Prediction Models for Long Horizontal Wells. Workflow for Assessing Effective Length and MRC Well Performance

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Abstract

Maximum Reservoir Contact (MRC) drains have been introduced and implemented as an attractive solution in reservoir developments to accelerate production/injection rate while optimizing development costs. Prior to implementing MRC drilling,the effective well length (Leff), will be assessed, where a certain limit for horizontal section indicates an increase in frictional losses and increment (Q, PI) is no longer favorable.

The main objective of this paper is to provide a workflow for Leff estimation and MRC evaluation. In addition, it aims to highlight the factors affecting Leff based on a study of a giant field and the planned execution plans to mitigate poor Leff.A new approach is proposed to predict the Leff based on the proportionality of flux rates and productivity index. The approach uses steady state well modelling packages built using the static well data such as trajectories, reservoir/fluid properties, vertical and lower completion. Output results are oil influx rates along the trajectory, PI profiles, and contrast of profile. For the sensitivities, an automated well model base calculation was implemented to facilitate performing different realizations of wellbore design, permeability ranges, and tubing sizes. Next, the evaluation of horizontal wells was assessed utilizing surveillance tools with integration of the several factors affecting Leff. The workflow can be considered as a preliminary assessment for horizontal length target as guidance to optimize dynamic simulation runs.

The findings proved the tool's efficiency to predict Leff with the capability to reduce simulation runs/efforts for multiple scenarios. The Leff was inferred to be in range of 7 to 10 k ft for the studied reservoirs. Tubing diameter size was found to have a major influence on the flux rate, while wellbore diameter had a negligible impact. A blind test will be performed to evaluate the conformance of the PI vs length with actual data. The results of the blind test will be illustrated in this paper. The workflow assessment on field studies with average conventional wells and MRC wells length of 1800 ft-9200 ft inferred significant factors affecting actual well effective length to be: Well placement (Porous/ dense), Heel-toe effects, Damage while drilling , Production/Injection rate, Barefoot vs. completion, Acid Stimulation after drilling, Well Accessibility due to hole condition and limited production rate (Spinner threshold).

The tool will help in the preliminary assessment to decide the optimum well length for the MRC, considering the reservoir settings and multiple completion options. In addition, the application can be extended to integrate with dynamic simulation as a robust tool to account for reservoir complexity, well-to-well interference and operating conditions. Furthermore, the field case set a generic workflow for confirming factors that may impact the Leff and Evaluate MRC performance.