Health & Safety Executive

Offshore Division

Maritime integrity of floating and mobile installations

Topic Strategy 2008 -2013

1.0 Introduction

This document defines a five-year strategy for HSE's Offshore Division (OSD) for the topic of maritime integrity, the generic term encompassing the disciplines of naval architecture and marine engineering related to asset integrity. This topic is the responsibility of OSD 4.3, which acts as the focal point for the Division for the following areas related to floating structures and vessels:

Stability and seaworthiness
Watertight integrity
Station/position keeping
Marine systems
Associated maritime issues such as marine personnel competence

Further details of OSD 4.3 responsibility areas are given in Appendix A

The strategy has been divided into the main types of marine installations encountered on the UKCS each requiring somewhat different approaches, as well as more generic maritime topics. As the topic of maritime integrity and other topics are inextricably linked, risks do not respect OSD discipline boundaries, therefore this strategy requires the co-operation and team working of other inspectors in OSD. The overall aim of the strategy is to ensure that risks to persons associated with the loss of maritime integrity of floating installations and vessels in the changing workplace in the up stream oil and gas and diving industries are properly controlled.

2.0 Main installation types / specific maritime hazards

2.1 Monohull installations

2.1.1 Background

The UKCS fleet of some 20 monohulls include FPSO and FSU installations. Some of these were specifically designed and built for the purpose, whilst others were converted from trading tankers - it is not unusual for the original marine systems and the new process systems to “Clash” within the latter converted vessels.

In many cases the vessels are 30 years of age and as such require a higher frequency of inspection, tank inspections being of particular relevance. The duty holders tend to be averse to dry docking the vessels, which would be the norm for trading tankers, largely due to the difficulty of demobilising and remobilising the installation, the time off location and the consequent loss in revenue at the current high oil price. The need for increasing maintenance leads to an increase in the numbers of personnel required on board and places a greater pressure on existing accommodation. It is not unusual to find that Safety Critical maintenance has to be deferred due to lack of available bedspace.

A frequent concern with all floating installations relates to the lack of maritime competence and the difficulty of recruiting personnel from a suitable background. The relative importance that is placed upon the need for competent maritime personnel varies considerably between duty holders, although all units are subject to maritime risk. The choice by some FPSO operators to deselect Class, (as a Fixed Installation the ship shaped FPSO does not require to be Classed), increases the concern yet further.

There has been an increase in the number of mooring failures of FPSO and FSU installations recently, thought to be for a number of reasons including age, link bending / fatigue and bad weather. Additionally a number of installations are dependent upon thrusters for heading control and as these are difficult to maintain it is not unusual to find one or more thrusters out of action.

The UKCS is considered to be mature and as such duty holders need to produce in deeper and more hazardous waters placing the FPSO and FSU installations under greater environmental forces. A number of new and relatively untried designs are due to be located in the UKCS in the near future, with the Sevan series of drum shaped FPSO units and a proposal for a deep draft production semi submersible combined with dry well heads mounted on fixed conductors being typical examples.

Shuttle tanker intervention brings with it the risk of collision and, as some installations have to reduce the size of the crude oil transfer cargoes while inspecting tanks, there is a likely increase in the number of shuttle transfers.

2.1.2 Intervention strategy

Assessment of Safety Cases - The opportunity will be taken to raise our specific concerns with each duty holder in each safety case assessment in addition to undertaking the

required assessment. Where the duty holder responses are considered to raise further questions one or more PAIT's will be created and followed up by inspection.

Inspections - Each of the 20 or so FPSO and FSU installations will be inspected both on and offshore by the maritime integrity team at least once every three years unless circumstances require a more rigorous regime. Each inspection will take into account all the maritime integrity concerns of mooring, stability, watertight integrity, competence, the maintenance of safety critical elements and shuttle tanker intervention. Particular interest will be shown in new and innovative designs such as the Sevan drum type design of FPSO.

Tank Entry Initiative. – In addition to the above, the joint initiative, set up between HSE and Oil and Gas UK in 2007, will be followed up over the next two years by an onshore and an offshore inspection of each FPSO and FSU duty holder. The purpose of the inspections will be to ensure that each duty holder has put in place adequate mitigating measures to reduce the risks of tank entry to a minimum. A team of inspectors from a range of topics, including maritime integrity, will be put in place and one of the team will undertake the inspections with an IMT inspector

2.1.3 Stakeholder engagement

The maritime integrity section, intend to maintain contact with and influence the relevant industry Trade Associations such as the Norwegian Petroleum Directorate (NPD), Oil and Gas UK, Norwegian Oil Industry Association (OLF), Oil and Gas Producers (OGP), and the Maritime and Coastguard Agency (MCA).

