ABSTRACT

The petroleum industry has been using different types of well testing procedures and technologies in coal bed methane (CBM, also known as Coal Seam Gas (CSG)) wells for many years: for instance – Injection/Falloff (IFO), Drill Stem Test (DST), and Wireline Formation Test (WFT). Evaluation of formation pressure, permeability and skin factor is as important in a CBM reservoir as in any other conventional reservoir for production and economic forecasting. Well testing represents a significant part of the total well cost, especially in Australia. In certain cases, the WFT approach has proven to be a means of reducing costs and saving rig time because it requires less time than DST.

The main objective of this paper is to review the conventional pressure transient analysis that is used to interpret WFT and DST build-up transients in the CBM environment. Examples of DST tests from Australia involving partial tubing fill-up followed by shut-in, and of WFT tests, have been evaluated and compared. The paper also discusses some of the abnormal trends in the pressure derivative of the WFT, which can be explained from a CBM geological point of view.

INTRODUCTION

CBM reservoir exploitation has developed into a significant part of the oil and gas industry worldwide, especially in the United States, Russia, China and Australia. However, CBM reservoirs exhibit complex behaviour which is dissimilar to conventional reservoirs due to their fractures, which are in the form of longitudinal and transverse cleats and joints. Gas production in CBM requires an initial de-wathering phase where the water in the cleat system is produced or pumped off. When cleat pressure falls below the desorption pressure, gas desorbs from the coal, travels through the coal matrix to the cleats, and production begins. The early stage of production is gas and water, with the gas fraction increasing as water is depleted and as declining pressure favours desorption.

The permeability and skin factor are important parameters to determine the potential of future CBM production, especially in the early stage of exploration and development. Therefore well testing is utilized to estimate the in-situ natural fracture system pressure, permeability and skin factor. Injection/ Falloff Testing (IFO), Drill Stem Testing (DST) and Wireline Formation Testing (WFT) are the common well testing methods carried out in CBM reservoirs. In some cases, IFO or DST may not be viable due to costs, or logistical, environmental and safety restrictions. Hence, WFT is one of the alternatives. Depending on the objectives and financial limitations of the well test, WFT can be used to achieve those objectives. It is known that WFT improves test results with real-time measurements and saves rig time by providing timely answers. Since the formation fluids are not produced to the surface during WFT, this will be an important safety advantage in the field.

This paper is focused on interpreting WFT build-up tests in CBM reservoirs by using conventional pressure transient analysis, and the information from the WFT interpretations is compared to that from DST interpretations.

Wireline Formation Testing

The WFT tool which is used in the field examples uses a downhole pump for extracting formation fluids