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DST Design for Deepwater Wells with Potential Gas Hydrate Problems

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Abstract

The main objective of this paper is to present a proper DST design for deepwater gas wells with potential gas hydrate problems because of low seabed temperature.

Prior to discussing the DST procedures, the importance of selecting a proper mud for drilling and interval for testing are explained. Factors affecting gas hydrate formation are discussed. Then, requirements for gas hydrate prevention during DST are described. Actions required to prevent gas hydrate formation during DST startup, fluid sampling, well shut-in and restart are addressed. Finally, procedures for incorporating gas hydrate prevention in DST are outlined.

At the end of the paper, a gas well with hypothetical data is used to assist in illustrating the DST procedures.

Introduction

Hydrates are physical combinations of water and natural gas formed at pressures and temperatures considerably above the freezing point of water[1-5]. For deepwater gas wells, the risk for gas hydrate formation always exists due to the low seabed temperature and the coexistence of gas and water inside the wellbore.

Figure 1 shows one of the popularly used pressure-temperature-gas density correlations for gas hydrate predictions[2,6]. As it can be seen from this figure, the generally low temperature of less than 50 ^{0}F in the deepwater seabed, together with the normal gas well operating pressure of several hundreds to thousands of psi, will result in wellbore temperatures below the gas hydrate temperature curve.

DST and Gas Hydrate

Although a deepwater gas well may be operated at certain flow conditions to take advantage of the warm fluid coming out from the reservoir, the need for DST to shut in the well for pressure buildup tests or produce the well at low rates for fluid sampling often cool the fluid inside the wellbore to the extent that gas hydrate will form. For the deepwater DST, it has been well recognized that hydrate prevention is needed for flow assurance in order to complete the test[7-11].

Gas Hydrate Inhibitors

There are many ways to prevent the formation of gas hydrates during DST. The most commonly used method is to inject gas inhibitors. References 7 to 14 discussed various gas hydrate inhibitors that were used or could be used to prevent the gas hydrate. Based on analysis results, methanol has been identified as one of the most effective gas hydrate inhibitors because of the following advantages:

- Low viscosity: Easier to inject and distribute in the system.
- Good contact efficiency: High solubility and volatility provide good contact with gas and liquid in the wellbore.
- Easy to dispose: Can easily be flared with produced gas at the wellsite.