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Experience Gained From Floating Units Integrity Management

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Abstract

Floating Units combining functionalities such as storage, production and offloading are important assets handling field production. They are prone to structural problems such as corrosion and fatigue. They cannot be easily removed for dry-docking and repair.

TOTAL has developed a tailor made methodology for the integrity management of ten major complex Floating Units in operation and in project. The program has been implemented through 2004 and 2005 and should be completed in 2006. This paper describes the experience learned so far.

This methodology allows modeling the various units, their anchoring and the coupled effects when for example interacting with offloading buoys. Residual fatigue life is calculated. Inspection, Repair and Maintenance plans are scrutinized on a periodical basis using Finite Element Analysis and Risk Based Inspection. A data management tool allows easy storage, retrieval and sharing of the information. An Emergency Response Service has been developed to provide effective support in emergency situations.

The paper explains how this methodology applies to all these Units in spite of their great variety:

- Types: size, shape, materials, age, fluid handled.
- Mooring: configuration, pattern, line composition.
- Offloading: side by side, tandem, offloading SPM.
- Environment: weather and depth.

For each unit, the implementation process includes a first assessment of the unit followed by annual re-assessments.

The first assessments being completed, the paper describes how the following goals set-up at the beginning have already been achieved:

- Hulls, anchoring and offloading are classed and designs (hull, stability, anchoring) have been verified against today rules and comply.
- Documentation is available on electronic format and shared through network systems.

- Inspection and maintenance plans have been updated.
- Offloading systems have a back-up.

Other expected results in the longer term are:

- Knowing at any time the condition of the Floating Units and anchoring systems.
- Minimizing the risk of incidents with consequences such as reduction of the storage capacity or production shutdown.
- Predicting the condition of the units for maintenance scheduling optimization.
- Pooling the experience gained from various units using the network system.

The subject is relatively new. Floating Units are more and more integrated and complex. Multi-disciplinary resources, management commitment and assistance of specialized service companies are required. It is believed that this paper presenting the experience learned during conception, implementation and use of the program, will significantly contribute to improving the reliability of operations from safety, environmental, operational, maintenance and quality management viewpoints.

The E&P Floating Units: past, present and future

When we look back at our own operated installations (combining those of former companies Total, Petrofina and Elf E&P), in the thirty-year period between 1972 (when our first loading buoy was installed on Djeno (Congo) and 2003 (the Matterhorn TLP and the last loading buoy installed on the Djeno field), the figures are as follows:

- 21 SPM (Single Point Moorings, i.e. buoys and fixed loading towers),
- 22 FSO (Floating Storage and Offloading, new-build storage units or converted tankers moored on chains, turrets, rigid arms, or mooring hawsers),
- 5 FPS (Floating Production Systems) comprising 3 FPSO (Floating Production Storage and Offloading), 1 FGPU (Floating Gas Production Unit) and 1 TLP (Tension Leg Platform).

Some fields, such as that of ABK (Abu Al Bukoosh) in Abu Dhabi, underwent several successive modifications (5 storage tankers between 1974 and 2003). A fair number of these installations have been removed because of their age or of changes in the field development architecture, giving way to more recent ones.

New projects, vying in complexity and innovation, have kicked off, the most advanced of which is Dalia in Angola (an FPSO, with first oil due for mid-2006). Also deserving mention are AKPO in Nigeria (FPSO, 2008) and Moho