



Society of Petroleum Engineers

SPE-190897-MS

Gamechanging Structural Repair Solution for FPSO Hulls with no Hot Work

Christophe Paillusseau - COLD PAD, Xavier ERROTABEHERE, Firas SAYED-AHMAD - COLD PAD, Luc MOUTON - Bureau Veritas

Copyright 2018, Society of Petroleum Engineers

This paper was prepared for presentation at the SPE International Oilfield Corrosion Conference and Exhibition held in Aberdeen, Scotland, UK, 18-19 June 2018.

This paper was selected for presentation by an SPE program committee following review of information contained in an abstract submitted by the author(s). Contents of the paper have not been reviewed by the Society of Petroleum Engineers and are subject to correction by the author(s). The material does not necessarily reflect any position of the Society of Petroleum Engineers, its officers, or members. Electronic reproduction, distribution, or storage of any part of this paper without the written consent of the Society of Petroleum Engineers is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of SPE copyright.

Abstract

An increasing number of Floating Production, Storage and Offloading Platforms (FPSO) are currently entering a mature age, requiring costly maintenance operations. Maintenance cost of the shipping industry is partly linked to corrosion management of the structural parts (incl. hull) while “Crop & Renew” of super tankers is usually taken care of during dry dock operations: FPSO hulls shall be maintained “on the field” creating challenges in terms of safety and economics. Indeed, for safety concerns, hot works on FPSO may yield to high risk simultaneous operations (SIMOPS) and/or production disruption. FPSO operators have therefore been looking for “cold work” solutions that guarantee safe and economical hull repair.

This paper presents an innovative cold repair solution called ColdShield for the permanent reinforcement of steel structures in such marine environment. The purpose of ColdShield is to strengthen - in a safe and controlled manner - corroded offshore structures by eradicating the use of hot works during the whole repair process, thus avoiding downtime. The technology is based on proven techniques of bonded composite reinforcement already used in other industries such as aerospace and civil engineering. This innovation was led by COLD PAD with the support of Total, the French Petroleum Institute, and involved four different private and public laboratories.

The paper describes how this innovative technology has marinized composite reinforcement techniques throughout the three critical stages: design, installation and service life. Classical bonded composite reinforcements are usually limited by their high sensitivity to environmental marine conditions. As water is a severe degradation factor of bonded interfaces, it is well-known that bonding process in high humidity conditions, such as marine environments where FPSO hulls typically are, leads to poor adhesion properties and a premature ageing of bonded reinforcements.

This led to a series of tests and simulations to finally obtain the class approval for ColdShield for hull girder strength by Bureau Veritas as a certified alternative to crop & renew.

The paper covers two field cases in West Africa comparing ColdShield with standard techniques in terms of safety, planning and savings. With an ageing fleet, the FPSO industry will face more and more corrosion challenges and COLDSHIELD proves to be a suitable tool to lower risks and costs while maximizing safety.