

A Dynamic Model for Predicting Reserves of the Gas Reservoir with Water Invasion

Leng Tian^{1,2}, Kaiqiang Zhang³, Meng Wang^{1,2} and Yingchuan Pei^{1,2}

Abstract

In Longgang reef flat (China), the gas reservoir conditions are complicated in terms of the reservoir water–gas relationship, reservoir scale variation, and serious water invasion., which causes prediction of the dynamic gas reservoir reserves to be challenging. In this paper, first, a water invasion model for the gas reservoir, which considering the water–gas profile and dynamic water production concurrently, is developed and applied to model the characteristics of well groups for the targeting formations A and B. Second, a dynamic gas reserves prediction model for the gas reservoir is built based on the actual water invasion at each pressure system. More specifically, the dynamic reserves from the edge water drive, linear water drive, and hemispherical bottom water drive can be predicted by means of this model. The dynamic reserves of the water-invasion gas reservoir at each pressure system are accurately predicted by solving the established dynamic reserves prediction mathematics model. Then, the water-invasion effect on the gas reservoir production is determined by using the partition of the material balancing method. The total dynamic gas reservoir reserves are calculated to be $223.13 \times 10^8 \text{ m}^3$ by using the developed model in this study, which is slightly higher than the recorded actual reserves. Two new infill wells need to be added in order to optimize the gas reservoir production, whose optimal prorations are determined to be $15 \times 10^4 \text{ m}^3/\text{d}$ and $19 \times 10^4 \text{ m}^3/\text{d}$, respectively. In summary, an accurate prediction of the dynamic gas reserves is important for gas reservoir production evaluation and the development potential analysis. The developed model in this study is applicable for predicting the dynamic gas reserves for similar cases.

¹ MOE Key Laboratory of Petroleum Engineering in China University of Petroleum , Beijing, China

² Faculty of Petroleum Engineering, China University of Petroleum, Beijing, China

³ University of Regina, Saskatchewan, Canada.

Leng Tian is Associate Professor, PhD, Faculty of Petroleum Engineering, China University of Petroleum Beijing (CUPB). His research interests are tight oil/gas reservoir production, mechanisms of fluid flow in porous media, and enhanced oil recovery. He holds a Bachelor degree and a PhD degree from CUPB.