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Optimisation of Onsite Acid Pumping Rates Based on Laboratory Flow Rates

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SUMMARY

Well stimulation treatments using acid have been performed for over 100 years. Over time the industry has become well aware that acidizing can not only connect to the natural fracture system but also increase water production.

In order to achieve the best stimulation result with the lowest skin possible using the least amount of acid without fracturing the formation an optimized pumping rate is required. Pumping at optimized rates will lead to an increased efficiency of matrix acid stimulation jobs.

An approach is outlined to optimize on site pumping rates as well as acid coverages (gal/ft) using laboratory flowrates. Constant pumping rates as well as pumping at an increasing rate schedule have been investigated. As a first step the maximum pumping rate based on the breakdown pressure of the formation should be determined. Graphs of pumping rate vs. total skin for different acid coverages can then be calculated to determine the optimum pumping rate for a certain stimulation scenario.

The results of this modeling study show that at a certain point an increased pumping rate does not further decrease the skin value, however pumping below the optimum rate can significantly impact stimulation results negatively.

For horizontal permeability ratios between k_{hmax} and k_{hmin} of up to 55, porosity fractions between 0.05 and 0.3 and formation thicknesses up to 300 ft, pumping rates between 2 bpm to 8 bpm can be sufficient to create optimum wormholing. For very high permeability contrasts such as the investigated permeability ratios between k_{hmax} and k_{hmin} of 500 most of the acid is lost into high permeability zones and the well does not get effectively stimulated. Operationally, an increasing rate schedule is recommended over a constant rate schedule because an increasing rate schedule can deliver a deeper wormhole penetration.