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Marine Monitoring of Gulf of Mexico Deepwater Floating Systems

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Abstract

BP has a comprehensive Integrity Management program in place to ensure safe operations of its Gulf of Mexico deep water production facilities. The integrity management effort includes the monitoring of critical marine parameters related to the environmental conditions, and responses of the hull, mooring and riser systems.

BP's seven Gulf of Mexico deepwater floating systems include a TLP, three Spars and three semi-submersibles in water depths ranging from 3,000 to 7,000 ft. As part of the BP Group Integrity Management Standard, efforts are underway to have a consistent set of monitoring requirements for all seven platforms. Marine monitoring contributes to safe operations due to a better understanding of platform and riser responses and confirmation that the floating system is behaving within the original design parameters. Additional benefits include understanding the behavior of the as-is configuration in the field, which leads to better utilization for additional tie-in or payload capacity.

The marine monitoring system includes monitoring of critical environmental parameters such as wind, wave and current conditions. Monitoring of the floating system responses includes motions from Differential Global Positioning System (DGPS) and 6 degree-of-freedom (6 DOF) inertial motion sensors, and mooring line tensions and riser responses. Critical system parameters such as ballast tank levels, void tank alarms and ballast/bilge valve positions are also monitored. The paper describes the details of the Integrated Marine Monitoring System (IMMS) which includes descriptions of the individual instrumentation sensors, data acquisition system (hardware and software), and approaches to data archiving and transmission to shore and monitoring in real time.

Introduction

BP's Gulf of Mexico Production Business Unit must comply with the internal BP Group Integrity Management (IM)

Standard, which applies to all BP operated projects and assets worldwide. It also must comply with all regulatory requirements set by the Minerals Management Service (MMS), the United States Coast Guard (USCG) and in some cases classing societies such as the American Bureau of Shipping. The internal BP Group IM Standard covers monitoring and assessment of structural integrity of floating system hulls, moorings, and risers; management of change related to critical marine issues; marine staff skills and competencies; marine operating procedures; hazard evaluation and risk management, and marine emergency response. This paper covers the performance monitoring aspects of BP's Integrity Management efforts for its Gulf of Mexico Deepwater production facilities.

Value of Marine Monitoring

Performance or marine monitoring contributes to:

- Operating facilities in a safe manner
- Assessing and verifying in-place performance
- Minimizing down time and lost production
- Maximizing future tieback capacity
- Forensic investigation

Operating Facilities in a Safe Manner

Monitoring of platform and riser performance is important for ongoing safe operation of deepwater floating systems. For example, measurements of TLP tendon tensions or mooring line tensions in Spars and semi-submersibles provide verification that these critical structural elements are performing within their allowable design loads. Anomalies of excessively high or low tensions are early indicators of performance problems or potential incipient failure in an extreme environment event. If one mooring line in a group has much higher tension than others in that group, then the higher tension line is more likely to fail first in an extreme event potentially resulting in a sequential progressive failure of the remaining lines in that group. As another example, if monitoring of riser performance shows that the fatigue damage rate for a critical riser element is much higher than expected, remedial action can be taken and a catastrophic failure with consequent harm to the environment can be avoided.

Assessing and Verifying In-place Performance

Comprehensive monitoring of environmental loads (e.g., wind, waves, and current) simultaneously with platform responses (e.g., position, 6 degree of freedom motions, and mooring line tensions) and riser responses provides the