Remaining Oil Distribution Research and Potential Tapping Practice of Offshore Bottom Water Reservoir After Long-term High Intensity Water Injection

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Abstract

Objectives/Scope: CFD oilfield is an offshore structural bottom water reservoir located in the Bohai Bay basin. The oilfield is developed by horizontal wells. After the high water cut of the oil wells, all oil producing wells are converted into reinjection wells to meet the needs of the production of the oilfield group. After more than 10 years of high intensity water injection, the injection volume has exceeded 20 times of geological reserves.

Methods, Procedures, Process: In order to understand the distribution law of water-flooded and remaining oil in this reservoir, we introduced the relative permeability time-varying characterization into the reservoir numerical simulation on the basis of large-scale physical simulation experiments, quantitatively described the evolution process of water ridge shape below the horizontal well and its internal oil displacement efficiency with time and injection volume during the production and water injection process of the bottom water reservoir, and finally predicted the current residual oil distribution law.

Results, Observations, Conclusions: According to the research results, when the injection volume of a single well is 5 times, 10 times and more than 20 times of the well control reserves, the radius of the water ridge below the horizontal well is <200m, 250~350m and >450m respectively. This conclusion is supported by the recent time-lapse seismic analysis results, and confirmed by several passing wells and their coring data, the current distribution of remaining oil is basically consistent with the research prediction. Under the guidance of research conclusions, we have developed an overall plan for inter-well infilling to tap the potential again, and achieved excellent results. During the implementation of this plan, many wells have achieved high production of more than 300m3/day at the initial stage. It is predicted that the recovery factor of this reservoir will increase by 11 percentage points.

Novel/Additive Information: This study makes a reservoir that is considered "abandoned" become the main production reservoir of the oilfield again, the relevant technologies and conclusions can provide guidance for other similar oilfields.