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Improved Moored MODU Design Codes for Hurricane Season

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Abstract

Hurricanes Ivan, Katrina and Rita in 2004 and 2005 resulted in twenty-one MODUs having suffered either complete mooring failures or partial mooring failure. The mooring work group under API SC2 was already actively working on the 3rd Edition of API RP 2I, In-Service Inspection of Mooring Hardware for Floating Structures [1] prior to these hurricanes. However, after the hurricanes, the API RP 2SK, Design and Analysis of Station Keeping Systems for Floating Structures [2], work group was reactivated to explicitly address this issue. The API RP 2SM, Recommended Practice for Design, Manufacture, Installation and Maintenance of Fiber Ropes for Offshore Moorings [3], work group was also reactivated in early 2006. The need to revise 2SM largely lies in the experience gained since it was first issued. However, the work group addressed numerous items that also benefit moored MODUs, especially since the use of a fiber rope insert mooring system can enhance the MODU mooring performance and reliability.

A summary of the major changes to API RP 2SK, 95F, Interim Guidance for Gulf of Mexico (GoM) MODU Mooring Practice - 2007 Hurricane Season [4], 2I and 2SM recommended practices will be presented. Highlights will be given to code changes to these Recommended Practices (RP) that enable technology to address reliability and robustness challenges. This information will be helpful for people who analyze, design and install MODU moorings.

Introduction

MODUs in the Gulf of Mexico are a critical part of the infrastructure for finding and extracting oil and gas to bring to the market. Industry standards that allow safe and economic operations are important to the industry, community and regulatory authorities. Much work has been done since the

events of the 2004 and 2005 hurricane seasons to better understand the causes of moored MODU failures and learn from them. This has resulted in changes to the industry standards.

API RP 2SK 3rd Edition is a minimum acceptable design code. 2SK requires a mobile mooring like that on a MODU to be designed to a 5-year return period event when operating away from other structures. When operating in the vicinity of other structures, a 10-year return period event was required. No specific definitions are provided, however, on what is considered “away from” and “in the vicinity of”. Some examples are given, however, for operations in the vicinity of other structures. The Recommended Practice also permits using a risk analysis to determine the design return period but in no case shall it be less than a one year.

Three strong hurricanes entering the Gulf of Mexico over roughly a 12 month period with paths through areas of the Gulf of Mexico with extensive infrastructure was unprecedented. In the past, hurricanes have occurred that produced MODU mooring failures; for example in Andrew and Lili. However, over time, the number of MODUs working in the deep water has increased along with more infrastructure thus increasing the probability of failure and also possible consequences of failure (damage).

New criteria, which is risk based, is needed in order to better protect critical infrastructure during GoM hurricanes. The industry’s initial response to the problem was addressed in API RP 95F, 1st Edition which was published in May 2006. The minimum design return period was increased to a 10-year return period event, whether far from or in the vicinity of infrastructure. It also requires the use of the Central Gulf metocean criteria developed by the ABSC MODU Mooring JIP or site specific criteria which includes the 2004 and 2005 hurricane season hindcast. In no case is the one-minute wind speed to be less than 64 knots (the lower range of a category 1 hurricane). 95F also recommends a site specific assessment be conducted to assess the risk of such operations during hurricane season.

A risk based approach is being developed and will be incorporated into a Commentary to 2SK to replace 95F for the 2008 hurricane season and beyond. For the 2007 hurricane season, a 2nd Edition of 95F will be released that is an enhancement of the 1st Edition. Mooring components also should go through a more thorough quality and inspection process. API RP 2I will address this issue with the release of