Reservoir Communication Assessment and Transmissibility Barriers Investigation Using Integrated Dynamic Data and Transient Interference Test

Mohammed Alghazal[1], Abdulaziz Abahusain[1], Rana Amin[1], Aqeel Bahrani[1], and Essam M. Al-Alyan[1]

[1]Saudi Aramco, Dhahran, Saudi Arabia.

ABSTRACT

There are several analysis tools and methods that could be used to assess the level of reservoir heterogeneity and connectivity. Analyzing dynamic production flow and pressure data, within different segments of the reservoir, provide a pragmatic tool to characterize reservoir communication and compartmentalization. This paper provides an integrated approach to assess the degree of reservoir communication, using multiple sources of dynamic reservoir information and transient interference test. From combined formation evaluation logs and dynamic data, areal and vertical reservoir connectivity are investigated. In addition, pressure distribution maps were analyzed to assess the relative pressure gradient between flank and up-structure areas. Moreover, flow capacities (Kh) and productivity and injectivity indices (PI/II) were mapped across the reservoir, and integrated with other dynamic pressure and fracture characterization maps. Integrating all results, a complex heterogeneous area with possible existence of low transmissible flow barrier was selected to conduct a long-term interference test. More than 10 wells, between active producers and observation sources with alternating shut-in and flowing cycles, were used to investigate the late time response. From combined dynamic data, it is observed that the reservoir layers exhibit a vertical pressure equilibrium. Additionally, areal pressure propagation across the field displays a relatively uniform flank-to-updip pressure-to-distance gradient. It is realized that areas with higher gradients are associated with more heterogeneous reservoir characteristics, as confirmed from pressure transient results. Pressure transient data, including flow capacities and productivity indices, indicated a preferential trend of improving rock quality and well productivity toward the middle of the field. Moreover, results from transient interference test were used to infer the degree of areal reservoir communication, and investigate the existence of transmissibility barriers across the area of interest. The results from this study demonstrates that dynamic reservoir data integration and interference test can be used as a valuable tool, to characterize areal reservoir heterogeneity, and evaluate the degree of reservoir communication and compartmentalization.