Improved Decision Making for Field Development through Integrated Geomechanics Risk Assessment: Multiple-Stacked Clastic Reservoir, Central Oman

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Abstract

The structural and stratigraphic trap of Permian play in central Oman is characterized by multiple stacked clastic, light tight oil Gharif reservoirs which present a range of opportunities and challenges for hydrocarbon development.While upper reservoir unit is optimal to be redeveloped with waterflood injection, hydraulic fracturing wells was key for improving the productivity and connectivity enhancing recovery per well in deeper and tighter reservoir unit. Here is an attempt to demonstrate how geomechanics plays a role to assist evaluating inter-related technical risks associated with different development approaches. As a preliminary effort of the corporate mandatory process, Geomechanical risk screening and assessment is carried out, based on available data and analogue learnings, that recognize three key geomechanical risks sand production, compaction and subsidence, and cap rock integrity which may threaten a largescale field development. further, matrix water injection in shallower reservoir and hydraulic fracturing deeper tighter reservoirs were main business opportunities where a detailed geomechanical analysis and linking with the well and reservoir performance helped understand the uncertainties and risk for future development. An integrated approach was taken to better assess the risks and their impact on the development opportunity which was well recognized and is now being executed for upcoming 60+ wells. For compaction and subsidence, a fit-for-purpose 1D geomechanical layer-cake model was used to understand the impact of the uncertainties in reservoir volume, matrix compressibility and reservoir pressure ranges. Probabilistic evaluation for multiple scenarios Confirmed the risks to be low which allowed to accelerate the drilling across field areas. One of the biggest challenges was huge opex spend for ESP replacement, sand production was one of the key culprits and a detailed iterative risk evaluation was performed on the sanding potential of t overall well stock and relevant subsurface parameters which confirmed a correlations of matrix strength and volume of shales. Above analysis was used to define safe drawdown limits to reduce ESP changeout frequency. To identify critical enablers for fracture placement and production, intensive of data over the operation history was collected and investigated. We found that such correlations might be used to optimize the frac strategy for future wells. A detailed analogue review, benchmarking with SRT and fall off test were used define the waterflood strategy. Matrix water injection based on the tradeoff analysis and sensitivities on fracture growth was done for various reservoir uncertainty A full integrated geomechanical analysis with other discipline was critical and is recommended as an important step which allows for faster, safely and informed decision making in a complex stacked reservoir development.