

**Template
for a
Safety Management System
for
Offshore Wind Farms
on the OCS**

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Template for a Safety Management System for Offshore Wind on the OCS

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Preface

Wind farms in general have had a remarkably good safety record with very few fatalities and injuries associated with them, according to available information. A number of technical papers have expressed concern going forward with the potential for safety incidents as the wind farms become more frequent in the offshore environment.

While the historic record is good, if wind farms continue their momentum, there is likely to be a shortage of qualified personnel to operate them. The mixture of disciplines (marine, structural, mechanical and electrical) combined with pressure on operating costs may lead to safety issues without a strong safety management system in place.

Specific concerns raised in the technical papers/speeches focus on a variety of issues including:

- Transport Access/ Egress: disembarking and embarking from boat or helicopter to the turbine structure
- Procedures for site assessment of temporary structures such as jack-ups to ensure they are suitable for the work, have sufficient airgap, and are capable of manned operations in reasonable return period storms
- Working at heights and climbing (including rope access): use of ladders and man-riding winches
- Working in confined spaces
- Material Handling: Lifting operations and equipment/ rigging
- Electrocution: High Voltage and Medium Voltage electricity
- Smoke and Fire
- Moving parts, stored energy
- Working in appropriate weather conditions
- Lone working
- Risk of familiarity and poor communications
- Diver Safety
- Competence of personnel to safely operate the equipment
- Rescue from heights
- The following of procedures written by the manufacturer when making adjustments and when operating the turbines

.....as well as many others.

The concerns raised can be minimized by use of appropriate procedures. Within the framework developed it is necessary to identify typical Safety Critical Elements which includes activities and equipment. A partial list of examples is:

- Escape Routes
- External Communications
- Rescue and Recovery
- Collision Avoidance e.g. aircraft warning lights
- Emergency Preparedness
- Structures
- Cranes and Lifting Equipment

The developed Safety Template calls for identifying those elements, e.g. Escape Routes and ensuring that a competent person is tasked with maintaining the escape routes clear, that he/she knows it is their responsibility, and is audited for performing this task. If the task is not being done appropriately then remedial action should be taken, and appropriately documented, as part of the total management of safety.

This document is part of a project sponsored by MMS to recommend design standards to ensure structural safety/ reliability/ survivability of offshore wind farms on the US Outer Continental Shelf (OCS).

This document is the Safety Management System Template providing guidance on the content and subject matter for the owner's Safety Management System.

Three other reports will be companions to this document and will cover the following subjects:

1. Report on Damage and Critical Review of Accidents in relation to Offshore Wind Farm Safety: documentation of significant damages relevant to wind farms for which appropriate information is available together with an analysis of the cause of the casualties, if available. This will result in insight into the robustness of the current industry standards, safety management systems, or quality and certification systems.
2. Report on a list of the required items to be established in a Design Basis document that a wind farm owner would submit to MMS for approval. This document would allow the owner to site the standards that they are going to use in the design.
3. Report on the Design Basis to include actual references for calculations for what could be used as a detailed design standard.

Acknowledgment

This Safety Management System Template was developed using the format, several of the ideas, and some of the wording and style from "Health Safety and Environment Case Guideline for Drilling Contractors Issue 3.2, International Association of Drilling Contractors, 2006". This has the benefit that U.S. contractors, and sub-contractors familiar with this workplace document will be able to instantly adapt to the safety management system proposed for the offshore wind farm industry. This contribution to safety and to this project by the International Association of Drilling Contractors is gratefully acknowledged.

1. INTRODUCTION

As a result of a number of initiatives in the chemical business and the offshore oil & gas business, the 1980s saw an initiative to adopt a set of Safety Management principles, partly developed by DuPont. This led to a sharp decline of incident rates. In that same period quality management systems were introduced in the offshore industry and, following the Piper-A disaster in the North Sea, it was realized that safety should be managed more rigorously and systematically. The result has been developed into a format used by many in the offshore oil industry as well as many other onshore industries today.

Many of the tools and concepts developed such as the Bow-Tie diagrams, risk assessment methods, and goals of As Low As Reasonable Practical (ALARP) have become the pillars of a kind of universal language and standards throughout much of the oil and gas industry. The methods assured that hazards were thoroughly identified, analyzed and managed, in an organization with competent people and thorough "checks and balances". While the more sophisticated risk assessment methods are recommended it should be a simple matter to first put in place a rudimentary safety management system which will build to include those more sophisticated techniques as the industry moves forward.

During this study the European standards were examined, but many of them rely on goal-setting requirements and do not delineate specific requirements in sufficient detail. This template should help the offshore wind farm owner to prepare a suitable safety management system, or advance his own, in order to address the key items thought to bring the most critical safety activities to a reasonable level of risk and safety. Each installation is different, with different parameters and personnel cultures and thus the summary report produced using this Template, or the safety management system itself should be

adjusted to take care of these unique factors in a project.

Understanding culture and human behavior is important in reducing accidents, e.g. payment of bonuses based on speed of activity rather than safety can lead to increased accident rates. Particularly changes to procedures or equipment made without consideration of risk implications and/or without documentation being updated have been important issues. Creating a Template for safety and encouraging enthusiasm for working the issues, together with a rigorous safety system that has personnel at all levels of the organization buying-in will lead to good results for the offshore wind farm reputation.

The road map to an improved culture starts with making the management expectations crystal clear: verifying whether the person carrying out the task understands the job and has the competence and resources to do the task. Only then can a person be held accountable for the action. The consequences of actions and behaviors, both positive and negative, have to be clear.

1.1. INTRODUCTORY REFERENCES

A number of other initiatives have been underway to develop Safety Guidelines and some of these are noted below and are quoted since they may prove to have suitable wording that an owner can adopt for some of the specific procedures:

Extracts from Environmental, Health, and Safety Guidelines for Wind Energy, International Finance Corporation (IFC), World Bank Group, April 30, 2007. (<http://www.ifc.org>)

Occupational health and safety hazards specific to wind energy facilities and activities primarily include the following:

- *Working at heights*
- *Working over water*

Working at heights

Working at heights may be required during construction activities, including the assembly of wind tower components and general maintenance activities during operations. Prevention and control of hazards associated with working at heights include:

- *Prior to undertaking work, test structure for integrity;*
- *Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers;*
- *Establishment of criteria for use of 100 percent fall protection (typically when working over 2 m above the working surface but sometimes extended to 7 m, depending on the activity). The fall-protection system should be appropriate for the tower structure and movements to be undertaken including ascent, descent, and moving from point to point;*
- *Install fixtures on tower components to facilitate the use of fall protection systems;*
- *Provide workers with an adequate work-positioning device system. Connectors on positioning systems must be compatible with the tower components to which they are attached;*
- *Ensure that hoisting equipment is properly rated and maintained and that hoist operators are properly trained;*
- *Safety belts should be of not less than 15.8 mm (5/8 inch) two in one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibres become evident;*

- *When operating power tools at height, workers should use a second (backup) safety strap;*
- *Signs and other obstructions should be removed from poles or structures prior to undertaking work;*
- *An approved tool bag should be used for raising or lowering tools or materials to workers on elevated structures.*
- *Avoid conducting tower installation or maintenance work during poor weather conditions and especially where there is a risk of lightning strikes;*

Working over Water

Prevention and control measures associated with working over open water include the basic principles described for working at heights, as above, in addition to the following:

- *Completion of a risk assessment and management plan for water, wind, and weather conditions before conducting work;*
- *Use of approved buoyancy equipment (e.g. life jackets, vests, floating lines, ring buoys) when workers are over, or adjacent to, water where there is a drowning hazard;*
- *Orientation of worker to avoid salt spray and contact with waves;*
- *Provision of appropriate marine vessels and qualified boat operators and emergency personnel*

Blade / Ice Throw

- *A failure in the rotor blade or ice accretion can result in the ‘throwing’ of a rotor blade or ice from the wind turbine (The risk of being hit by turbine parts or ice fragments within a distance of 210 m is 1:10,000,000. (Taylor and Rand, 1991)), which may affect public safety, although the risk of ice throw is only relevant to cold climates and the overall risk of blade throw is extremely low.*

(Data indicate that most ice fragments found on the ground are estimated to be 0.1 to 1 kilogram mass and are between 15 and 100 meters from the wind turbine. (Morgan et al. 1998)).

Blade throw management strategies include the following:

- *Establish safety setbacks, and design / site wind farms such that no buildings or populated areas lie within the possible trajectory range of the blade. This safety setback range is unlikely to exceed 300 meters, although the range can vary with the size, shape, weight, and speed of the rotor, and with the height of the turbine;*
- *Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary;*
- *Regularly maintain the wind turbine;*
- *Use warning signs to alert the public of risk.*

Ice throw management strategies include:

- *Curtail wind turbine operations during periods of ice accretion;*
- *Post signs at least 150 meters from the wind turbine in all directions;*
- *Equip turbines with heaters and ice sensors;*
- *Use cold-resistant steel for the turbine tower;*
- *Use synthetic lubricants rated for cold temperature;*

- *Use black fluoroethane-coated blades;*
- *Provide full-surface blade heating, if available, or otherwise use leading-edge heaters at least 0.3 m wide.*

Extracts from UK HSE "The Health and Safety Risks and Regulatory Strategy Related to Energy Developments" June 2006.

Health and safety risks

160 *The offshore wind power industry is relatively low risk compared with the major hazard nature of offshore oil and gas. Currently the numbers of employees and contractors working in the industry is small, but estimates are for an offshore workforce of some 500 people by 2010.*

161 *The occupational hazards associated with offshore wind farms have been considered in a major risk study (Offshore windfarms – risk review). The principal hazards arise from:*

Construction and major repair: operation of jack-up construction barges and associated lifting operations during tower and nacelle erection. These health and safety issues may be more challenging in the future, as the new generation of wind turbines become significantly larger and taller.

Operation (maintenance and minor repair operations): primary issues are access and egress (frequent personnel transfers between boats/construction vessels/towers), working at height, and emergency response. It is anticipated that each offshore wind turbine could require up to six maintenance or repair visits per year.

