The development study on gas recycling injection in Yaha Gas Condensate Field, Tarim Basin, China

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Abstract  The Yaha Gas Condensate Field is the largest one discovered in China so far. In order to enhance the condensate recovery, gas recycling at 50 MPa has been implemented in Yaha field. Such high-pressure injection is very rare throughout the world. This paper offers the description of the geology and fluid phase behavior of Yaha field. The reservoir productivity and injectivity equations, the optimal development and well patterns are presented. The follow-up investigation of the design implementation leads to the reasonable adjustment of the original development plan. The perforation principle and program of gas recycling for Yaha field are set up. The numerical simulation is used to predict the future production performance of gas recycling. Finally, a complete set of high-pressure gas recycling technology suite has been established. The field has come on-stream for one and a half year with condensate throughput of 590000 t in 2001, and fat profit returned. The success of high-pressure gas recycling in the Yaha field is of considerable importance from the theoretical and practical points of view and will considerably benefit the future development of other gas condensate fields in China.

Keywords: Tarim Basin, gas condensate, phase behavior, development pattern, gas recycling, numerical simulation.

Yaha Gas Condensate Field is located in Kuche County, Xinjiang, China, and within the Yaha fault zone of Luntai fault-block in the middle Tabei Uplift in Tarim Basin (fig. 1). The original...
gas-equivalence in place in Yaha field is estimated to be $252.32 \times 10^8 \text{m}^3$ with the original gas in place (OGIP) of $226.51 \times 10^8 \text{m}^3$ and the original condensate in place (OCIP) of $1573.8 \times 10^4 \text{t}$. It ranks as the largest gas condensate reservoir delineated in China to date, and characterized by the reservoir conditions of high-temperature, high-pressure, high content wax and condensate, small difference between the original reservoir pressure and dew-point pressure. The oil- and gas-bearing formations contain three reservoirs, the Bottom Neogene sandstone, the Bottom Eogene sandstone and the Top Cretaceous sandstone. The Bottom Neogene sandstone ($N_{1j}$) is a layered gas condensate reservoir with edge water. The Bottom Eogene sandstone and Top Cretaceous sandstone (E+K) are a massive gas pool with bottom water (fig. 2).

1 Development study of gas recycling

1.1 Structure and reservoir of Yaha field

The study of gas recycling concentrates on Yaha 2-3 unit of considerable interest, the major reservoir in Yaha field. The trend of the Yaha structural belt is NEE-SWW\textsuperscript{[1]} with the structural top depth shallowing from west to east (fig. 3). The depth of pay zone averages about 5000 m. The ratio of long vs short axis of the anticline is about 9:1. The structural dip angles of the formation in the south and north are 4.5 and 2.7 degrees, respectively. The south side of the structure is