OTC 18563

Implementing Risk-Based Inspection on Our F(P)SOs: From a Practical Approach to the Edge of R&D

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This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

Abstract

Total E&P operates an increasing fleet of floating production units, most being ship-shaped. They range from converted tankers to new built mega-FPSO projects, see reference [1].

In order to keep these units fully operational from the safety, security, environmental, operational, maintenance and quality management view points our Company has developed a tailor made Floating Units Integrity Management System including hull and mooring models, inspection plan, database management and emergency response on a shared web based system.

HAZOP and HAZID are performed during the design in order to minimize the risks. However during the field life of these complex units, damages to the hull structure cannot be excluded.

Due to the comprehensive integrity management program in place, the probability of unseen damage is very low but potential consequences may be important if no cure is made.

The hull integrity, with very sound design, will not be at risk but the cost of offshore repair with immobilization of part of the storage capacity may be high.

It is important to assess properly the consequences of these low probability events and to rank the structural components by order of criticality. This is achieved through the implementation of Risk Based Inspection techniques (RBI).

Different approaches have been considered, from qualitative to quantitative, including risk assessments for degradation phenomena such as fatigue induced crack propagation particularly in highly repetitive structure. One unit is used as a pilot for an advanced approach in RBI within a joint industry R&D project.

The paper reviews various scenarios of failures and addresses these issues by analysing on a pragmatic point of view what can be reasonably implemented and achieved.

A multi level approach has been implemented for the integrity management of complex hull structures. These facets of the programme are complementary and inter-act with each other to give the best possible inspection programme. They combine structural models, inspections, fatigue and trend analysis. Risk based inspection when properly applied helps ranking the hull structural items by order of criticality and in turn improving the inspection program.

Aim of the Integrity Program

The aim of Floating Units Integrity Management is to ensure management and continuous follow up of Floating Units from the safety, environmental, operational, maintenance and quality management viewpoints. It includes recommendations on inspection, maintenance and repairs. This calls for:

1. Structural and anchoring modeling and analysis (1st assessment and subsequent annual re-assessments).
2. Inspection plan and inspection manual, completed by RBI implementation (Risk Based Inspection).
3. Yearly reviews of the unit condition and IRM plan when necessary (Inspection, Repair and Maintenance).
4. Data management and storage (including reports).
5. Assistance for Emergency Response.
6. And gives the framework for exceptional analysis.

Panorama of Floating Units covered by the Integrity Management Program

First priority for implementation of the program has been given to the most important assets, i.e. those being operated by our Company and having the function of storage, and/or production, and/or offloading - in short F(P)(S)U. See references [4] to [7].

These Floating Units can be ship-shaped or box-shaped or any other shape such as TLPs, SPARs, SEMIs, etc. They can be in steel or concrete and can handle various types of hydrocarbon products (oil, condensates, gas, liquefied gases…).

The Floating Units Integrity Management program also applies to the anchoring systems and to the offloading buoys, either coastal (associated with onshore storage) or offshore (associated with offshore field development).

The Figure 1 is a world map showing the location of the present and projected Floating Units concerned in priority by the Floating Units Integrity Management program (due to the lack of space the figure does not show all the loading buoys).