162 *The potential external hazards to the operation of the wind farm come from marine and aviation activities. These matters are currently addressed by having the Ministry of Defence (MoD), the Civil Aviation Authority (CAA), the National Air Traffic Services (NATS) and the Maritime and Coastguard Agency (MCA) all as consultees to DTI in the consent process.*

Extracts from RECOFF, EC Project: ENK5-CT2000-00322, "WP 6: Operation and Maintenance, Task 2: Labor Safety (Health and Safety), SGM. Ramakers, T.W. Verbruggen, L.W.M.M. Rademakers, Nov. 2004.

(Note: Recommendations for Design of Offshore Wind Turbines' financially supported by the European Community (contract no. ENK5-CT-2000-00322, acronym RECOFF) under the Energy, Environment and Sustainable Development Programme, a Fifth Framework Programme (1998-2002). The project has been coordinated by Risø National Laboratory, Denmark, and has run over the period from 1st of January 2001 to the 31st of August 2004).

4.3.3 Safety Training and Licensing

Personnel shall have the training according to the national legislation. All service engineers should be VCA certified and fully trained in offshore emergency responding. The training does not require any prior maritime education. It comprises practical exercises using safety equipment, vessels, cordage, and fire extinguishing equipment. The main content of the training is given in Table 4.1

Table 4.1: Contents of the training:

<i>Survival:</i>	<i>Life jackets</i>
	<i>Hypothermia Protection against cold</i>

*Safety suits Heli-hoist
Life saving first aid*

*MOB-boats: Positioning, launching, manoeuvring, and landing
Equipment and contents
Rescuing a person from the water
Boarding and access ladder from a boat*

Emergency Radios and Pyrotechnics

*Life rafts Positioning and launching
Equipment and contents
Boarding from the water
Stay at life raft
How to afloat a capsized raft*

*Basic maritime knowledge:
Knots and hitches
Lashing
Mooring*

*Fire fighting
Fire extinguishing theory
Portable fire extinguishers
CO2 equipment*

Personal Protection Equipment (H-belt with safety line, fall protection, safety helmet, footwear suitable for climbing)

4.3.4 Practical Advice During Inspection

During inspection and repair the following procedures must be followed.

- During visit at a turbine at least 2 persons must be present at the turbine*
- Before ascending, turbine must be stopped (emergency stop activated)*
- During climbing, Personal Protective Equipment (PPE) has to be worn:*
 - Suitable footwear*
 - H-belt with fall safety device fastened*
 - Safety helmet*
- Wear tools, parts and lubricants in a bag, locked onto the safety belt or in a backpack*
- Close trap doors in the landings when passed*
- Notice locations of emergency stop push buttons*
- Check the presence and state of safety and evacuation equipment in the nacelle*
- Rotor locking system must be activated before anybody climbs out in the nose cone*
- Oil and grease must be cleaned up before leaving*
- Check all covering and locking provisions before leaving.*

4.3.5 New Safety Procedures

General

- *Analysing of all the working and transfer situations leads to the necessary procedures.*
- *The safety facilities need to have valid approvals.*
- *Procedures for operating and maintaining turbines need to cover the environmental aspects as well.*

For boats

Procedures are needed for:

- *Minimal crew members on board*
- *Registering/licensing of maintenance persons;*
- *Checking of equipment and provisions*
- *Weather conditions and forecasting;*
- *(Remote) operating of the turbines to be visited;*
- *Embarking and disembarking of the boat;*
- *Use and inspection of the embarking and disembarking facilities;*
- *Use and inspection of the turbine hoisting facilities;*
- *Use of the specific communication equipment;*
- *Communication during work activities;*
- *Communication during emergencies;*
- *First aid in case of injuries;*
- *Evacuation during emergencies.*

The procedures need to be authorised by the licensing authorities, the coast guard and/or rescue authorities and the insurer.

For helicopters

Procedures are needed for:

- *Minimal crew members of helicopter and hoist operator*
- *Registering/licensing of persons visiting the wind turbine;*
- *Checking of equipment and provisions*
- *Weather conditions and forecasting;*
- *Embarking and disembarking of the helicopter;*
- *Use and inspection of the specific embarking and disembarking equipment;*
- *Use of the specific communication equipment;*
- *Remote operating and positioning of the turbines to be visited;*
- *Communication during work activities;*

- *Communication during emergencies;*
- *First aid in case of injuries;*
- *Evacuation during emergencies.*

The procedures need to be authorised by the licensing authorities, the aviation authorities, the coast guard and/or rescue authorities and the insurer.

For overnight stay

Procedures are needed for:

- *Decision to stay on the turbine;*
- *Licensing and authorisation*
- *Check of provisions*
- *Communication during the stay;*
- *Use and maintenance of the equipment and provisions;*
- *Handling of garbage.*

For emergency situations

Procedures are needed for:

- *Contacting the stand by vessel or helicopter station;*
- *Evacuation;*
- *Getting medical advice and assistance;*
- *Coordination of the different aid organisations as: stand by vessel or helicopter, coast guard, rescue organisation.*

Information from the Danish Standard DS/EN 50308 Wind turbines – Protective measures – Requirements for design, operation and maintenance:

This document defines minimum and/or maximum values for doors, hatch openings, floors, climbing facilities or lighting levels for safety acknowledging that member states may have more stringent values. It also states the European requirement for “safety instructions included as a chapter in the operator’s instruction manual” some of which follow:

- *“When supplied, portable fire fighting equipment;*
- *Escape routes;*
- *Use of specific personal protective equipment and descent devices as escape route equipment;*
- *Safe use of ladders;*
- *Closing of hatch covers;*
- *Securing in open as well in closed position the nacelle covers, doors and hatches affected by wind or gravity;*
- *Attaching not permanently installed emergency descent devices (if any) in their operating positions before starting operation;*
- *The prohibition of normal work inside the nacelle during normal operation of the turbine;*
- *Description of available mechanical blocking of rotor, pitch and yaw movement, including wind speeds for safe operation, application and removal;*
- *The instructions for the application and removal of the blocking devices;*
- *Requirements to remove traces of oil leakage from the floors as soon as they are discovered;*

- *Replacing at service of contaminated oil absorbing materials such as mineral wool, sand or sound insulation;*
- *How to handle the safety aspects in case of remote operation;*
- *Separate instructions for provisions such as elevators and hoisting equipment;*
- *Separate instructions for hoisting equipment in connection with wind speed, clearance, obstructions and yawing;*
- *Work restrictions related to usual weather conditions such as hail, lightning, high winds, fog or icing;*
- *All foreseeable emergency situations (to include evacuation and escape);*
- *Procedure in the event of wind turbine failure (especially a freewheeling station); information on actions to be taken by personnel after a prolonged period of turbine stand still. “*

“A maintenance manual is related to a specific turbine type”. “The requirements for the manual in relation to health and safety are given below”. A maintenance manual shall:

- *Prescribe requirements for trained and competent personnel;*
- *Contain all the necessary drawings diagrams and part specifications;*
- *Contain any specific turbine modifications;*
- *Identify the need to test and inspect all safety equipment, lifts, hoists and fire extinguishers periodically in accordance with local regulations;*
- *Specify wind speeds, including allowances for gusts, above which specific activities are not permitted, making due allowance for safe use of emergency descent equipment;*
- *Give instructions for*
 - *The number of personnel needed for specific activities*
 - *Inspection of safety features (e.g. ladders, descent devices, anchorage lines, attachment points),*
 - *Inspection of installed safety devices (e.g. over speed detection, electrical protection),*
 - *Inspection of installed lighting and emergency back up*
 - *Maintenance and capacity tests of installed safety devices (e.g. mechanical brake, tip mechanism, emergency pitching),*
 - *Maintenance of descent devices;*
 - *Safe-working (e.g. high temperature, high pressure, trapped energy, etc.),*
 - *Specific sequences of work*
 - *Storage of equipment in each turbine such as manuals, blocking devices, etc.”*

Section 4.15.3 Personal protective equipment

“A sufficient number of fall arresters shall be available on a wind farm to equip persons required to undertake simultaneous work activities in or on wind turbines requiring their use.”and it is presumed the planning for installation of anchoring devices should account for multiple persons working simultaneously.

“Full body harnesses, fall arresters, shock absorbers and lanyards need periodic inspection, testing and periodic training of personnel. It is very helpful for this equipment to be of unified type, at least for all turbines on a particular site”.

Section 4.15.3 Additional safety instructions

“Safety instructions shall

- *prescribe carrying communication equipment when climbing to the nacelle,*
- *prescribe keeping escape routes free at all times,*
- *prescribe two persons to be present when working above base level,”*

“Storage of flammable materials inside a turbine shall not be allowed.”

Further Guidance can be found in various references including the government Code of Federal Regulation and other industry standards:

:

- Lock-out Tag-out - 29 CFR 1910.269 and 1910.147
- Service lifts - ASME A10.4 A10.5 A17.1 A17.7 A18.1
- ARC Hazards NFPA 70E NEC Article 110.16
- Fire NFPA 850 NFPA 30 (nfpa.org)
- Permit-required Confined space 29 CFR 1926.146
- Personal Protective Equipment 29 CFR 1910.132
- Occupational Foot Protection 29 CFR 1910.136
- Training – Electrical 29 CFR 1910.332
- Selection and Use of Work Practices 29 CFR 1910.333
- Safeguards for Personal Protection 29 CFR 1910.335
- Rotating Equipment - various
- Hotwork in Tower
- OSHA Standards for the Construction Industry, CCH Editorial Staff Publication. (hr.cch.com/safety)

OHSAS 18001 and ANSI Z-10 are occupational safety and health management system standards which may be of assistance in providing a suitable Safety Management System.

The British Wind Energy Association (BWEA) produced a set of guidelines and training that are noted in the References.

2. THE TEMPLATE

This Template provides guidance to offshore wind farm owners as to what is proposed to be used in managing safety effectively according to the requirements of 30 CFR 285. The benefits of this process are maximized when implemented with a structured risk management approach.

Safety is the responsibility of the offshore wind farm owner/operator referred to herein as (Owner) and not the regulator. The owner is responsible for developing systems and procedures that best suit the needs for pre-construction, construction, installation, operations and maintenance, and decommissioning and agreeing upon these with the regulator. It is hoped that the adoption and improvement of this Template by an industry group will achieve a suitable safety record for the offshore wind farm industry over time in the United States OCS.

