Research on Flow Assurance of LH16-2 Oil Fields in South China Sea

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ABSTRACT

This paper discusses some problems on flow assurance of LH16-2 oil fields in the South China Sea. The main difficulty of flow assurance is about wax disposition and hydrate formation for the LH20-2 oil field. If these two problems are not solved, wax and hydrate may block the flow line, causing huge losses. In the research, the subsea production system was dynamically simulated. The actual flow was modeled with the dynamic multi-phase flow simulator OLGA. All the wells and some jumpers were analyzed hydrate formation, which include the jumper shutdown study. This paper also focuses on wax deposition and scraping. Based on the experimental results of wax deposition in the laboratory, the basic data flow package of wax was fitted to the simulation calculations of the dynamic software. Then, the wax deposition principle analysis and the pigging dynamic simulation of wax deposition in deep water pipeline is conducted, and the relevant pigging operation principles are given. The allowable maximum wax deposition thickness of the total flow line profile is recommended for the subsea production system. Since the wax removal simulation is dependent on the selection of modeling parameters, it is strongly suggested that some key wax simulated parameters firstly need to get from the lab for wax deposition simulation, then the simulation results may be accurate. If the offshore oil field has high water cut in the middle or late life, there is recommended subsea separation system may be a good choice to resolve the problem.

KEY WORDS: Flow Assurance; Hydrate; Wax; Sand; Pigging; subsea separation.

NOMENCLATURE

FPSO Floating Production Storage and Offloading Unit
LH16-2 LIUHUA 16-2 Oil Field
LH20-2 LIUHUA 20-2 Oil Field
LH21-2 LIUHUA 21-2 Oil Field
OLGA Dynamic Multi-phase Flow Simulator
PCV Production Control Valve
SCPM Subsea Central Production Manifold

INTRODUCTION

For deep water flow assurance, solid management is very important, especially hydrate and wax. The LH16-2 oil fields are located in the South China Sea, which are the fields developed by the subsea production system. The LH16-2 oil fields include LiuHua16-2 oil field (LH16-2), LiuHua20-2 oil field (LH20-2) and LiuHua21-2 oil field (LH21-2). The paper mainly discusses some issues about flow assurance of LH20-2 oil field. Firstly, all the wells and some jumpers were analyzed for hydrate formation. Considering the difference of the gas and oil component between A1-A7 and A8-A10, hydrate will be formed if single well produced, such as A8, A9, A10, produces. For the initial start, A1 and A8 well will be analyzed as typical for the first start-up of single well from A1 to A7 and from A8 to A10. The downstream temperature of subsea tree choke needs to be focused on. If the temperature was lower than hydrate formation temperature, some effective measures need to be taken. For the LH20-2 flow assurance, wax deposition is a main problem. The Wax deposition module includes three options which are RRR (Rygg, Rydahl and Ronningsen) HEATANALOGY and MATZAIN in OLGA. Comparing with the calculated results of RRR, HEATANALOGY and MATZAIN model, the calculated result of RRR model is the most conservative. Therefore, if there is no accurate wax experimental data, RRR model will be used for LH16-2 subsea system simulation. Wax deposition simulations were performed using wax module in OLGA. The deposited wax in the wall of flow line must be scraped frequently, so scraping wax simulation will be studied especially for subsea production system. The paper will give some scraping wax rules for reference. Finally, the paper recommends an assumed subsea liquid-liquid separation scheme to resolve the high water cut problem in the LH20-2 field. There are two subsea separator schemes that can be selected for the project (Prescott, N., Sankar, K., Swenson, J, 2016).

SUBSEA PRODUCTION SYSTEM DESCRIBE

LH16-2 oil Fields Layout

LIUHUA16-2 OILFIELDS DEVELOPMENT PROJECT located in South China Sea, the People’s Republic of China, includes LiuHua16-2 oil field (LH16-2), LiuHua20-2 oil field (LH20-2) and LiuHua21-2 oil field (LH21-2). The three oil fields will be developed by means of subsea production systems (SFS) and one new-built FPSO (HYSY119).