Riser Integrity Management Plan for Lingshui 17-2 Project

Chenteh Alan Yu, & Hao Song
ABS
Houston, USA

Yongming Cheng
Keppel FloatEC, LLC
Houston, USA

Jing Hou
China National Offshore Oil Company
Beijing, China

ABSTRACT

The production riser is a critical element connecting subsea equipment on the seafloor (e.g., subsea production tree, pipeline) to the floating production facility. Looking back on all the installed risers worldwide in the last 3 decades, the steel catenary risers tend to be designed conservatively to accommodate the requirements in applicable codes and standards. There are several riser types adopted for offshore oil and gas production, which includes steel catenary risers (SCRs), top tensioned risers, flexible risers and hybrid riser systems. However, the SCRs, with a simple configuration and low fabrication and installation cost, is the most installed riser configuration for deepwater oil and gas production worldwide in the last 3 decades.

SCRs have been facing more challenging environment (e.g., large OD gas export SCRs, and HPHT applications SCRs) and requests for longer service life (e.g., 30 years’ design life). Regulatory bodies (e.g., BSEE in GoM) prefer riser operations to be managed through an integrity management program, demonstrating that a continuous feedback of conditions of risers throughout their service life are in place with their field data maintained in a robust framework, especially for riser life extension applications. This paper investigates the integrity management program for Lingshui 17-2 SCRs that are designed for 30 years of continuous service life in South China Sea.

The Lingshui 17-2 riser integrity management (RIM) program starts with reviewing the basis of design, global strength and fatigue performance, and installation analysis results. With the understanding of the global performance, a reliable and robust measurement system for monitoring key SCR performance parameters is proposed; these include vessel motion measurement in six degree of freedom, measurement of SCR top hang-off angles and tension, and full water column current measurement using ADCP. Sampling production fluid as well as documenting fluid data for indicative internal corrosion measurement are also planned.

An initial maintenance plan with ROV inspection is established based on the understanding of the design data. A further plan to convert the collected measurement data into riser digital twin input is outlined in this paper. The riser digital twin is part of the existing ABS integrated hull structure - mooring - riser digital twin service. The periodical output of the riser digital twin analysis model helps updating the regular maintenance program that is defined and executed starting from the commissioning/ producing first gas to the decommissioning.

Keywords: Steel Catenary Riser (SCR), Riser Integrity Management (RIM).

INTRODUCTION

Since the first SCRs were installed on the Shell’s Auger TLP in 1994 (Enze, et. al., 1994), there have been over 275 SCRs installed worldwide (de Boer, 2019). The SCR can be in the form of single pipe, pipe-in-pipe and bundled pipe, and may experience very challenging environment (e.g., HPHT environment for Bonga, Thunder Horse, and Tahiti’s SCRs). The shallowest water depths of those installed SCRs by far is 1,500’ for Prince TLP SCRs and record of the deepest water depth for SCRs is 8000’ for Independent Hub Facility.

Lingshui 17-2 gas field (termed LS17-2) is located in the northern part of the Qiongdongnan Basin in the western continental shelf of the northern South China Sea, with water depth of 4,003’ to 5,118’. LS17-2 consists of a subsea production system, a deep-draft semi-submersible (SEMI), and an export riser/pipeline as shown in Figure 1. The processed natural gas will be transported to Hong Kong through a subsea export pipeline system.