The Safety Management System (SMS) is a structured process intended to ensure that the safety operations of an organization are planned, conducted, and monitored in such a way as to provide assurance that the safety objectives of the organization are met for the benefit of the stakeholders, regulator, and the public. The owner's Safety Management System starts with setting safety goals, by establishing policy statements, procedures, processes (including auditing), approved work practices, and recording the risk issues in a Risk Register to provide a corporate history of safety, and to ensure design and modification risks are recorded in locations accessible to workers and engineering management. Measurements are made to monitor results. When such measures are effectively applied by the management and by workers in the workplace it provides the best opportunity to limit risks and consequences (accidents) to an optimally low level.

MMS is responsible to assure that offshore wind farms are reliably managing safety. This Template is

to provide one acceptable method, that when completed faithfully, will be a method of reaching an approvable goal.

It is important to ensure that the contribution to safety made by all third party contractors is adequately addressed. Prior to commencement of operational activities, especially those that involve third party contractors, it is important that individual and collective responsibilities to ensure safe operations are clearly defined and documented. This is carried out through a Safety Management System Bridging Document which determines which safety procedures of the companies involved in the operation prevails. Clarity of communication of these responsibilities, to all relevant personnel, is essential to ensure that individual responsibilities are known, understood and accepted before start-up of such operations.

As one example it was noted that during construction of the NUON wind farm offshore Netherlands that there were on average 48 vessels in the field at any one time and that coordination of safety on the site was a rigorous task. (Ref: Jeep Olthoff - NUON, 2009 Marine Technology for Offshore Wind Power Workshop, Marine Technology Society, Arlington June 2009).

Appendix D provides a matrix of vessels and documents which give an example of those vessels where the SMS Template may be applicable.

3. MANAGEMENT SYSTEM ELEMENTS

An owner may use different terms to describe the system used in their company, but all management systems share some form of similar content as outlined in this Template in some form.

Note: Effective application of this management system of safety is also aligned with OHSAS 18001.

Policies:

The policies set a clear direction for the organization to follow. It is useful to set objectives of zero accidents or a low number of incidents, against which safety performance can be measured.

Organization, Responsibilities and Resources:

The Organization defines the structure, roles and responsibilities for setting and carrying out the policies and for implementing the necessary safe work practices to achieve success with the safety system. Each department is likely to have a contribution to safety in some form.

Procedures and Organization Standards:

The owner's processes, procedures, specifications, work practices, etc. define how the owner intends to conduct the business activities while providing and maintaining a working environment where safety and environmental risks are managed for minimum impact.

Performance Monitoring:

The owner defines the arrangements for monitoring by supervisors and other line management to ensure that plans and operations are being implemented as intended and for measuring performance which includes periodic monitoring, audits, incident reporting and analysis, and feedback to all stakeholders.

Note: The recording and improving of items that can give rise to safety events is an important aspect for the industry. The reporting and sharing of accident investigation results, near misses that could lead to accidents, and development of industry standards on safety are part of the safety management system. Safety Alerts within the company and within the industry are important elements for promoting safety.

Management Review and Improvement:

A key part of the process involves review and improvement of Safety Management System strategy, resources, processes and audits by management and by the workforce. This will ensure the ability to achieve appropriate results.

The minimum expectations of the document itself would be to cover for each state of the project:

- Safety policies and organizational and project safety objectives selected by the owner
- Organizational reporting structures – roles and responsibilities
- Risk assessment identification and management of the risks – with workforce participation
- Methods of employee involvement in the process of developing and managing safety
- Employee selection, competency, training and induction
- Integration of third party contractor and support services
- Safety during the assessment phase of the work
- Design, transportation, construction and commissioning arrangements so far as safety is concerned.
- Safe operational procedures for normal and abnormal circumstances
- Safety systems of maintenance, inspection and modification – some of which will involve the manufacturer's procedures which need to be bridged with the owner's.
- Systems of managing any changes to ensure safety
- Emergency response and rescue
- Incident investigation and reporting, corrective and follow-up action
- The method of performance review and auditing including review in the light of industry experience.

The Safety Management System (SMS) should ensure that all necessary linkages between system elements are identified.

4. BUSINESS FUNCTIONS RELATED TO SAFETY

Each owner and each third party contractor arranges their business functions differently depending on their activities and scope of operations. Most business functions contribute to safety; sometimes in ways that are only considered if the safety culture spreads throughout the organization with the guidance of upper management.

Some business functions that are sources of safety functionality are:

- Human Resource – hiring, medical fitness and competence
- Training –safety and induction
- Operations –electronic monitoring, power backup, etc.
- Procurement – ensuring safety critical equipment is procured specifying and resulting in equipment to appropriate standards
- Maintenance – of safety critical equipment (e.g. aircraft warning lights, ladders), and safety critical elements (e.g. ensure escape ways are clear).
- Engineering – management of change (including change in software if the safety depends

upon software) etc.

- Documentation – up-to-date, as-built drawings, manuals, etc.
- Finance – ensuring funds available for emergencies and prioritizing safety critical equipment
- Safety – ensuring the safety management system runs appropriately
- Environment – waste and pollution (for this case).

Each of these business areas should have their own written procedure to assure their part in the Safety Management System is being carried out, and that they and others know what they are responsible for, and what they are not responsible for, so that gaps can be identified.

5. DEMONSTRATION OF THE SMS

In order to demonstrate the extent and depth of the Safety Management System (SMS) it is useful to develop (for submission to stakeholders) a summary of the owner's system: the **Safety Management System Summary (SMSS)**. The Summary document may be part of the Safety Management System provided as an overview document embedded in the owner's SMS, or it can be kept as a stand-alone document which shows how the SMS works. The key here is to demonstrate the SMS process and keep this Summary document up to date for examination by the workforce and MMS at each inspection visit to the facility.

The purpose of the SMS summary (SMSS) is to describe the process of safety as carried out by the owner, and the workforce. The summary documents may be separated for pre-construction, transportation, construction/installation, for on-going operations and maintenance, and decommissioning. The process should include providing explanations of how the following actions are handled:

- Identification of the sources of the safety hazards involved in pre-construction, transportation, construction, installation, operations and maintenance, and decommissioning of the offshore wind farm.
- Assurance that the risks associated with hazards and sources of hazards have been assessed and that the controls (documented and experience-based work practices) within the owner's safety management system are effective.
- Identification of how identified gaps in the owner's safety management system relating to workplace hazards including overall failure and occupational safety concerns are surfaced, resolved and the results incorporated into improving the system.
- Verification to ensure that identified risks are reduced to a level that does not exceed the reasonable limits for safe operations.
- Demonstration of compliance with safety requirements of applicable regulations (vessels at the OCS lease may be under the jurisdiction of marine authorities while fitting into the framework of the owner's safety management system).

This Summary document (SMSS) provides a suitable submittal document for the purposes of assuring safety. The document should be kept up-to-date with an annual review and a comprehensive review after 5 years. The Summary document together with updates and a Risk Register noting changes, if available at the owner's field office, with its contents familiar to the workforce, would provide an appropriate demonstration of the Safety Management System.

5.1 SAFETY MANAGEMENT SYSTEM EXPECTATIONS

While the result of completing a summary of the SMS systems (SMSS) based on this Template provides internal assurance for the owner, it also provides assurances to external stakeholders that risks of safety matters are suitably addressed.

5.1.1 Senior Management Demonstration of Commitment

The owner's senior management should be able to demonstrate from their Safety Management System that the following is in place:

- An established Safety Management System within the offshore wind farm activities;
- Potential hazards have been identified and risks associated with these hazards have been identified, assessed and managed within tolerable limits;
- The offshore wind farm installation is in compliance with all mandatory rules and regulations.

The following would demonstrate that these expectations are achieved:

- Provide a brief summary of the Owner's organization including: - name and address of head, region and or field offices - history and relationships with parent company (if applicable) – activities within the various operations provided;
- Provide a description of the arrangements (such as described in this Template) for providing assurance and verification that the expectations as outlined above are met;
- Provide a description of how the document demonstrating the above is kept current;
- Identify the positions with overall ownership and responsibility for the inputs to safety within the organization: (e.g. documentation to ensure that policies are in place to address safety issues, practices in place to assure procurement of safe contractors and safe equipment to an appropriate quality standard is procured etc.);
- Identify the positions with responsibility for ensuring that the Safety Management System is implemented and complied with;
- Identify the positions with responsibility for updating and periodically reviewing the changes in the Safety Management System and a brief description of these responsibilities;
- Identify the schedule on which these plans and the SMS summary document (SMSS) is formally reviewed;

The owner's Safety Management System (SMS) should demonstrate it has criteria and arrangements for reviewing and updating the SMSS information for:

- changes in requirements of qualification of personnel for key positions;
- changes in requirements for training of personnel;
- changes in the operation or equipment which significantly affect the overall risk;
- significant changes to manning levels or the organizational structure;
- significant changes to the owner's safety management system (or industry standards) referred to in the documentation;

- lessons learned from incidents that may alter the results of existing risk assessments or barriers to the hazard or consequence;
- changes in legislation / regulatory requirements;
- results from audits that may alter the results of existing risk assessments or risk management barriers;
- results from internal worker or other safety meetings that may alter the results of existing risk assessments or risk management barriers;
- expiry of the owner-specified review interval.

The following would demonstrate that these expectations are achieved:

- Provide a statement of the owner's policy and stated commitment to review and update the SMSS documentation on a specified interval;
- Provide a description of the arrangements (including responsibilities) for reviewing and updating the SMSS information.

It is of significant importance to have a commitment from upper management to transport, construct, install and operate the wind farm in accordance with the arrangements detailed in the Safety Management System and as summarized in the SMSS document which should contain:

- A statement that there is an effective management system in place for systematically managing all safety hazards;
- A statement that a rigorous process has been applied to identify potential hazards;
- A statement that the risks associated with these hazards (both major and other workplace hazards) have been identified, assessed and are being managed to a tolerable level;
- A statement that all the relevant regulatory safety requirements are being complied with;
- A commitment to complete all agreed corrective actions identified;
- A statement of the senior management commitment to operate the offshore wind farm in accordance with these statements.
- A signature of the senior executive responsible for safety.

5.1.2 Continuous Improvement

A key element in the SMS will be a demonstration that the Owner is committed to continually improving the management of risks and environmental impacts associated with wind farm operations.

