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Inclusion of Advanced Completions and Surveillance Data in History Matching and Utility of the Resulting Dynamic Models

Pruthviraj Kasaraneni[1] and Nouf Al-Mutairi[1]

[1]Kuwait Oil Company, Kuwait City, Kuwait.

ABSTRACT

Abstract: Traditionally most Reservoir Engineers give emphasis in matching Water-Cut, GOR, SBHP/FBHP and Cumulative Oil/Water & Gas production. Matching the above said will yield good results at the well level, however what is happening within the layers where the well is completed still remains unclear. In addition to the conventional production data matching various well surveillance data like Pressure from the RFT data will enhance tracking of the Vertical/Aerial distribution of reservoir fluids. Matching PLT data will result in improving the relative contribution of different layers in the dynamic model. Capturing time-lapse changes of Water/Gas saturation as observed from the TDT/PNC logs in the model will mimic fluid flow and saturation changes in the dynamic model closer to reality. Identifying the amount of water unwantedly being injected in to the reservoir due to casing integrity and simulating its effect during history matching will help in capturing its impact on increasing water saturation and pressure near the well bore. At the same time due to the complexity and the resultant convergence which arise in modeling advanced completions, typically a positive to skin at the well level is considered to achieve the additional pressure drop which is observed in the constriction (Nozzle) of the ICD. However the effect of flow equalization as a result of implementing ICD is missed in the above approach. We propose a simplified approach by amalgamating the ICD's into an equivalent acting one. Using Amalgamation it is possible to compute the equivalent length and cross sectional area of an ICD that represents multiple ones. This reduces the number of ICDs in the model, avoids looped flow paths and correctly models annular flow along with great reduction in computational time and convergence. After thoroughly matching the dynamic model with observed data, well-surveillance data and capturing the flow equalization impact of advanced completions during the long history of 57 years the level of confidence in the history match has increased significantly. The history matched dynamic model is then used to generate Stream Lines to establish well pair interactions and identify the movement of injected water to optimize injection/production targets. Precisely capturing movement of OWC and tracking the size of Gas-Cap with time has significantly improved the confidence in planning wells.