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Application of Propellant High-Energy Gas Fracturing in Gas-Injector Wells at El Furrial Field in Northern Monagas State, Venezuela

To optimize oil production and ultimate oil recovery in the Furrial Field in eastern Venezuela, a gas injection project was implemented. Several wells were drilled and completed as cased-hole completions using through tubing and casing gun technology. The results obtained with conventional perforating techniques yielded less-than-optimum injectivity indices, non-uniform injection profiles and increased compression requirements on the gas injectors.

The most important factor in the evaluation of available perforating and stimulation technique was the ability to improve the productivity or injectivity. The primary damage mechanism in these completions was identified as asphaltine deposition; thus, the challenge was to identify the damaged zones and to selectively treat the zones safely and economically. A secondary damage mechanism was the effect caused by use of inverted mud in the completion. After review of the available perforation and stimulation methods, a propellant high-energy gas-fracturing technique was selected for field trials.

The methodology used to validate the application of the propellant high-energy gas fracturing technique on gas injection wells and the use of surfactant during propellant activation will be discussed. A computer simulator was used to design the propellant treatments and analyze the results of generated pressures on the mechanical well configuration and wireline design. The primary benefit of propellant treatments in the form of mild fracturing near wellbore to bypass damage will be demonstrated.

This technique is particularly beneficial to low permeability formations, wells with low producing bottomhole pressures, deviated and horizontal wells and water-sensitive sands.

The propellant high-energy fracturing technique offers a simple and cost effective, timesaving alternative to more commonly known stimulation techniques. It provides selective treatment of HP/HT and other formations with adverse characteristics, increases productivity indices, and when properly applied, successfully breaks down all types of perforations regardless of permeability and orientation.