The following would demonstrate that these expectations are achieved:

A statement by the Owner's stating a commitment to continuous improvement, by providing information about:

- applying and contributing to the identification and development of industry standards and best practices (e.g. industry groups that inform and alert to issues of safety concerns);
- participating in the development and/or improvement of industry standards and promulgating any appropriate safety alerts;

- reviewing and assessing the application of new regulations and implementing necessary changes within their management system.

5.1.3 Action Plan / Recommendations

As part of an action plan the owner should demonstrate the recommendations and gaps in safety performance are addressed. These recommendations and gaps would include those identified as part of the risk assessment process; follow-ups and close-out agreed corrective actions from the risk assessments; Job Safety Analyses; or from the worker safety meetings .

The following would demonstrate that these expectations are achieved:

- Provide information on the arrangements for the review of recommendations identified during the risk assessment process, including:
 - References to the incident investigation or other sources from which each recommendation originated;
 - Arrangements for follow-up and close-out of agreed corrective actions, including:
 - Persons/positions responsible for implementing each recommendation;
 - Target dates for completion of each recommendation;
 - Arrangements for verifying the close-out of all recommendations;
- Provide a description of arrangements to establish and maintain compliance with applicable regulatory requirements.

5.1.4 Safety Management

It is appropriate to confirm that effective management of the SMS has been implemented and is maintained.

The following would demonstrate that these expectations are achieved:

- Provide a description of arrangements for monitoring/auditing and confirming that management of the SMS has been implemented and is maintained.

5.1.5 Environmental Impact and Aspect Assessments

During each phase, pre-construction, transportation, construction, installation, operations and decommissioning there will be potential to pollute either from the wind tower contents, or the attending vessels. It is important to provide confirmation that the Owner has systematically identified and assessed all pollution impacts and aspects associated with the offshore wind farm.

The following would demonstrate that these expectations are achieved

- Confirmation that systematic pollution identification and assessment has been carried out;
- Confirmation that the associated risks have been reduced to meet or exceed regulatory environmental requirements.

5.1.6 Audits

The SMSS document also forms the basis for ongoing audits of the facility and its operation throughout its life. Key aspects of inspection/auditing by MMS will be to monitor the effectiveness with which the commitments to safety as described by the SMSS are being implemented, monitor the effectiveness of the owner's audit of the SMS, and to critically examine the efforts made by management to actively involve the workforce in the SMS process.

6. CONTENT OF THE SAFETY MANAGEMENT SYSTEM

The Safety Management System Summary document (SMSS) can be developed using this Template to demonstrate that safety objectives are met.

This Template serves to prompt the issues through which documentation describes the owner's safety management system. To build a safety management system it is helpful to outline in the documentation what is:

- Planned – what objectives exist, what procedures and standards are in place;
- Organized – who is responsible for conducting the procedures, to what level and expected outcome;
- Implemented – how are the procedures implemented, resourced and how are competencies of personnel ensured;
- Controlled- how the system is monitored, and reviewed and the results are used to update and improve the system's ability to produce the desired outcome;
- Confirmed – through audits.

The linkages between the various different departments and business functions is also important to ensure no communications gaps i.e. ensuring that where changes occur in work systems that the changes are recorded, everyone needing to be is informed and the system adjusted accordingly.

Demonstrating that the safety objectives are met through a risk analysis is part of the exercise and this may identify additional controls to meet safety management objectives. Identified controls should be incorporated in the Safety Management System prior to commencement of work whether for pre-construction, transportation, construction, installation, operations or decommissioning.

The safety management system will also either incorporate or refer to Marine Procedures, and Site-Specific Assessments for certain vessels on the lease. This is all part of the overall safety management system. Site-specific requirements/ guidance for reference in the owner's and third party's site acceptance criteria are given in Appendix A: this is particularly useful for gathering information prior to construction and during construction and operational repairs. Some suggested Marine Procedures are given in Appendix B.

6.1 TYPICAL CONTENT OF SAFETY MANAGEMENT SYSTEM DOCUMENTATION

The following is a typical table of contents of the SMS documentation. It is given as a guide to some of the provisions of the content of a Safety Management System.

SAFETY POLICIES OF THE COMPANY

Smoking

Drug and Alcohol Policy

Following Manufacturer's Transportation, Installation, Operations and Maintenance Manuals

NO Bypassing of Safety Systems

Policy of working in Teams for Safety: minimum and maximum numbers in tower, on ladders, No Lone work etc.

Policy related to critical equipment for safety of public, safety of personnel (incl. procurement Policy, signs, lights, underwater cables)

Policy related to Emergencies

ORGANIZATION, RESPONSIBILITIES, AND RESOURCES

Organization

Owner Organization & Contact #'s/ Subcontractors /Equipment suppliers/ Manufacturer, Maintenance etc, incl. Safety Organization

Document Management - Quality, Safety, Instruction Manuals by Manufacturer, Changes and Communication of Changes etc.

Workforce Participation in Safety/ Information/ Feedback

Field Unit Organization & Contact #'s/ Subcontractors /Equipment suppliers/ Maintenance etc. incl. Safety Organization

Responsibilities

Senior Management Responsibility

Line Management Responsibility

Individual Responsibility

Safety Critical Roles

Regulatory Requirements

Resources

Safety Resources

Safety Committee Representation

Shore-based and Office Support

Contractors and Contractor Third Parties: Requirements for safety management system

COMPETENCE & TRAINING

Competence

Medical Audits for Fitness for Duty

Selection of Owner's Personnel

Selection of Contractor Personnel

Qualifications of NDT Inspectors, Welders and Blade Repairers, Condition Monitoring personnel, Maintenance Personnel etc.

Qualification and Competence particularly in Rope Access, Rotating Equipment, Electrical

Emergency Rescue and Medical Support

Competence Assessment and Records

Training

Induction Program

Safety Training Provided incl. Marine Survival training

Training in using equipment and tools

Training in tracking tools on the job

Training of bolt tighteners

Rope Access Training and Competence (Ref. ANSI, supplemented by IRATA, and/or SPRAT)

Training for Emergency

Awareness training provided (e.g. for reporting potentially safety critical items).

Accreditation (if any)

STANDARDS AND PROCEDURES

Planning and Risk Management

Hazard Identification for field and through each Work Phase

Safety Critical Equipment list – e.g. foghorns, lighting, warning devices, tower, lighting and fire protection; ability to detect outage; and ensuring critical equipment properly specified.

Assignment of Person responsible for each piece of identified safety critical equipment e.g.

foghorn, aircraft warning lights, lifting register

Management of Change

Tracking Changes incl. change of suppliers; changes affecting design or procedures
Engineering/ Risk Assessment check of Changes

Emergency Preparedness and Response

Hazard Communications Plan - incl. information on any hazardous issues e.g. ice, discovered flaws

Crisis Management - who does what; ability to contact

Emergency Resources including Medical Support

Emergency Response - incl. location of nearest facilities; contact numbers; location of litters

Emergency Drills

Rescue from Heights including from inside towers

Rescue of fall arrested persons

Hurricane Contingency

Incident Notification

Reporting of Incidents and Near Misses

Permit to Work System

Permit to Work

Shutdown of Turbine prior to Boarding

Mitigating Consequences of Runaways

Lock Out Tag Out

Location of LOTO Provisions

Energy Isolation

Conditions i.e. Signage

Recording communication method: e.g. cell phone # or marine band radio frequency

Tracking of Personnel

SAFE WORKING PRACTICES

Short Service Employees

Personnel Protective Equipment

During Marine Transportation

At the Turbine

Lifesaving Equipment at the tower including ring life buoys, lifejackets, immersion suits (if any and if appropriate)

Hearing Conservation – Noise

Heat Stress

Cold Weather

Respiratory Protection

Confined Space Entry

Calibration of Atmospheric Testing Instruments (if applicable) (when, how, who, and records)

Diving Safety: 46 CFR Part 197 Subpart B: Commercial Diving operations; Association of Diving Contractors International (www.adc-int.org) Consensus Standards (currently in 5th edition).

Electrical Safety - U.S. Dept of Energy, Electrical Safety Handbook, DOE-HDBK 1092-98; Dept of Health and Human Services, National Institute for Occupational Safety & Health (NIOSH)

Electrical Safety: Safety & Health for Electrical Trades www.cdc.gov/niosh, Cincinnati Ohio.

Mechanical Lifting & Material Handling

Crane Operations

Winch Lines

Rigging Register

Rigging Certification - possible color codes/tags

Lifting tools and materials into nacelle from boat

Personnel Lifting Operations (Man-Riding)

Working at Heights

Personnel fall arrest systems ANSI Z3591

Tower

Out of Tower

Working above electrically energized cables

Rope Access outside Tower or on Blades; qualification /inspection of safety harness attachment points

Scaffolding

Ladders

Standards and inspection requirements used for personnel nets/baskets (if applicable)

Work vests or lifejacket when working over water (if applicable)

Guarding of Deck Openings

Boarding Procedure

Helicopter Operations (if any)

Machine Guards

Compressed Gas Cylinders

Communications

Fire Protection - portable if applicable

Hand/Power Tools - operation and tracking location

Hot Work: Welding, Cutting, Grinding and Burning

Bolt Tightening

First Aid

Distance - and procedure in case of a runaway

Lightning – Warning, Protection, Safe Locations

General Housekeeping

Pest Control and Extermination

Provision of Potable water and Potable Water Testing

Food and Temperature Storage (e.g. offshore Control station)

Hazardous Materials/Inventory

Flammable Material

Eyewash Station

Hazardous Materials - Material safety data sheets

Handling and Mixing of Chemicals and Paint

Security

Security of the field – incl. underwater cables

Security of each tower

Security of computer systems- supplying power to grid

Posting of Information at Each Turbine

Safety Equipment/ Procedures

T-Card system to track personnel at the wind farm installation - for construction phase particularly

Right to Stop the Job

Ventilation

Inventory of Safety Equipment at Tower-

Means of Escape e.g. for turbine, procedure for top hatch and bottom door for fire with personnel in the Nacelle as with both hatches open may act like a chimney

Lighting/ Emergency Lighting

Lighting, Marking and Warning

Collision Potential - survey of traffic; Confirm Lighting, Marking, and Foghorns.

