A Simulation Study of Immiscible CO2 WAG Injection in the Bati Kozluca Heavy Oil Field

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Bati Kozluca field is a heavy oil carbonate reservoir discovered in 1984; it is located in the South East of Turkey, close to Syria border. The reservoir began primary production in 1985, developed with 41 wells producing 12 API oil. The permeability and porosity are 500 mD and 25% respectively. Reservoir depth is up to 1520 m and the original reservoir pressure is 2000 psia. Reservoir thickness is 133 m with 17% of net to gross ratio. Main constraints for oil recovery of the field are the high viscosity and low aquifer support. To increase the oil recovery, reservoir management and re-evaluation studies started in 2000. First EOR methods were screened and it was decided to apply immiscible CO2 injection. There is a CO2 reservoir at Camurlu Field which is 10 km away from the Bati Kozluca Field so that CO2 injection method has the priority among other EOR methods. In 2003, immiscible CO2 injection was started to increase the oil recovery. Until 2007, immiscible CO2 injection had been continued. However, the increase in the recovery was limited because of the quick breakthrough and adverse mobility ratio between CO2 and oil. In 2007, to overcome the problems associated with the mobility ratio, water alternating CO2 injection was started. According to results, oil recovery increased and also water and gas production decreased after applying WAG method. This paper describes the field-wide simulation study conducted to predict the future reservoir performance of the black oil simulation model under various operating and development strategies. Firstly, available data is screened and quality of the data is evaluated and then the model is history-matched on both the field and the well scale. Continuous CO2 injection and WAG methods are considered and WAG method is found the most favorable method to increase the oil recovery and to decrease the amount of CO2 injected.