%.

**About the Contact family**
The MaxCO₃ Acid system is part of the dynamic category of the Contact® four-category portfolio of staged fracturing and completion services. These technologies maximize reservoir contact by offering the most efficient and effective services for each well. The Contact dynamic category offers fluid-base and tool-free fracturing of multiple stages in one continuous operation. Contact services can be enhanced with real-time measurement options.

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