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Independence Hub Flowline SCRs: Design, Fabrication, and Installation Challenges

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Abstract

This paper describes the challenges encountered during the design, fabrication and installation of the seven deepest Production Flowline Steel Catenary Risers (SCRs) which are connected via flexjoints to the Independence Hub Deep Draft Semi-Submersible located in Mississippi Canyon Block 920 (MC920) in 8,000 ft water depth. The SCRs are for high pressure and low temperature gas production service. The Vortex Induced Vibration (VIV) suppression system of these SCRs comprises of a combination of fairings and strakes to achieve the thermal requirements for the minimum target 18°F arrival operating temperature of the produced gas.

Among project firsts is the S-lay installation of the fairings on five of the seven Independence Hub “S-lay installed” flowline SCRs. The other two flowline SCRs were installed using J-lay method. All SCRs including the 20-inch export were laid on the seabed with several crossings. The pick up, cross haul and hang off installation of the SCRs was a significant challenge since the SCRs have to be cross hauled underneath the semi and supported by temporary installation aids while the installation vessel maneuvers to the other side of the semi. The design, fabrication and testing of the temporary installation aids were unique. This paper presents in some details the aforementioned challenges in addition to others that were encountered during the execution of the project. An example describing the 10-inch Spiderman West SCR fatigue re-evaluation based on the steps taken to provide robustness to the SCR design is also demonstrated.

Introduction

Floating support facilities are in many instances installed as hubs for the development of several remote wells or fields in addition to providing direct access to wells if applicable. One such example is the Independence Hub Semi Platform shown

in Figure 1 which is installed in block MC920 in a record 8,000 ft water depth. The Independence Hub is designed to support total of sixteen (16) 10-inch Production Flowline SCRs and one (1) 20-inch Export SCR. Initially, seven Production Flowline SCRs (2 x 10-inch and 5 x 8-inch) will be tied back to Independence Hub to transport the produced gas from several subsea fields shown in Figure 2. In addition, the processed gas will be transported to a shallow water platform, located 134 miles away in West Delta Block 68 in 150 ft water depth, via 24 inch pipeline system (Independence Trail) which will be connected to the Independence Hub through a 20-inch Export SCR. The initial production flowline SCRs with their sizes, departure angles and actual suspended lengths are presented in Table 1. The entire Independence Hub and Subsea Field layout is shown in Figure 3.

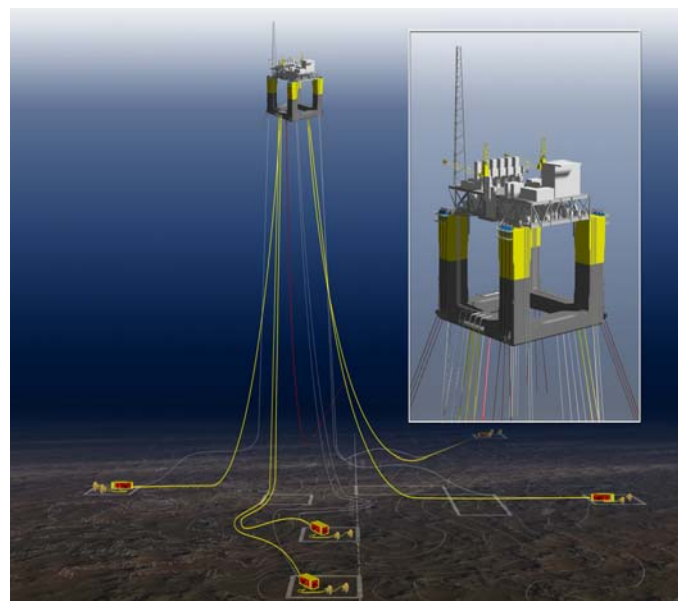


Figure 1: Independence Hub Semi with SCRs

The design of the SCRs presented a significant challenge given that it involved the application of SCRs in 8,000 ft water depth which is a record water depth. Although the knowledge in the SCR designs has increased in recent years, deeper SCRs can experience significantly different behavior due to the change in the structural properties [1]. In addition the Independence Hub deeper and heavier SCRs have presented fabrication and installation challenges that have to be taken into consideration during the SCR design.