Analysis of Spatial Distribution Pattern of Reservoir Petrophysical Properties for Horizontal Well Performance Evaluation-A Field Case Study

Reservoir development planning and well placement significantly affect hydrocarbon recovery. Therefore, strategic well placement and development techniques are essential to minimize the risk of unproductive drilling and also to maximize production within the reservoir. Furthermore, a good understanding of the performance of fully penetrated wells in a reservoir are essential for the maximization of the economic profitability of field development projects. In other to analyze reservoir performance, both static and dynamic models are required. For the purpose of maximizing oil recovery, reservoir behavior must be modelled properly to predict its performance. This requires the study of the variation of the reservoir petrophysical properties as a function of spatial location. In recent times, the method used to analyze reservoir behavior is the use of reservoir simulation. Hence, this study seeks to analyze the spatial distribution pattern of reservoir petrophysical properties such as porosity, permeability, thickness, saturation and ascertain its effect on cumulative oil production. Geostatistical techniques were used to distribute the petrophysical properties in building a 2D static model of the reservoir and construction of dynamic model to analyze reservoir performance. Vertical to horizontal permeability anisotropy ratio affects horizontal wells drilled in the 2D static reservoir. The performance of the horizontal wells appeared to be increasing steadily as kv/kh increases. At kv/kh value of 0.55, a higher cumulative oil production was observed compared to a kv/kh ratio of 0.4, 0.2, and 0.1. In addition, horizontal well length significantly affects cumulative oil production of the petroleum reservoir studied.

At kv/kh of 0.55, the results of the analysis showed a rapid decrement in cumulative oil production as the horizontal well length decreases. Considering horizontal well length of 3000 ft, 2000 ft, and 1500 ft, a minimum cumulative oil production was obtained from a horizontal well length of 1500 ft. The geostatistical and reservoir simulation methods employed in this study will serve as an insight in analyzing horizontal well performance.

Keywords: Kriging, Simulation, Variogram, Geostatistics, Permeability, Thickness, Porosity, Reservoir development

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