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Application of Tubing Stem Test as Alternative Low-Cost Solution for Dynamic Reservoir Evaluation: Case Study from Appraisal Well in Offshore Malaysia

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Abstract

This paper demonstrate a unique combination of techniques and equipment that enabled dynamic reservoir revaluation process using simplified Drill Stem Test (DST) string and completion accessories. The well testing was conducted on a shallow slanted offshore well, drilled into faulted reservoirs with multilayer and complex fluids environment. Key technical challenges to perform well testing includes designing a custom DST string to cater for the multilayer reservoir and articulating a surface well testing equipment that capable of efficient separation to ensure safe and environmental friendly disposal while having accurate flowrate measurements, to deliver good interpretable data given that the uncertainty and complexity of the formation and the well itself.

During drilling campaign, contingency plan to mitigate against losses was implemented which had a significant impact on the well testing program. As such, uncertainty-based well test design and interpretation methodology was used to address this and to achieve well objectives. This involved numerical model analysis considering reservoir uncertainties and their interaction with each other, to identify which parameters can be interpret confidently and to indicate the test duration for the well testing program. Since the area is nearby to producing fields, several cases model based on reservoir pressure regime was also constructed during the design stage to tolerate flexibilities for the decision tree.

The well testing was successfully conducted result from integrated approach to well test design and real time data support throughout the operation along with innovative DST string design, customize completion accessories for multiple zones testing and adaptive intervention tools for highly deviated well. Matching with nearby wells were also conducted during monitoring to predict future pressure behaviour which allow for the duration of final build-up to be optimized. Given that Health, Safety and Environment(HSE) is the top of priority, an important aspect of the surface well testing package was the water treatment equipment to treat the produced water from reservoir before being discharge in order to guarantee safe environmental disposal.

The well was successfully test at maximum flowrate 2,000bpd of oil and 20MMscf/d of gas with traces of produced water. Data gathered thru the Tubing Stem Test (TST) can used to interpret reservoir parameters and all the well testing objectives were successfully achieved despite the many challenges encountered during the drilling campaign and design stage. The end results may contradict traditional testing methods for pressure transient analysis, but hopefully this paper might create the opportunity to replicate TST as quick and effective reservoir evaluation in other parts of the world.