Winterization of Drilling Systems and Equipment in the Cold Climate Conditions

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ABSTRACT

Oil and gas offshore exploration drilling and production facilities in cold climate and Arctic environmental conditions need various design considerations and operational preparation for intended operations. Offshore winterization of drilling systems and equipment is considered to be one of the essential aspects for ensuring that a facility is capable of and suitably prepared for operations in cold climates. When a facility is in the operational mode at cold temperature for the intended operating site, the drilling systems and equipment essential for safety and commercial operation must remain functioning, and have to be adequately protected to minimize risk of hazards against icing, freezing, dropped objects and material properties. Winterization issues on the drilling systems and equipment are investigated based on system by system review. Risk based methodology and risk reducing hierarchy focused on potential hazards to system, equipment and operations in cold climate conditions. The objective of the paper is to identify winterization needs and design considerations and proper measures for drilling systems and equipment, considered to be important to safety of the facility, personnel and environment.

KEY WORDS: Offshore winterization; drilling systems and equipment; extreme temperature; icing; freezing; dropped objects

INTRODUCTION

Oil and gas offshore exploration drilling and production facility design incorporates high performance and safety critical systems and equipment for safe operation, control and emergency action while also focusing in particular on creating a safe and well protected working area. Under the cold climate conditions, such facilities need additional design considerations and operational preparation for intended operations due to complex process-related and/or drilling related systems and equipment on board.

If the geographical location of operation is such that ice and snow accumulation may occur, systems and equipment for effective anti-icing, anti-freezing or de-icing with necessary availability shall be installed for continuous operation. Further, such winterization issues have direct and indirect influences on arrangement and layout of the drilling plant, its system and equipment, and working environment for personnel at any environmental situations.

Winterization issues on the drilling system and equipment are investigated based on a risk based methodology and risk reducing hierarchy focused on potential hazards to system, equipment and drilling operations in cold climate conditions. After identifying the main hazards, a qualitative ranking of the identified hazards is carried out based on basic assumptions and generic challenges related to actual drilling operation and emergency situation.

System by system review for a semi-submersible mobile offshore drilling unit (MODU) that is intended to operate in cold climate conditions is carried out with focus on system and equipment functionality and criticality affecting safety and operability of the facility. The results of the system by system review propose possible measures to reduce identified risks to an acceptable level from safety, environment, technical and regulatory perspectives. However it should be further discussed with owner, operator, vendors and builder for practical applications based on an overall operating and winterization philosophy taking into account cost, technology and environmental footprint.

The background to the offshore winterization standard development, DNV-OS-A201, is also given, and design consideration fulfilling functional requirements in cold climate conditions is addressed.

The objective of the paper is to identify winterization needs and design considerations and proper measures for drilling systems and equipment, based on a case study of semi-submersible drilling unit, considered important for the safety of the facility, personnel and environment.

WINTERIZATION FUNDAMENTALS

Purpose of Winterization

The purpose of winterization is to ensure that an offshore facility can operate safely and efficiently in cold climate. Winterization addresses four primary issues: icing, freezing, wind chill and material properties. In winterizing an offshore facility preference is generally given to safe