Similarly contact will be maintained with the International Association of Classification Societies (IACS), members of which include Lloyds Register (LR), Det Norske Veritas (DNV) and the American Bureau of Shipping (ABS). The contact with the Class Societies is particularly relevant as they are almost invariably selected by the owners and operators of floating monohull installations to be their Independent Competent Person (ICP) for Verification purposes. It should be noted that as FPSO and FSU installations are defined as Fixed Installations a number of duty holders have removed the propulsion machinery from the vessels, defined them as Barges and therefore remove the requirement for them to maintain Class.

2.2 Semi submersible installations

2.2.1 Background

Many semi submersible units operate in the UKCS where they are used not only for drilling with its associated activities but also for accommodation and production purposes. Dynamic positioning and thruster assisted moorings are now being utilised as well as the more standard spread mooring systems, and there are particular safety concerns during the approach to, operations alongside, and departure from fixed installations, where for the accommodation units up to 800 personnel may be put at risk.

The current high oil price is driving operators to utilise units which would not normally be employed in the UKCS. Installations are being brought in from abroad with no history of UK operations or which until now have been laid up for a considerable length of time. The

vessels maintenance records are sometimes non existent and safety critical maintenance in particular is suspect. Intact and damaged stability standards may not comply with what is now the norm in the UKCS.

On all types of semi submersible installations larger deck loads and deck areas are being demanded by operators and the accommodation facilities are invariably under pressure. The need to drill and operate in deeper waters West of Shetland exposes the units, many of which are 30 or more years old, to harsh environments and more severe motion responses.

The shortage of competent and experienced maritime personnel creates difficulties for the owners and operators of semi submersible installations. Personnel training both on and offshore, mentoring and the use of emergency exercises has become a very high priority for all duty holders.

2.2.2 Intervention strategy

Assessment of Safety Cases - The opportunity will be taken to raise our specific concerns with each duty holder in each safety case assessment in addition to undertaking the required assessment. Where the duty holder responses are considered to raise further questions one or more PAIT's will be created and followed up by inspection.

Inspections - Each semi submersible installation owner will be inspected both on and offshore by the maritime integrity team at least once every three years unless circumstances require a more rigorous regime, particular interest will be shown to accommodation units and units that have been outside the UKCS for some time. Each inspection will take into account all the maritime integrity concerns, typically mooring, stability, watertight integrity, competence and the maintenance of safety critical elements.

2.2.3 Stakeholder engagement

Frequent discussions will be held with the owners and operators of semi submersibles. Influence will be brought to bear on Trade Associations, these include the British Rig Owners Association (BROA), International Association of Drilling Contractors (IADC) and the International Maritime Contractors Association (IMCA).

Typically influence has been brought to bear on the owners of Semi Submersible MODU's through presentations to the Technical Committee of BROA/IADC and to international conferences supported by IMCA.

Similarly contact will be maintained with the International Association of Classification Societies (IACS), members of which include Lloyds Register (LR), Det Norske Veritas (DNV) and the American Bureau of Shipping (ABS). The contact with the Class Societies is particularly relevant as they are almost invariably selected by the owners and operators of floating installations to be their Independent Competent Person (ICP) for Verification purposes.

2.3 Jack up installations

2.3.1 Background

The number of jack up installation operating in the UKCS varies, and their uses include drilling with its associated activities, accommodation and production. A major risk occurs when jack-ups approach to, operate alongside, and depart from fixed installations. Additional concerns relate to the preparations and competences that the owners and operators have put in place to ensure the safety of the jack up in transit, when jack ups are particularly subject to loss of stability through water ingress. The secure storage of loose equipment on deck is a vital requirement as in a number of cases loose equipment has been moved by heavy weather and damaged a vent allowing water ingress.

The watertight integrity of the hull, which includes the bulkheads, doors, hatches and vents is therefore given a high priority. It is not unusual to find an installation, which has come from outside the UKCS, where the hull bulkheads are watertight but the penetrations through the bulkheads are not.

In addition a critical process for a jack up, following the final positioning, is the pre-loading operation where the weight of the jack up is maximised in a safe manner to ensure the integrity of the foundations. The procedures and arrangements for the pre load operations are therefore subject to close scrutiny.

As with the semi submersible installations jack up units are in great demand and there is a tendency to bring in units from abroad or out of lay up. Consequently concerns are raised as to the state of maintenance of the safety critical equipment.

