Design and Practice of Minimum Platforms for Shallow Water Oilfield

Aixia Zhang1,2, Jieming Liu2
1 Department of Naval Architecture & Ocean Engineering, Dalian University of Technology
Dalian, China
2 Design and Research Center, China National Petroleum Offshore Engineering Co., Ltd.
Beijing, China

ABSTRACT

Exploration of oil/gas resources in shallow waters has been a challenge in Bohai Bay, China. Jidong Nanpu oilfield is the largest shallow water oilfield in Bohai. How to develop it effectively and economically is of great importance and has been becoming an attractive topic. This paper introduces the Characteristic technologies and development modes of Jidong Nanpu oilfield. The design practice of minimum structures for Nanpu oilfield development is presented. The fabrication and installation of minimum structure are also discussed in this paper. At the end of the paper the design proposal and design considerations of minimum structures used for shallow water oilfield are discussed.

KEY WORDS: Jidong Nanpu oilfield; shallow water; development mode; minimum structure; structure type.

INTRODUCTION

The Jidong Nanpu oilfield in Bohai Bay, China, has a reserve of one billion tons, or about 7.35 billion barrels and it is the largest discovery in China over four decades. The Nanpu block, partly offshore, covers an area of 1,300-1,500 sq km and is expected to produce light crude. It is a high-grade oilfield with average oil layer thickness of 80-100 m and major target zone depth of 1,800-2,800 m. Production testing results show that the daily output of each vertical well is between 80-100 tons and between 200-500 tons for each horizontal well. The good exploration prospects make Nanpu oilfield attract much attention. So, how to develop it effectively and economically is of great significance and has been becoming an important topic.

Usually very simple engineering modes are adopted in very shallow waters, for example, one subsea pipeline, one sea cable and one minimum structure are applied together for production of a small field, and an FPSO together with other movable facilities are used to transport crude oil to shore. Anyway, steel platforms have played an important role in oil field development, and minimum structures are paid much more attention to due to the cost effective for construction, transportation and installation. It is even more attractive when applied to marginal shallow water fields. Several types of minimum platform structures have been developed in the Nanpu oilfield.

DEVELOPMENT MODES IN JIDONG NANPU OILFIELD

Jidong Nanpu oilfield is a new oilfield in the tidal and shallow water area of Bohai Bay. Kinds of engineering modes are applied or developed for different water depths. In principle, pile roads and artificial islands are used in shallow waters of 3m or less, and steel platforms in relatively deeper waters. For platforms, oil/gas is transported to shore usually by ships or by pipelines, and the process systems are not provided on platforms. Up to date, four types of development modes have been put into use in Nanpu oilfield.

The first type is to use oil tanker to transport oil and only wellhead platform built to produce crude oil. Oil and gas separation system is equipped on oil tanker. This mode has been out of use for its poor safety and a lot of ship reformation work.

In the second type, oil and gas are separated on platforms and then transported by oil tanker. Wellhead platform, production platform and flare platform are installed at sea and connected by bridges. This mode is widely used in Jidong Nanpu oilfield, especially in the shallow water where low water level is larger than the draft of oil tanker.

In the third mode, oil and gas are separated on platforms and then transported by oil tanker. Wellhead platform, production platform, storage platform and flare platform are installed at sea and connected by bridges. This mode can be used in the shallow water where low water level is smaller than the draft of oil tanker while high water level can satisfy the requirements of mooring.

In the fourth mode, oil and gas are separated and measured on platforms and then transported by oil tanker. Wellhead platform, production platform, storage platform and flare platform are installed at sea and connected by bridges. This mode can be used in the shallow water where low water level is smaller than the draft of oil tanker while high water level can satisfy the requirements of mooring.

In the fourth mode, oil and gas are separated and measured on platforms and then transported by oil tanker. Wellhead platform, production platform, storage platform and flare platform are installed at sea and connected by bridges. This mode can be used in the shallow water where low water level is smaller than the draft of oil tanker while high water level can satisfy the requirements of mooring.

Fig.1 and Fig.2 illustrate two typical development modes in Jidong Nanpu oilfield.