Detailed Design and Construction of the Hull of an FPSO (Floating, Production, Storage, and Off-loading Unit)

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ABSTRACT

This study presents the ways and means of detailed design and construction of an FPSO installed in the AKPO field, offshore Nigeria with a close attention on the offshore market in deepwater developments.

First, we explain the overall process of the on-going AKPO FPSO from detailed design to construction and lessons learned from AKPO FPSO, contributing to successful design and construction of future FPSO’s. The design and construction of an FPSO (Floating, Production, Storage, and Off-loading unit) is divided into two parts: one for the hull system and the other for the topside system. The FEED (Front End Engineering Design) and specification on the FPSO commenced with the DBR (Design Basis Report). This resulted from a feasibility study on the exploration of the specific field in order to meet the market requirements for stabilized oil. We performed a detailed design of the hull system of AKPO FPSO based on the FEED and coordinated the overall FPSO designs of the hull and the topside system, which were performed by other contractors. After finishing the detailed design of the FPSO, we performed the construction and integration of the hull and the topside.

Second, we describe some problems and their solutions of the detailed design and construction of the AKPO FPSO. Through this study, readers will be able to learn the detailed design and construction of the FPSO.

KEY WORDS: FPSO (Floating, Production, Storage, and Off-loading unit); Design; Construction; FEED (Front End Engineering Design); DBR (Design Basis Report)

INTRODUCTION

Introduction to FPSO

FPSO, which stands for Floating, Production, Storage, and Off-loading unit, is a floating vessel that is able to produce crude oil and gas. It is made up of two parts: the topside and the hull. The topside, like chemical plants, produces and off-loads crude oil and gas, and the hull, like a big tank, stores the produced oil. The FPSO produces and processes crude oil and gas on the topside, and stores the stabilized oil in cargo tanks of the hull. The FPSO also off-loads the stabilized oil and gas to a shuttle tanker through the oil export/metering pump (Mather, 2000). However, the FPSO alone can not produce oil and gas in the oil field. It requires many offshore production systems such as the SPS (Sub-sea Production Systems), UFR (Umbilicals, Flow lines, and Risers), mooring lines, a shuttle tanker, an off-loading buoy, etc., as shown in Fig. 1. Thus, the design and construction of an FPSO includes many other offshore production systems (Shimamura, 2002; Infield, 2005a, Infield, 2005b; International Maritime Associates Inc., 2005).

Fig. 1. Offshore production systems

Fig. 2 shows a typical layout of an FPSO. The FPSO is subdivided into two parts: topside and hull. An FPSO has many sub-systems such as the flare tower, living quarters, lay down area, mooring fairleads and a helicopter deck.