Signage and Warning for those entering the confines of the field - e.g. fisherman

Safety Critical Equipment

Electronic Defibrillator

Safety Meetings

Job Safety Analysis

Safety Meetings & Feedback

Daily Operations Meetings

Safety Alerts and Bulletins

Signage and Warning for Field Personnel

Bulletin Boards

Safety Information - incl. near misses

Safety Alerts from Industry incl. accidents

Environmental Management & Protection

Environmental Management Plan
Inventory of Hydraulic oil, Lubricating oil, Mineral oil (for transformers), paint etc.
Environmental Protection
Spill of Fluids Response Plan

Waste Management

Waste Management Plan
Garbage
Construction and Repair Waste
Toilet Facilities

Management of Subcontractors

Minimum requirements of safety systems for subcontractors incl. safety management system;
quality control of equipment affecting safety; any adverse effect on owner/operator's safety
management system

Procurement Management

Safety Critical Equipment – ensuring attention
Specification of Critical Equipment (Bolts)

Maintenance Management

Safety Critical Equipment – maintenance by periodic and condition monitoring scheme
Spares

Simultaneous Operations

BRIDGING DOCUMENTS (See Appendix C)

Marine Operations

Adverse Weather
Support Vessels
Site Assessment – Criteria for airgap and survival
Floating Systems- Criteria for Mooring

Engineering Management

Items /Changes requiring P.E. authorization

PERFORMANCE MONITORING

Accident Reporting and Analysis

Environmental Monitoring and Measurement

Recordkeeping

Risk Assessments
Certification
Test and Commissioning Reports
Training Records and Certification
Safety Reports – Lagging (after the fact) Key Performance Indicators (KPI)
Safety Action Item Lists - tracking issues
Documentation of Competence & Training
Safety equipment - inspection records
Safety equipment - testing e.g. emergency lighting, lifts, hoists and fire extinguishers
harnesses, fall arresters, shock absorbers etc.
Safety Equipment - logs and documentation
Safety equipment - repair records
Safety Inspection Periods - Equipment inspected weekly, monthly, annually, or at longer
intervals. – List
Investigation of Accidents and Incidents

Safety Management

Safety Auditing - Internal, External -Audit compliance and Feedback mechanism
Audits - Periodic Inspection by Whom?
Management Review and Improvement
Annual Safety Plan - providing goals

Documentation - Plans, Schedules, Safety Design Basis

Pre-Construction Information

Construction Phase Plans
Drawings
Design Documents
Specifications

Note: MMS Requirements or Ref: USCG Requirements (Subchapter N) may be a responsive citation

6.2 POLICIES AND OBJECTIVES

6.2.1 Policies

It is expected that the policies demonstrate that senior management has established clear expectations for safety management objectives.

The following would demonstrate that these expectations are achieved:

- Provide documents that show the policies which clearly state the company's expectations and providing details of the company health (fitness for duty), safety and environmental (oil spill and waste) policies;
- Provide the document that clearly states commitment to comply with the Owner's written policies, procedures, and standards; relevant safety regulatory requirements and standards; and local or regional policies.

Certain policies may be written by the senior management and included in this section since they are of key importance i.e. Drug and Alcohol Policy; following the manufacturer's instructions (since bypassing the manufacturer's safety system may easily lead to a fatality e.g. in bypassing the braking systems); policy related to ensuring that teams of 2 or more are in the towers; policies related to ensuring that safety critical equipment has spares, and is replaced with some urgency i.e. fog horn, aircraft warning lights etc.; policies related to ensuring the safety of personnel public and workers; and policies related to emergencies e.g. rescue from heights during a rope access inspection needing an instant ability to respond.

6.2.1 Objectives

It is expected that the organization maintains safety objectives against which the organization can be measured.

The following would demonstrate that safety objectives have been formulated and actions being taken to achieve them.

Provide information to show what safety management objectives have been set and what arrangements there are for communicating and cascading the safety management objectives through the organization.

6.3 ORGANIZATION, RESPONSIBILITIES, AND RESOURCES

6.3.1 Organization

6.3.1.1 Organization

An organizational structure with the appropriate business functions identified in the safety chain is important to ensure compliance with the policies to achieve the safety management objectives. The organizational structure should set out how individual and collective responsibilities between owners, constructors, contractors, manufacturers, maintenance contractors and other participants/ stakeholders

are defined.

The following would demonstrate that these expectations are achieved:

- Provide organization charts showing the owner's management and support team structure, how subcontractor's fit in including manufacturers, maintenance suppliers and contact details to enable compliance with the policies and achievement of the safety management objectives;
- Provide details of safety management responsibilities assigned to organizational positions. When safety of the system depends on equipment suppliers for safety critical equipment i.e. navigation lights, and maintenance organizations, details of their organizations and contact information should be provided;
- Provide information on the process for developing and preparing a joint bridging document with the involvement of all participants in the activities before starting operations when more than one company or vessel is involved in an operation. This is particularly important when multiple vessels and contractors are in the field together or personnel under different supervisory situations are in the turbine tower or other field location together. If different policies apply, the governing policy should be decided upon and stipulated. This is particularly important when multiple vessels are in the field together as occurs during construction and installation. It is also particularly important when policies of the manufacturers' are proposed, and these are different than those of the owner: providing written agreement to the mutually accepted way forward is an important aspect of the bridging document allowing understanding by all parties (See Appendix C).

6.3.1.2 Document Management

It is a fundamental cornerstone of safety that relevant, accurate and up to date safety documentation is readily accessible; that electrical and other plans reflect the as-constructed arrangements; information providing quality control requirements can be found when ordering safety critical equipment; that the latest version of the equipment manufacturer's instruction manuals can be located; that any changes in the field are reflected in the documentation; and to assure that safety documentation that is updated is communicated into the field.

The following would demonstrate that these expectations are achieved:

- Providing information about the owner's effective document management system: description of the document management system. The document management system should include documentation on software including details of up-dates carried out;
- Providing information on the clearly defined system for developing and revising documents: providing a description of how the safety documentation (including areas mentioned above) is revised and updated to reflect changes in the Owner's organization, systems, equipment, etc. and to reflect any changes in the systems – i.e. up-to-date as-built drawings;
- Providing a description of the ownership of the documents and authorities for reviewing, issuing and withdrawing documents and communicating with personnel about the changes.

6.3.1.3 Workforce Participation

Involvement of the workforce which actively participates in safety management activities, including safety meetings, job safety analyses (JSAs) and tool box talks prior to jobs starting etc is expected and a fundamental building block of safety.

The following would demonstrate that these expectations are achieved:

- Provide the information on arrangements for programs that recognize the workforce's participation and contribution to meet safety management objectives;
- Provide details of the JSA process.

Explanation as Example: The JSA process normally defines the task to be performed in detail. It designates who is in charge of coordinating the procedure, the team members that are relied upon, the members of the supporting group, a list of the equipment or tools needed for the job, and the methods of communicating and reporting during the job. The procedure is normally laid out step by step with timings. The procedure is then analyzed by the workforce and supervisor, identifying all known hazards, and procedures to control them ensuring that all parties are aware of the risks and the mitigations. Developing procedures to compensate for potential mistakes is also part of the JSA process. Reviewing, critiquing and documenting any changes to a set procedure in light of the experience in carrying out the task allows improvements to be made over time. Usually JSA Tasks are mandated for routine tasks and reviewed prior to the task being performed. Some of these required JSAs may be whenever a crane is used, or maintained, when there is a confined space entry, when commissioning new equipment to ensure all personnel are trained in its operation and maintenance etc., when mooring vessels, when carrying out hot-work in the Tower. Such standard JSAs may be part of the documented system.

6.3.1.4 Organizational Responsibilities

A documented structure for managing safety on the offshore wind farm for which roles and responsibilities are defined is an expected part of any suitable safety plan.

The following would demonstrate that these expectations are achieved:

- Provide documentation of the structure in which the senior Marine Supervisor/ Construction Supervisor/ Maintenance Supervisor (depending on phase and activity) and his crew work effectively together with respect to safety risks in the field. The Owner determines who has overall control and responsibility at the wind turbine structure, and for the wind turbine functions. The vessels in the field and the safety of the people who board the wind turbine will be the charge of the Master or designated marine person-in-charge (depending if one or more vessels are in the field). The overall control and responsibility for the management of the safety risks and associated activities should be documented. This relationship and the relevant responsibilities need to be defined, understood, agreed, documented and communicated to all relevant workers (see Appendix C);
- Provide information on arrangements for written documentation of the workforce participation, the safety meetings (with documentation); and the method of recording employee concerns in the Risk Register and/or safety action list as appropriate;
- Provide information on the written arrangements defining the supervisory roles and responsibilities particularly in simultaneous operations; definition of the provisions for ensuring subcontractors making adjustments/ changes in the equipment which could relate to safety concerns are adequately documented through a "management of change" procedure. This may apply to software and changes to software if the safety of the wind turbine structure is dependent on power and software performing appropriately;
- Provide documentation of the responsibilities for safety among the field unit teams with appropriately documented systems e.g. documenting the minimum requirements for communications between field workers prior to continuing with the maintenance operation underway together with information on communication devices and their backups.

6.3.2 Responsibilities

6.3.2.1 Senior Management Responsibility

It is expected and important to safety to ensure that senior management has established safety management responsibilities embedded in a documented system for the organization's business activities.

The following would demonstrate that these expectations are achieved:

- Providing a summary of senior management's responsibilities in safety management activities which shows their commitment to safety initiatives;
- Identifying the senior management positions with safety critical activity responsibilities and identifying how they will stay informed of safety deficiencies (e.g. procurement has the ability to ensure that appropriate specifications of safety critical equipment are issued, and suppliers do not provide sub-standard quality in the products upon which safety depends); (e.g. the responsibility for developing and promulgating bridging documents should be the responsibility of a senior management position);
- Confirming the method by which senior management stays aware of deficiencies in safety critical equipment.

6.3.2.2 Line Management Responsibility

It is expected that safety is an integral part of the line management's responsibilities.

The following would demonstrate that these expectations are achieved:

- Details of line management's safety responsibilities particularly for safety critical activities and authorities.

6.3.2.3 Individual Responsibility and Authority

It is expected and important to ensure that each individual knows and understands his or her responsibility and authority for safety and that any safety critical activities are communicated to the individual responsible in the documented system.

