Coupling Geoscience and Reservoir Engineering Perspectives in Optimization of Completions and Well Spacing: A Case Study From a Jurassic Unconventional Play in Saudi Arabia

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ABSTRACT

Ultra-low permeability reservoirs require hydraulic fracturing to provide fracture surface area and pathways for increasing production from horizontal wells. Part of unconventional field development is devoted to planning future wells, determining well counts, creating production profiles and booking probable reserves. These allow economic evaluation and logistics planning. Determining well counts to guarantee future production requires an understanding of optimal completion design, including well spacing, which can be challenging. The focus of this study is on the organic rich Jurassic Tuwaiq Mountain Formation in the Jafurah basin of Saudi Arabia. The formation is being considered a potential world-class unconventional play owing to its excellent shale gas characteristics such as high total organic content (TOC), low clay content and proper maturity window for hydrocarbon generation. This study demonstrates how integration of outputs from geoscience workflows with multidiscipline data such as microseismic, production logs and hydraulic fracturing modeling, can be essential for characterizing an unconventional reservoir and provide insights on drainage strategies. Completion optimization and field development scenarios for two distinct industry reservoir models requiring moderate to ultra-low matrix permeability, respectively, have been illustrated. Based on this study, it was realized that assuming wrong fracture geometries, matrix permeability and reservoir drainage models has consequences on optimal and economic development of an unconventional field. To supplement planning of initial pilots for understanding completion design and well spacing, investigation of fracture and production interference using reservoir simulation was undertaken. Results from this effort provided an understanding on how long it would take to obtain results from well spacing pilots and possible uncertainty in interpretation. This assisted in the setup of pilot wells and associated data acquisition strategy.