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Evaluation of Double Displacement Process via Gas Dumpflood from Multiple Gas Reservoirs

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Abstract : Double displacement process is a method in which gas is injected at an updip well to displace the oil bypassed by waterflooding operation from downdip water injector. As gas injection is costly and a large amount of gas is needed, gas dump-flood from multiple gas reservoirs is an attractive alternative. The objective of this paper is to demonstrate the benefits of the novel approach of double displacement process via gas dump-flood from multiple gas reservoirs. A reservoir simulation model consisting of a dipping oil reservoir and several underlying layered gas reservoirs was constructed in order to investigate the performance of the proposed method. Initially, water was injected via the downdip well to displace oil towards the producer located updip. When the water cut at the producer became high, the updip well was shut in and perforated in the gas zones in order to dump gas into the oil reservoir. At this point, the downdip well was open for production. In order to optimize oil recovery, oil production and water injection rates and perforation strategy on the gas reservoirs were investigated for different numbers of gas reservoirs having various depths and thicknesses. Gas dump-flood from multiple gas reservoirs can help increase the oil recovery after implementation of waterflooding upto 10%. Although the amount of additional oil recovery is slightly lower than the one obtained in conventional double displacement process, the proposed process requires a small completion cost of the gas zones and no operating cost while the conventional method incurs high capital investment in gas compression facility and high-pressure gas pipeline and additional operating cost. From the simulation study, oil recovery can be optimized by producing oil at a suitable rate and perforating the gas zones with the right strategy which depends on depths, thicknesses and number of the gas reservoirs. Conventional double displacement process has been studied and successfully implemented in many fields around the world. However, the method of dumping gas into the oil reservoir instead of injecting it from surface during the second displacement process has never been studied. The study of this novel approach will help a practicing engineer to understand the benefits of such method and can implement it with minimum cost.

Keywords : gas dump-flood, multi-gas layers, double displacement process, reservoir simulation
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