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PEMEX Uses MaxCO$_3$ Acid to Increase Sustained Oil Production 700%

Degradable diversion acid provides uniform zonal coverage in naturally fractured southern Mexico well

CHALLENGE

Remove reservoir damage and overcome contrasting permeability and reservoir pressure to achieve a commercial level of production.

SOLUTION

Use MaxCO$_3$ Acid* degradable diversion acid to temporarily divert stimulation fluids to understimulated zones—ensuring effective fluid placement without reservoir damage.

RESULTS

Delivered a sustained production of 254 m^3/d, up from 32 m^3/d, with contribution across the entire interval.

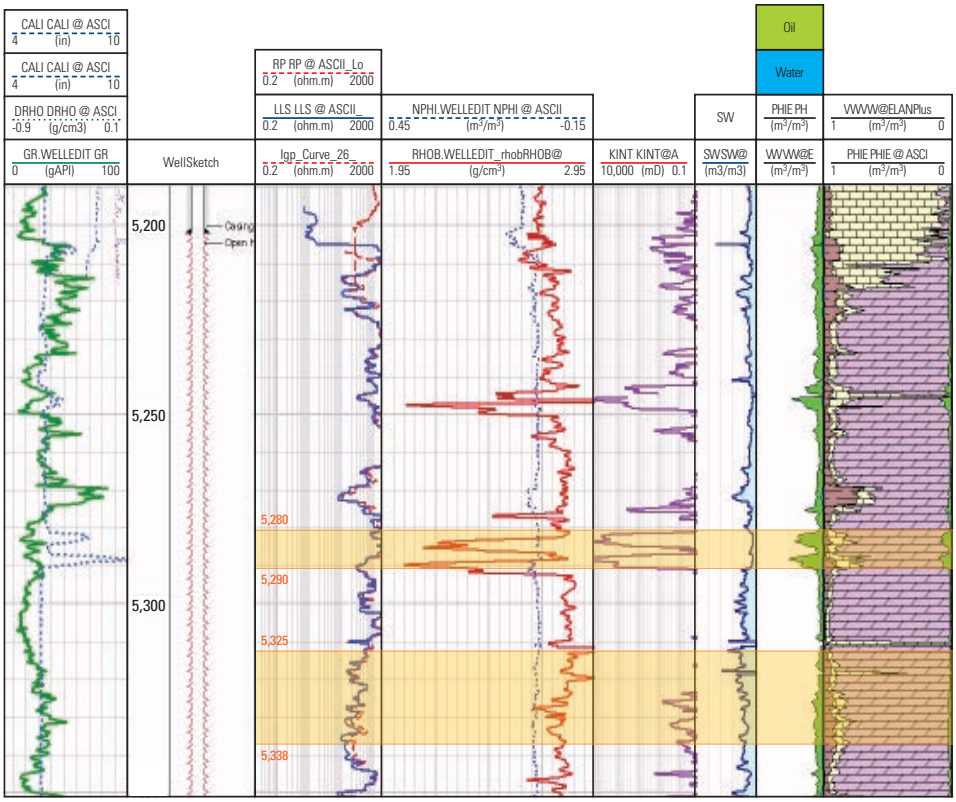
After five conventional acid stimulation treatments and a workover failed to increase production, PEMEX applied the MaxCO$_3$ Acid degradable diversion system. After treatment, oil production stabilized at 254 m^3/d—700% higher than the previous production rate of 32 m^3/d.