2.3.2 Intervention strategy

Assessment of Safety Cases - The opportunity will be taken to raise our specific concerns with each duty holder in each safety case assessment in addition to undertaking the required assessment. Where the duty holder responses are considered to raise further questions one or more PAIT's will be created and followed up by inspection.

Inspections - Each jack up installation owner will be inspected both on and offshore by the maritime integrity team at least once every three years (unless circumstances require a more rigorous regime). Each inspection will take into account the maritime integrity concerns, typically transit arrangements, mooring and unmooring, stability, watertight integrity, pre loading procedures, competence the maintenance of safety critical elements. and the procedures for combined operation approach.

2.3.3 Stakeholder engagement

Frequent discussions will be held with the owners and operators of jack up installations. Influence will be brought to bear on Trade Associations, principally through the BROA/IADC Technical Committee and IMCA meetings.

Similarly contact will be maintained with the International Association of Classification Societies (IACS), members of which include Lloyds Register (LR), Det Norske Veritas (DNV) and the American Bureau of Shipping (ABS). The contact with the Class Societies

is particularly relevant as they are almost invariably selected by the owners and operators of floating monohull installations to be their Independent Competent Person (ICP) for Verification purposes.

3.0 Other installation types and generic concerns

3.1 Other installation types

3.1.1 Background

Floating installations other than the more usual monohull, semi submersible and jack up types may include the TLP, spar buoy, crane/pipelay barge, offloading buoy, well intervention vessel, shuttle tanker and attendant vessel.

Each proposal for an unusual type of vessel will be given a high priority for early involvement in the design process, using existing OSD procedures. Subsequent maritime integrity interventions will be specific to the installation type.

HSE's maritime integrity interest lies primarily in installations because the responsibility for regulating maritime integrity on non-installations lies with either the MCA, (for UK registered ships) or elsewhere for non UK registered ships. Pipe lay and crane barges are not normally installations unless used in long term accommodation roles, similarly interest in non installations is limited to where the vessels work on connected activities as in Shuttle tankers offloading FPSO and FSU installations.

3.2 Generic maritime concerns

3.2.1 Background

The continuing integrity of each type of maritime asset or installation is a concern of the maritime integrity section. Ageing installations, the reluctance of duty holders to dry dock FPSO and FSU installations and the utilisation of mobile installations that have either not worked in the UKCS or have been in lay up for some time increases the risk of a reduction in maritime integrity. The need for higher personnel numbers offshore puts an increasing pressure on existing accommodation constraints.

The reduction in the available pool of competent and experienced maritime personnel upon which the duty holders can draw increases the risk of personnel being employed offshore in safety critical roles for which they are not adequately qualified to perform.

Reliable marine incident, accident and failure rate data is required by the offshore industry for both the creation of safety cases and to ensure that each floating offshore installation has in place adequate mitigating measures. The data is also utilised by safety professionals on a world wide basis.

Floating installations and the activities required by their operations are heavily dependant upon the environmental conditions at the time. The approach of shuttle tankers to an FPSO, the lift of a jacket from a barge to the cranes of a heavy lift vessel and the maintenance of position of an accommodation unit alongside a fixed and live platform are all affected by the environment at the time.

3.2.2 Intervention strategy

The maritime integrity of floating assets is best managed by interrogating the duty Holders Written Scheme of Verification (WSV). The duty holders understanding of major maritime hazards and the associated safety critical elements, performance standards and assurance activities will be clearly reflected in the WSV. Onshore inspection of selected parts of the verification scheme combined with an offshore maritime inspection of the installation and verification scheme will highlight any shortcomings.

The competence of on and offshore maritime staff is demonstrated by personal discussion with individuals and an inspection of the training matrix, roles and job descriptions. A comparison of what experience and qualifications the individual is expected to possess with the actual experience and qualifications possessed is an effective method of inspection.

The UKCS has a robust accident and incident reporting regime, OSD receives in the order of 500 incident reports per annum. In order to enable the offshore industry to make good use of this information it is necessary to ensure that it is provided in a format which allows simple interrogation by search and sort tools and that it is regularly updated.

The Green Seas initiative, a weather related HSE initiative, was put in place some time ago. Essentially the duty holders of FPSO and FSU installations were required to ensure that no safety critical equipment could be damaged by foreseeable weather criteria. A number had to make modifications to their vessels in order to comply. A similar initiative related to the approach and positioning of shuttle tankers to an FPSO and took into account environmental forces.