The following would demonstrate that these expectations are achieved:

- Provide information on the arrangements for ensuring safety responsibilities and authorities are established for employees, contractors, and 3rd parties at the Owner's locations (including at the offshore turbines and control locations) in each phase including pre-construction, transportation, construction, installation operations and decommissioning;
- Provide information on the individual positions with safety critical activity and equipment responsibilities.

6.3.2.4 Regulatory Requirements

Regulatory compliance is an expected part of the safety system not only for the OCS site, but also for the attending vessels, equipment, divers, and cable laying activities etc. as well. It is important to ensure that the equipment is not installed if it is damaged in transportation. The Certified Verification program is part of the assurance of regulatory requirements for the MMS, but a number of other agencies have jurisdiction over the fleet of vessels that may be part of the overall system. Assurance is

necessary to demonstrate that relevant regulatory requirements are complied with.

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements and responsibilities for identifying and advising on relevant regulatory requirements;
- Provide information on arrangements for ensuring that the requirements are being complied with.

6.3.3 Resources

6.3.3.1 Safety Resources

Adequate and available resources are expected, in order to adequately provide a suitable safety management system.

The following would demonstrate that these expectations are achieved:

- Provide information on knowledgeable and experienced individuals the owner has designated to be responsible to carry out safety management activities;
- Provide information on appropriate documentation, training and development for employees and contractors in company safety standards and practices (refer to competence and training section if appropriate).

6.3.3.2 Safety Committee Representation

Safety committee arrangements and suitable safety representation from the workforce are expected to effectively implement the safety management system.

The following would demonstrate that these expectations are achieved:

- Provide information on how you encourage and support the establishment of safety committee arrangements and formal safety representatives, with feedback on potential safety issues. Describe the training given for the safety representative in the field, and arrangements for meeting and documenting and tracking issues for follow up and close out;
- Provide information on how safety information on owner's and other wind farm incidents, accidents and near misses is provided to the safety representatives to ensure they take account of these experiences (e.g. distributed information from AWEA, BWEA etc, information on safety from internet /conferences and other sources).

6.3.3.3 Support

Some support resources are expected in the organization to adequately meet the senior management safety objectives.

The following would demonstrate that these expectations are achieved:

- Provide information on what support functions are required for safe operations and what competence in safety systems is provided for person(s) carrying out the support functions;
- Provide information on emergency support functions i.e. relationship and preparedness of working with US Coast Guard or other appropriate agencies in case of a requirement for emergency response.

6.3.3.4 Contractors, Manufacturers and Other 3rd Parties

Safe and effective working relationships are important and expected with the manufacturer, Owner's contractors, other 3rd party contractors, and offshore wind farm clients with regard to safety management.

The following would demonstrate that these expectations are achieved:

- Results of identification and agreement of safety management interfaces, responsibilities and authorities between wind farm owner's organization and construction and/or maintenance contractors or other 3rd parties. (e.g. Bridging documents – Appendix C);
- Arrangements for communicating the agreed arrangements to the relevant personnel so they know their responsibilities on the interface arrangements;
- Arrangements for monitoring and regularly reviewing, with the construction and/or maintenance contractors and other 3rd parties, the effectiveness of the interface arrangements.

6.4 COMPETENCE AND TRAINING

6.4.1 Competence

6.4.1.1 Medical Audits and Fitness-for-Duty

Some of the work involved with offshore wind farms is strenuous and requires a higher level of fitness i.e. climbing ladders 140 meters, performing rope access work, hanging at heights on wires etc. It is expected that there would be an employee, and contractor selection process that ensures personnel are medically fit to perform their job safely.

The following would demonstrate that these expectations are achieved:

- Provide information on the medical requirements for personnel in field positions or other positions which are critical to safety;
- Provide information on the method for ensuring that personnel are medically fit for the position they are being assigned.

6.4.1.2 Selection of Owner's Personnel

It is expected that an employee selection and assignment process will be in place that ensures personnel have the appropriate qualifications, experience and ability to perform their job safely and effectively with regard to safety management.

The following would demonstrate that these expectations are achieved:

- Provide information on the positions and competencies required for each of the positions with safety critical activity responsibilities (e.g., Field manager/ Construction manager, Service Manager, Lead Service Technician, Service Technician etc); hazardous activity responsibilities (e.g. rope access supervisors and personnel); and each of the positions with environmental (waste and pollution) oversight responsibilities.

(As an example only: Service Technician, Lead Service Technician, and Service Manager may meet the following requirements:

1. Service Technician

The Service Technician shall have performed maintenance on wind turbines, generators, gearboxes, and associated equipment and shall be able to locate and correct electrical and mechanical problems within a wind energy facility.

The Service Technician shall be able to perform maintenance within the wind generation facility in a safe, efficient, and professional manner.

The Service Technician shall be responsible for the maintenance, repairs, and inspection of wind turbines, generators, gear boxes, switchgear, and vibration monitoring equipment to maintain a high reliability factor.

The Service Technician shall have the skill to analyze and initiate corrective action on outages and troubleshoot service related problems.

The Service Technician shall have the skill set to safely operate and maintain tools and equipment assigned, according to owner's policies and procedures.

The Service Technician shall be capable of operating personal computers, hand held programmers, communication equipment, mechanical, electrical, and electronic test equipment, hand tools, electric hand tools, and precision measuring tools, (micrometers, dial indicators, etc.).

The Service Technician shall be able to lift/carry up to 100 pounds on a daily basis.

The Service Technician shall be physically and mentally able to climb and work on wind turbine equipment inside and outside of the nacelle; which will be in excess of (300) feet in the air on a daily basis.

The Service Technician shall hold a two-year degree in a technical (electronics, electrical, or mechanical) discipline, and shall have five (5) years of experience with mechanical, electrical, electronics, and instrument control systems (SCADA), wind energy facility operation and maintenance experience, or shall have a High School Diploma/GED, and seven (7) years of experience with mechanical, electrical, electronics, and instrument control systems, wind energy facility operation and maintenance experience.

2. Lead Service Technician

The Lead Service Technician shall, at a minimum, meet or exceed the following requirements:

Meet the requirements of the Service Technician, and in addition, the Lead Service Technician shall have the qualifications set out below.

The Lead Service Technician shall hold a four-year degree in a technical (electronics, electrical, or mechanical) discipline, and shall have seven (7) years of experience with mechanical, electrical, electronics, and instrument control systems, wind energy facility operation and maintenance experience, or shall have a High School Diploma/GED, and ten (10) years of experience with mechanical, electrical, electronics, and instrument control systems, wind energy facility operation and maintenance experience.

3. Service Manager

The Service Manager shall, at a minimum, meet or exceed the following requirements:

Meet the requirements of the Lead Service Technician, and in addition, the Service

Manager shall have the qualifications set out below.

The Service Manager shall hold a four-year degree in a technical (electronics, electrical, or mechanical) discipline, and shall have ten (10) years of experience with mechanical, electrical, electronics, and instrument control systems, wind energy facility operation and maintenance experience, or shall have a High School Diploma/GED, and twelve (12) years of experience with mechanical, electrical, electronics, and instrument control systems, wind energy facility operation and maintenance experience.

Note: this is only an example for guidance: the qualifications and experience levels may be different)

- Provide information on defining the procedure for assessing the individual competency as part of the selection and assignment process for the positions above, including the requirements for short service employees (e.g. employees employed for less than, for example, 3 months in a similar position at this offshore wind farm, unless the employee comes from the same owner's offshore wind farm with exactly the same safety policies/ procedures etc). Clarify the company policy as to whether short service is defined as time in the industry, or with the type of turbine at the installation, or with this specific company/ owner.

6.4.1.3 Selection of Contractor Personnel

It is expected that the Owner uses contractors with a robust safety management system.

The following would demonstrate that these expectations are achieved:

- By applying the policy and providing a statement that the same selection process is applied to the selection of contractor staff assigned to positions with safety critical responsibilities /hazardous activity responsibilities and environmental oversight responsibilities;
- By providing information that the owner ensures that the contractors comply with the above policy.

6.4.1.4 Competence Assessment and Records

It is expected that personnel including Owner's, Contractors and 3rd parties have the necessary qualifications, knowledge, skills, and abilities to meet their responsibilities and perform their job safely and effectively.

The following would demonstrate that these expectations are achieved:

- Provide a description of the competence assessment arrangements for establishing arrangements for identifying both the general and specific (e.g. wind farm supervisor, technician, controller, NDT Inspectors, Welders & Blade Repairers, Maintenance personnel, Condition Monitoring personnel, rope access personnel etc.) competencies required to meet the responsibilities for each job function;
- Provide a description of the method of assessing individual competencies against the defined responsibilities for the job and identifying those individuals assessed as being "not competent" and who require additional training or experience;
- Providing a description of the performance appraisal system;
- Providing information on the maintenance of records of each assessment and appraisal;
- Providing a reference to the list documenting all identified safety critical/hazardous activities and environmental activities, the individuals who are assigned responsibilities for each safety

critical/hazardous or environmental activity, the required competence criteria, and verification that this competence has been attained and is current.

6.4.1.5 Emergency Rescue and Medical Support

It is expected that there will be available Rescue and Medical personnel that have the necessary knowledge, skills, and abilities to meet their responsibilities and perform their function safely and effectively should emergency rescue and/or medical support be required.

The following would demonstrate that these expectations are achieved:

- Description of the competence assessment of emergency support and emergency medical support personnel in the area (even if government supported) and provide action plan to supplement any shortfall in available services if they are insufficient for the activities anticipated in emergency;
- Description of periodic meetings, practice drills etc to ensure support agencies are aware of the responsibilities and have provided suitable support activities as required by the offshore wind farm presence.

6.4.2 Training

6.4.2.1 Induction Program

It is expected that there is a structured induction program to ensure all new personnel are informed of the Owner's safety policies, commitment and arrangements, and that appropriate refresher training is conducted for all personnel and that the safety management system has been adequately described to all appropriate personnel.

The following would demonstrate that these expectations are achieved:

- Provide description and details of the induction program for all new employees, contractors and 3rd parties.
- Provide details of the arrangements for refresher training periodically for those who have completed the initial induction.

6.4.2.2 Specialized Training

Certain job functions will require specialized training and it is expected that there is a plan to ensure that personnel are adequately trained to meet the requirements of their part in the management of safety.

