New Subsea Dynamic Riser Base Design for HYSY111 FPSO in South China Sea

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ABSTRACT

Due to H2S corrosion, the process piping in SDRB of HYSY111 FPSO dynamic riser system will be in the risk of oil leakage. In order to ensure the oil field production facilities integrity, it is necessary to find a solution to lay a new SDRB to replace the existing SDRB. This paper is to summarize the SDRB replacement strategy, the new SDRB structure design, mudmat & scour protection design, dynamic cable tray design and installation tolerance analysis & control method. The design idea and method described will provide reference for other similar subsea products design in South China Sea.

KEY WORDS: Subsea; Dynamic Riser Base; Structure Design; Installation Tolerance

NOMENCLATURE

API American Petroleum Institute
CNOOC China National Offshore Oil Corporation
COOEC Offshore Oil Engineering Ltd., Co.
DNV Det Norske Veritas
EF End Fitting
FPSO Floating Production Storage and Off-loading
HYSY Hai Yang Shi You
ID Inner Diameter
MBR Minimum Bending Radius
MWA Mid-water Anchor
OD Outer Diameter
PLEM Pipeline End Manifold
POC Panyu Operation Company
PUF Polyurethane Foam
PY Panyu 4-2/5-1 Offshore Oil Field
SDRB Subsea Dynamic Riser Base
STP Submerge Turret Production
TDZ Touch Down Zone
WT Wall Thickness

INTRODUCTION

The Panyu 4-2 and 5-1 oil fields are in the South China Sea, operated by CNOOC POC. The water depth is approximately 105 meters. The field development includes four (4) fixed drilling wellhead platforms, two (2) pipelines and associated rigid risers, two (2) subsea power cables, and a Floating Production Storage Offloading Vessel (HYSY111 FPSO) and associated dynamic risers system. The production started in October of 2003. Due to H2S corrosion, the process piping in the subsea dynamic riser base(SDRB) will be in the risk of oil leakage. In order to ensure the oil field production facilities integrity, it is necessary to find a solution to lay a new SDRB to replace the existing SDRB.

In 2011, CNOOC POC entrusted COOEC provided an overall SDRB replacement solution, including the feasibility of the solution, detailed design, procurement, construction, testing, offshore installation, etc. This paper presents an overview of the new SDRB design considerations, the first needs to determine the replacement solution based on the existing dynamic riser system and SDRB location, ensure the safety and reliability of dynamic riser system; For new SDRB design, many input conditions shall be considered such as lifting constraints of installation vessel, scour from seabed current, dynamic cable support tray, loads from dynamic risers, and so on. In addition, installation of new SDRB will be affected by existing SDRB and dynamic risers, so the installation tolerance shall be determined as per the results of dynamic risers sensitivity analysis, to ensure the best installation location.