

Overcoming Challenges with Fracture Initiation in Jafurah Wells

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ABSTRACT

Aramco has taken a holistic and integrated approach to appraising the unconventional resource plays in the Jafurah field. Assessing the geomechanical parameters, especially the fracability, and developing methods for trouble-free placement of hydraulic fracture treatments, are key elements of de-risking the play. The unconventional rock productivity is being appraised through the use of multistage hydraulic fracture treatments. Occasionally, frac jobs could not be executed per design and resulted in early termination. This paper presents a discussion on root causes and risk management related to the cases when fracture placement had been compromised upon initiation, when only a minimum amount of fluid and proppant could be placed before treatment was aborted because of high pressure. Any subsequent attempts to re-initiate fracture treatment would typically be challenging or unsuccessful. In most cases, the frac stages would be skipped, leaving rock unstimulated and so not contributing to production. When assessing the rock fracability, the technical community tends to focus on the key mechanical rock properties and their variation along the lateral. These parameters are Young's modulus, Poisson's ratio, minimum horizontal stress, horizontal stress anisotropy, and brittleness. A number of workflows has been developed in the industry, which use these parameters as an input for so called "engineered" perforation clusters depth selection. From an operational standpoint, different measures were employed to address risks related to fracture initiation. Recommended practices include hydrochloric acid as a spearhead, increased pad volumes, proppant slugs, increased polymer loading of frac fluids, conservative proppant schedule, etc. Despite implementation of all these measures, the treatments can pressure out after little, if any, proppant was placed. The paper present the "Rock Conditioning" method, as a reliable way for mitigating the difficulties with fracture initiation. The elements of the method will be discussed in detail, including their purpose, sequence of implementation, and desired outcomes; as well as their limitations and uncertainties. The case histories from Jafurah operations will be presented to substantiate the claim for effectiveness of the Rock Conditioning technique.