The following would demonstrate that these expectations are achieved:

- Provide definition of safety training requirements for each job function;
- Detail the established arrangements for completing safety training for safety critical activity responsibilities, including familiarization of emergency procedures (e.g., evacuation, blade throw, rope access, rescue from heights, climbing ladders, transport vessel foundering, lifting etc.), in a timely manner after joining the field team at the offshore wind farm;
- Detail the established arrangements for completing safety training for hazardous activity responsibilities;

- Detail how records are maintained for safety training completed.

Specialized training may include:

- Safety Training using equipment and tools (e.g. torque wrenches; condition monitoring equipment etc.);
- Training in method used for tracking of tools (e.g. to ensure none left in a position to dislodge and affect the wind turbine functions);
- Training for tighteners (e.g. bolt torque is critical to ensuring an even transfer of load);
- Rope Access (training to comply with ANSI requirements plus guidelines of IRATA (Industrial Rope Access Trade Association) and SPRAT (Society of Professional Rope Access Technicians) or similar organizations);
- Training for emergencies;
- Marine Survival training (if appropriate – e.g. donning lifejackets etc.);
- Security training (e.g. offshore worker permit etc);
- Environmental cleanup training;
- Awareness training – to ensure all workers are familiar with Risk Register, safety representatives, with the sensitivity to understand why substitute parts cannot be used, to ensure that safety critical equipment is reported immediately etc.

6.4.2.3 Accreditation

As part of the documentation system the Records/ Certificates should be kept on file for personnel attending accredited courses i.e. Rope Access, Non-Destructive Testing, Blade Repair etc. The accreditation requirements for organizations carrying out training should also be on record.

6.4.2.4 References: Rope Access

1. ASTM Rope Access Standard (E 2505 - 07), August 1, 2007.
2. "Crane or Derrick Suspended Personnel Platforms" OSHA 3100 2002 (Revised).
3. CFR 1910.66 Fall Protection System.
4. CFR 1926.502 Fall Protection System Criteria and Practice.
5. CFR 1926.503 Training Requirements.
6. ANSI 289.1 20004 Helmets.
7. ANSI 2359.1 1992 Harnesses.
8. CE EN 361 EN 3358 Harnesses.
9. Cordage Institute C11810 Low Stretch and Static Life Safety Rope.
10. "Rope Access Technology: Engineers on a Thread", Beaufort 6 Magazine of Germanischer Lloyd Edition 2 – 2006.
11. Industrial Rope Access Trade Association (IRATA), "Safety Bulletin SB08 - Scaffold/Barrel Knot- Dangerous if Incorrectly Tied", www.irata.org.
12. Society of Professional Rope Access Technicians (SPRAT), Brochure, www.sprat.org.
13. Industrial Rope Access Trade Association (IRATA), "Safety Inspection Notice August 2008 Periodic Examination of Fall Protection Systems for Working at Height", www.irata.org.

14. Industrial Rope Access Trade Association (IRATA), "Training Scheme Flowchart", www.irata.org.
15. Industrial Rope Access Trade Association (IRATA), "Statement of Medical Condition - Pre-Assessment Requirements", www.irata.org.
16. Industrial Rope Access Trade Association (IRATA), General Requirements, www.irata.org.
17. Industrial Rope Access Trade Association (IRATA), "Guidelines on the use of Rope Access Methods for Industrial Purposes", www.irata.org.
18. Industrial Rope Access Trade Association (IRATA), "General Requirements for Certification of Personnel Engaged in Industrial Rope Access Methods", www.irata.org.
19. Industrial Rope Access Trade Association (IRATA), "International Guidelines on Use of Rope Access methods for Industrial Purposes", www.irata.org.
20. Industrial Rope Access Trade Association (IRATA), "Directory of Members", www.irata.org.
21. Jan Atwell Holan "Industrial Rope Access - Best Practices & Industry Standards", Ropeworks Ltd.
22. Jan Holan, Steve Beason, "Rope Access Equipment Testing- The back-up Safety System" , www.ropeworks.us.
23. Skala Wind Energy Services Brochure, "Blade and Tower Services by Rope Access", www.skalawind.com.
24. UK HSE "Height Safe: Essential Health and Safety Information for People who Work At Height", www.hse.gov.uk.

6.5 STANDARDS AND PROCEDURES

6.5.1 Planning and Risk Management

Proactive planning is an expected fundamental requirement to the achievement of a successful safety management system.

The following would demonstrate that these expectations are achieved:

- Provide the plan to show that prior to activity on the lease, that a risk assessment will be carried out for each phase of the work and all work activities within that phase, rating the risks of all planned work activities e.g. as High, Medium or Low. The plan should record the findings, and plans for mitigating the risk in a Risk Register available to all personnel on site;
- Provide information on how you plan to develop and implement wind turbine specific procedures which enable the organization or those attending the wind farm (in all phases e.g. pre-construction, transportation, construction, installation and operational phase etc.) to identify ongoing hazards, assess risks and establish controls to ensure that the risks are acceptable to the Owner, adding them, when appropriate to the Risk Register;
- Provide a list of the safety critical equipment that is developed in the risk assessment e.g. foghorn, aircraft warning lights, lifting equipment, monitoring system etc. upon which safety depends and state how the maintenance system prioritizes the safety critical equipment, and that the assigned persons responsible for maintaining each item of safety critical equipment understands their responsibilities;
- Provide a statement on how you plan to apply the procedures as appropriate for all routine and non-routine activities in operations and decommissioning involving owner, contractors and third-party representatives;

- Provide explanations as to the ability to muster resources for arrangements to develop task plans;
- Provide explanation for the arrangements for supervisors and other line management to monitor work activities.

6.3.2 Management of Change

Since changes often lead to safety issues, it is expected that changes in organization, procedures or equipment, or turbine structure/foundations will be assessed as part of the change control process.

The following would demonstrate that these expectations are achieved:

- Provide a description of the change management procedures to show the following:
 - Applying hazard identification and risk management principles is part of the change process;
 - Defining the roles and responsibilities for initiating and authorizing changes (i.e. wind turbines and their structures and foundations are quite complex and small changes may have significant effects that are not perceived appropriately by the field workforce);
 - Ensuring open consulting and effective communication with those affected by any change;
 - Ensuring that those responsible for safety critical/hazardous activities and equipment/structures and foundations accept and take ownership of any changes.

6.5.3 Emergency Preparedness and Response

It is expected that plans and arrangements for emergencies are in place to provide effective response to all reasonably foreseeable emergencies (including environmental incidents).

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements for developing and maintaining the emergency procedures after identifying foreseeable emergency scenarios ensuring that for each scenario, emergency plans and procedures for both offshore and onshore are developed and maintained. Details should include information on how to react to hazardous situations including ice, discovered flaws etc. and details of actions of each party;
- Provide information on arrangements (including communications) for ensuring the Owner's representatives are able to be contacted and can respond at any time to emergency situations;
- Provide details of arrangements for establishing contact with external agencies and resources i.e. location and contact numbers for nearest equipment (e.g. litters), nearest hospitals, life-flight helicopters, and other emergency evacuation facilities;
- Provide information on arrangements for identifying the personnel to carry out emergency response and ensuring the competence of personnel with emergency response responsibilities ensuring they are trained in emergency activities e.g. rescue from heights inside the tower, and outside the tower e.g. rescue of fall arrested persons or rope-access persons;
- Provide details of the emergency drills and exercise programs, including arrangements for reviewing and retaining records for practiced drills;
- Provide details of the medical support and first aid arrangements in the event of an emergency;

- Provide details of emergency notifications e.g. US Coast Guard, MMS, or persons in the vicinity;
- Provide details of incident and near miss reporting arrangements;
- Provide details of hurricane contingency plans or winter storm (as appropriate) including personnel safety details and safety of the offshore wind towers against collapse;
- Provide an awareness of the consequences of potential incidents e.g. workforce should be aware that an overspeed may lead to a tower collapse so as to protect themselves and others if this is anticipated.

6.5.4 Permit to Work System

It is expected that there is in place an effective Permit to Work (PTW) system for managing higher risk tasks and activities.

The following would demonstrate that these expectations are achieved:

- Provide a summary of the PTW arrangements for employees, contractors, and third-parties;
- Provide a definition of the criteria for determining the tasks and activities requiring a PTW;
- Provide actions for PTW areas e.g. shutdown of turbine prior to boarding; and safety actions to prevent runaways;
- Provide details of Lock-Out-Tag-Out so actions are not over-ridden particularly in relation to electrical items;
- Provide details of how energy isolation is provided;
- Provide details of signage necessary to indicate that turbine is under maintenance with personnel on board;
- Provide information on arrangements for pre-shift and pre-task (Job Safety Analysis (JSA)) meetings;
- Provide details of the PTW training provided;
- Provide details of communications during work e.g. communications from Nacelle to base, and communications from turbine structure to maintenance vessel;
- Provide details of the closeout process for PTWs.

6.5.5 Safe Working Practices

A method is expected that can demonstrate that safety management associated with tasks, activities and working areas is effective.

The following would demonstrate that these expectations are achieved:

- Provide details of how to distinguish short service employees from experienced personnel (e.g. those less than 3 or so months of relevant experience);
- Provide details of personal protective equipment (PPE) and training of personnel on the use of personal protective equipment noting that the equipment and training may change depending on the phase of the work and whether at pre-construction, in transit to the turbine, construction at the turbine location or at the location during operations of the turbine etc. Details of the PPE may include lifesaving equipment at the tower including for example ring lifebuoys, lifejackets and/or immersion suits (if any and if appropriate), hardhats, special boots etc. PPE details

- should include hearing conservation provisions, provisions for overcoming cold weather and heat stress; provisions for Respiratory Protection; and for confined space entry. When atmospheric testing instruments are used for confined space entry details should be provided in the plan for detailing the calibration process and calibration frequency for the instruments;
- Provide details of relevant standards to be used at location based on experience for carrying out similar jobs e.g., procedures, safety alerts, industry guidance, etc. e.g. diving protocols based on 46 CFR Part 197 Subpart B: Commercial Diving operations and, for example, Association of Diving Contractors International (www.adc-int.org) Consensus Standards (currently in 5th edition); Electrical work based on, for example, U.S. Dept of Energy, Electrical Safety Handbook, DOE-HDBK 1092-98; Dept of Health and Human Services, National Institute for Occupational Safety & Health (NIOSH) Electrical Safety: Safety & Health for Electrical Trades www.cdc.gov/niosh, Cincinnati, Ohio;
 - Establishing arrangements for conducting, recording, communicating and reviewing work practice assessments.