3.2.3 Stakeholder engagement

Each of the generic concerns requires specific engagement with the duty holders, both individually and via the Trade Associations. The assessment of safety cases and the inspection both on and offshore of duty holders will be required in order to influence each of the generic concerns.

(The Reliability of marine incident data research project was previously funded totally by the HSE and contracted to DNV but in future Oil and Gas UK will fund 75% of the work and HSE 25%).

4.0 Future maritime integrity challenges

OSD 4.3 will therefore continue to work closely with others, including those stakeholders mentioned above, and colleagues, to anticipate and meet these challenges through effective research, and maintaining topic awareness.

4.1 Challenges

The owners and operators of floating production and storage units are reluctant to consider fully the maritime risks to which all floating installations are subject, production operations being given the highest priority.

In the current climate OSD is experiencing difficulty in attracting suitably experienced and qualified personnel due to the upturn in the industry combined with a high oil price for the foreseeable future. At the same time there is a worldwide shortage of competent maritime personnel for the industry itself to draw upon.

The high oil price has created full employment for the vast majority of floating installations, many of the floating installations are in excess of 30 years old. Some of the MODU's being brought into the UKCS from less well regulated areas are found to be in poor condition, in contrast some new, innovative and unproven floater designs are being proposed for work in the UKCS.

Oil exploration and production are moving to deeper waters with a consequent worsening of environmental conditions which either places mooring systems under higher dynamic loads or requires more reliance upon Dynamic Positioning.

More FPSO and FSU installations are being utilized in the UKCS which creates a higher risk of shuttle tanker / FPSO collisions, particularly in the worsening environment brought about by deeper water. Additionally there is a reluctance by operators to bring the FPSO / FSU installations off location for survey and repair.

In order to reduce the number of helicopter flights or shuttling operations required in the Southern North Sea a number of major operators are piloting the Walk To Work concept where a DP vessel is being utilized to act as both a crew change vessel and accommodation unit.

Class Societies act as both the Class Society and the ICP for Verification purposes, in a number of instances there is a degree of conflict between the two sets of requirements. HSE does not enforce the duty holder to take action on ICP verification findings.

UKCS Accident and Incident data is not generally disseminated and in a number of instances safety cases have not referenced the data.

4.2 How do we meet the challenges of the future

Continue to raise the profile of maritime hazards through industry organizations, work closely with Class, in particular with ageing MODU's and inspect all MODU's which are entering the UKCS for the first time.

Work with industry to ensure adequate training systems are in place and highlight the need for competent personnel to be employed in the maritime area.

Become involved at an early stage in innovative designs and insist upon third party design review for innovative floater designs.

Determine the effect of environmental conditions in deep water on installations and ensure that the consequent deep-water mooring and DP systems are robust and understood. Insist upon third party design review for innovative deep-water mooring systems. Ensure that the duty holder management systems in place to manage DP risks are adequate.

Closely monitor the Walk To Work concept trials and other innovative personnel transfer proposals.

Work with Class to investigate how to close the Class/Verification/ICP loop.

Ensure continued dissemination of freely available and published HSE Accident/Incident data.

Appendix A OSD 4.3 topic responsibilities

Stability and seaworthiness

Buoyancy, floating stability (intact and damaged).
Hydrodynamics (including motion response).
Deck wetness (green / aerated seas) and air gap.
Watertight integrity including internal and external closing appliances.

Station / position keeping

Mooring systems design analysis and hardware.
Maritime elements of turret, swivel, drag chains, deck and other machinery.
Emergency mooring release.
Thruster assist.
Dynamic positioning (DP).
Combined mooring and DP.
Moorings and riser interaction.

Other marine systems

Propulsion, manoeuvring and steering systems including power generation, control, transmission and delivery systems.
Stability / flooding detection, control and mitigation systems including space and tank contents, draught measurement, bilge and ballast systems, including power availability and control systems under normal and emergency situations.
Jack-up pre-load systems.
Oil cargo systems (non process) including on / off loading.
Inert gas and hydrocarbon blanketing systems.
Gangway design, operation and disconnection.

Other maritime issues

Site assessment for floating installations.
Safe operating limits and procedures.
Metocean information for maritime issues.
Response forecasting and decision making tools for weather dependent operations.
Transit operations for mobile installations.
Competency of marine personnel (e.g. stability, ballast, weight, mooring control and DP operators) under normal and emergency operations.
Shuttle tanker, supply boat, diving support, pipe lay and other vessel operations and integrity issues in so far as they effect the installation.

Maritime design, operations and risk management tools including scale model tests to predict full scale performance.