Impact of Hydraulic Fracturing on Improving Liquid Yields from Rich Gas-Condensate Reservoirs

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Abstract

Productivity of low permeability (1-5 md), rich gas condensate wells deteriorates due to the formation of near-well bore condensate bank **[1]**. The condensate-bank forms as the pressure near the well-bore falls below the dew-point pressure of the fluid. It is usually diagnosed by gradual decrease in the producing condensate-to-gas-ratio (CGR) and productivity of the well. This condensate bank acts like a damaged zone and usually remains immobile under primary recovery, thus reducing the ultimate recoveries of the valuable liquids from the rich gas-condensate reservoirs.

In order to understand the mechanism of condensate-bank formation in Field 'A' and to develop a viable strategy to recover these valuable drop-out liquids, we make use of single-well, dynamic sector model of a depleted gas-condensate well. Reservoir fluid in this model is characterized by fully compositional, Peng-Robinson Equation of State (EOS) **[2]**. Fluid models are tuned to reproduce the standard PVT lab tests available for wells in Field 'A'. This detail compositional description was required to track the compositional changes occurring in the liquid and the vapor phases.

Using this modeling approach it was confirmed that significant liquid was dropping out near the well-bore, causing significant impairment in the well's productivity and decrease in the producing CGR of the well.

In the next phase, hydraulic fracture was incorporated in this model to reduce the near well-bore pressure drops. Results of this modeling showed that hydraulic fractures helps to reduce the viscous pressure drops that aids in mobilizing the drop-out liquid, and predicted significant increase in the producing CGR after fracturing treatment.
The results of these simulations are in close agreement with the performance of various gas-condensate wells in Field 'A' that were hydraulically fractured after significant depletion. Both simulation and actual field results showed significant increase (3-4 times) in the producing CGR and productivity of the well after fracturing treatments.

The results presented here show that gas-condensate wells with declining productivity and producing CGR have problems associated with condensate-bank formation. All such wells are rewarding candidate for hydraulic fracturing treatments. Also, hydraulic fracturing should be adopted as a completion strategy for all low permeability, rich gas-condensate wells to inhibit condensate-bank formation and improving the well's productivity.