Naturally fractured carbonates created stimulation challenges

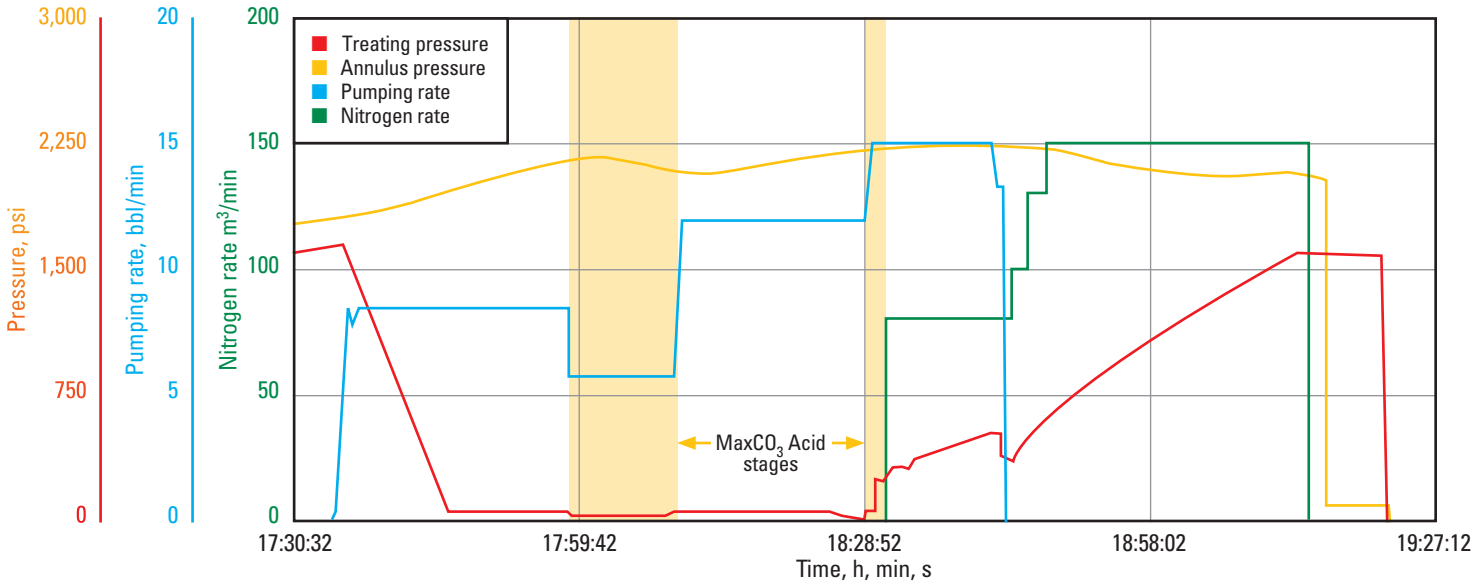
Most oil produced by PEMEX in the southern region of Mexico comes from deep, hot wells located in mature carbonate reservoirs. Due to complex natural fractures in the carbonates, reservoir pressure and permeability can vary drastically between intervals. This makes achieving uniform stimulation—and stable production levels—particularly challenging. Ineffective treatments that only stimulate high-permeability zones amplify the permeability contrast, making any subsequent treatments even more difficult.

PEMEX needed to extend economic viability of declining well

In one openhole well, oil production had dropped from 203 m^3/d to less than 32 m^3/d despite five conventional acid treatments over a three-year period. PEMEX performed a workover running a 5-in casing with swelling and inflatable packers, but production continued to decline. The well, which was completed in two distinct intervals, exhibited a permeability contrast of more than 300:1—indicating a conductive fracture in the upper interval. A production log showed that only half the upper interval and less than half of the lower interval were contributing to hydrocarbon production. PEMEX needed a stimulation technique that would optimize fluid placement and bring the well back into economic production.



Well logs identifying the two target zones. The upper zone has a permeability of over 1D, indicating natural fractures. The lower zone has an average matrix permeability of approximately 3 mD. Such large contrasts make effective uniform stimulation challenging.



Treatment plot of $MaxCO_3$ Acid system showing diverter stages (shaded orange). The treatment pressure was difficult to maintain at the start of the treatment, but increased significantly following the second $MaxCO_3$ Acid stage.

Schlumberger recommended $MaxCO_3$ Acid system to tap understimulated pay zones

Schlumberger proposed $MaxCO_3$ Acid degradable diversion system, a viscoelastic surfactant in HCl blended with degradable fibers, to stimulate the well. The acid develops viscosity by reacting with the carbonate formation, while the fibers bridge across perforation tunnels and fractures to form a filter cake. This two-part diversion method temporarily limits injectivity to thief zones, forcing acid into zones with lower natural permeability. The interlocking fiber network completely degrades with time, producing a weak acid that continues to stimulate the well. The spent acid breaks when it comes into contact with hydrocarbons or solvents during flowback. This ensures that diverted areas are left undamaged and fully contribute to poststimulated production.

Operator realized 1,400% higher initial production and 700% higher sustained production

PEMEX bullheaded the matrix acidizing treatment through 4½-in and 3½-in production tubing at pumping rates between 8 and 15 bbl/min. The team pumped a total of 15,800 galUS of organic acid in three stages separated by two stages of self-diverting acid totalling 2,600 galUS. The last stage of the job was energized with nitrogen to enhance well cleanup.

Production immediately after treatment reached 477 m^3/d. The well also showed rapid cleanup—producing 60% of spent fluids in three days. After three months, production stabilized at 254 m^3/d. A poststimulation production log indicated a homogeneous production profile contribution from both intervals, confirming that the $MaxCO_3$ Acid system provided complete zonal coverage.

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