6.5.6 Environmental Management

It is expected that sound environmental performance will result from identifying the environmental hazards and controlling the environmental impact of activities and services, taking into account defined environmental policies and best available practices and technology.

The following would demonstrate that these expectations are achieved:

- Provide definition of the potential environmental risks for each phase e.g. pre-construction during observations of weather, birds etc; site investigation; construction; transportation; installation; operations and decommissioning;
- Provide data on volumes/inventory of hydraulic oil, lubricating oil, mineral oil (for transformers), paint, and any hazardous chemicals and quantities on the lease at any time;
- Provide details of any environmental specific management processes and the environmental protection plan for the wind farm including details of any oil pans, and like protections;
- Provide arrangements for emergency response including spill response to environmental incidents;
- Provide clarity of responsibilities for managing environmental issues;
- Provide detailed requirements and notifications required for any potential incident.

6.5.6.1 Management of Waste

It is expected that compliance with legal requirements, company policies and standards in relation to the environmental concerns of waste management can be demonstrated.

The following would demonstrate that these expectations are achieved:

- Provide details of the regulatory requirements and Owner's waste management policies and relevant waste tracking methods. Waste includes construction and repair waste, oil, paint, garbage, etc. for the wind turbine locations and for the vessels attending the offshore wind farm;
- Provide details of the waste management plan to include any anticipated toilet facilities at offshore wind turbine sites;

- Provide details of the garbage management plans for any vessels not under USCG regulatory authority for this item. (This is particularly applicable during construction and noting that there may be in place special provisions for handling waste from foreign flag vessels);
- Provide garbage management plan for any “control” structure that is offshore i.e. manned structure controlling the offshore wind turbines.

6.5.7 Mechanical Lifting and Material Handling

It is expected that all mechanical lifting operations and manual material handling on the offshore wind turbines are risk assessed and carried out safely, with minimum risk to personnel and the environment for each phase of the operation.

The following would demonstrate that these expectations are achieved:

- Provide details of provision of suitable lifting equipment and any certificates required and/or in place;
- Provide a summary of how mechanical lifting operations are managed including: the competence of crane operators, banksmen, roustabouts, etc. for each phase of the work including pre-construction, construction, installation, operations and repair particularly taking note of when personnel are under the lifted items;
- Provide information on responsibilities and organization of rigging register, and practices of rigging certification, e.g. color codes etc.;
- Provide details of inspection and marking systems for lifting and material handling;
- Provide details of lifting tools and materials into and out of the vessels to the nacelle (operations);
- Provide details of any personnel lifting devices and operations;
- Provide details of certification by qualified independent third party for cranes and mechanical lifting devices and details of those that are not certified;
- Provide information on procedures for rejecting consignment or delivery of non-conforming loads and scope of risk assessments carried out in determining acceptability for the lift;
- Provide details of communication arrangements for lifting operations;
- Provide details of supervision arrangements for different types of lifting operations;
- Provide details of supervision arrangements for safe deck management;
- Provide manual of material handling procedures;
- Provide details of responsibilities and authorities for manual handling and lifting operations.

6.5.7.1 References: Lifting Safety

1. Crane Safety Awareness, British Wind Energy Association (BWEA), Revision 0 (June 2007); Amendment 1 (Dec 2008) http://www.opito.com/library/bwea/bwea_crane_awareness.pdf.
2. Statoil Safe Use of Lifting and Transporting Equipment, <http://info.ogp.org.uk/liftingandhoisting/RPR/StatoilWR0235.pdf>.
3. NORSOK Standard Lifting Equipment R-002 Draft Edition 2 December 2008, [http://www.standard.no/PageFiles/11437/NORSOK R-002 Hearing, Edition 2 December 2008.pdf](http://www.standard.no/PageFiles/11437/NORSOK_R-002_Hearing_Edition_2_December_2008.pdf).
4. API RP 2D, Recommended Practice for Operation and Maintenance of Offshore Cranes.

5. OGP Recommended Practice References on Lifting and Hoisting, <http://info.ogp.org.uk/liftingandhoisting/RPR.html>.
6. Lifting and Hoisting Safety Recommended Practice, Report No 376, April 2006, International Association of Oil and Gas Producers, London, www.ogp.org.uk.
7. The North American Rigging and Lifting Handbook rev 2006, www.iadc.org.
8. Rigger Training, MMS OCS Crane Open Forum, http://www.mms.gov/cranes/Open_Forum.htm.
9. International Regulators' Forum Generic Report on Offshore Lifting and Mechanical Handling Issues, <http://www.mms.gov/International/PDF/IRFLiftingReport.pdf>.
10. OGP Lifting and Hoisting Safety, International Oil and Gas Producers (OGP), [http://info.ogp.org.uk/lifting and hoisting/Keys.html](http://info.ogp.org.uk/lifting%20and%20hoisting/Keys.html).
11. Notice to Lessees and Operators (NTL) of Federal Oil, Gas, and Sulphur Leases in the Outer Continental Shelf, Guidelines for Crane and Rigging Operations on Fixed Offshore OCS Facilities, NTL 2000-N-04, <http://www.mms.gov/ntls/PDFs/ntl00-N04CR.PDF>.
12. North Sea Offshore Authorities Forum Multi-National Theme Audit,"Lifting Equipment and Lifting Operations" NSOAF HS&E Working Group 17/4/2007.
13. Lifting Strategy, www.mms.gov/cranes/PDFs/MMSNationalLiftingStrategy.pdf.
14. Proceedings of Workshop on Crane Safety, Lafayette Louisiana 28 March 2000. www.mms.gov/cranes.
15. IADC Lifting Conference 2008, www.iadc.org.
16. "Safe Rigging - Set of Five Videos, www.iadc.org.
17. International Maritime Contractor's Association, Competence Assurance & Assessment, Guidance Document and Competence Tables, July 2003 www.imca-int.com.
18. Update to Findings and Recommendations of the Crane Accident Workgroup, www.mms.gov/cranes/1999.htm.
19. Lifting Incidents in the Gulf of Mexico, [www.mms.gov/cranes/Presentations/crane_\(rock4\).pps](http://www.mms.gov/cranes/Presentations/crane_(rock4).pps).
20. Crane Accidents-Fatalities-Injuries, <http://www.mms.gov/safetyalerts/1.htm>.
21. DNV, Standard for Certification No. 2.22 - Lifting Appliances, www.dnv.com.
22. Simple Guide to the Lifting Operations and Lifting Equipment Regulations 1998, UK HSE, <http://www.hse.gov.uk/pubns/indg290.pdf>.
23. A Need for Change, Crane Safety 2001, <http://www.mms.gov/cranes/Presentations/doncrane2001.PDF>.

6.5.8 Safety Procedures

It is expected that operating procedures which define how safety tasks and activities should be performed will be in a manual available to all employees, contractors etc.

The following would demonstrate that these expectations are achieved:

- Provide details of the safety tasks and activities that you have selected which require written procedures that are relevant, and clear;
- State how the safety procedures will be periodically reviewed.

Suggested items which may be provided are as follows:

- Fall Protection - Personnel fall arrest systems (ANSI Z3591)
- Tower
- Out of Tower
- Working above electrically energized cables
- Rope Access outside Tower or on Blades; qualification /inspection of safety harness attachment points
- Scaffolding
- Ladders
- Standards and inspection requirements used for personnel nets/baskets (if applicable)
- Work vests or lifejacket when working over water (if applicable)
- Guarding of Deck Openings
- Boarding Procedure
- Helicopter Operations (if any)
- Machine Guards
- Compressed Gas Cylinders
- Communications
- Fire Protection - portable if applicable
- Hand/Power Tools - operation and tracking location
- Hot Work: Welding, Cutting, Grinding and Burning
- Bolt Tightening
- First Aid
- Distance - and procedure in case of a runaway
- General Housekeeping
- Pest Control and Extermination
- Provision of Potable water and Potable Water Testing
- Food and Temperature Storage (e.g. offshore Control station)
- Hazardous Materials/Inventory
- Flammable Material
- Eyewash Station
- Hazardous Materials - Material safety data sheets
- Handling and Mixing of Chemicals and Paint

.....and so on.

6.5.9 Safety Communication

It is expected that there will be a suitable structure for communicating safety information throughout the organization.

The following would demonstrate that these expectations are achieved:

- Provide a description of the safety meeting/information dissemination structure and arrangements with defined responsibilities for sharing safety information company-wide and to relevant manufacturers/ contractors and other 3rd parties.

6.5.10 Observation of Safety Practices

It is expected that members of the workforce are encouraged to monitor safety practices through a structured observation process.

The following would demonstrate that these expectations are achieved:

- Provide details of the safety observation process and information on how safety issues can be reported and monitored by the workforce;
- Provide details of training and instruction given to employees and contractors on its application;
- Provide details of the arrangements for processing and reviewing issues identified through the process and feeding back the results to the people raising the issues.

6.5.11 Safety Alerts and Bulletins

It is anticipated that arrangements will be in place for issuing safety alerts and bulletins.

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements for issuing and responding to safety alerts and bulletins, arrangements for ensuring actions in safety alerts are followed up and closed out and sharing relevant safety information with others.

6.5.12 Offshore Wind Farm Security

It is expected that some form of security for the offshore wind farm will be required which may be legal requirements, company policies and/or industry standards.

The following would demonstrate that these expectations are achieved:

For each phase of the development, pre-construction, construction, installation, operations and decommissioning:

- Provide details identifying regulatory requirements, agreed exclusion zones (if any), and other security issues;
- Provide details of signage for each turbine structure;
- Provide details of owner's security standards related to the operations at the various stages of wind farm development and operations, in cooperation with the contractors and 3rd parties at the wind farm;
- Provide details for identifying if the wind turbine structure is temporarily manned;
- Provide details of the location security plan (as security measures allow);
- Describe the security issues in relation to each tower e.g. locking arrangements of tower access points when unmanned. When manned, accounting for potential safety of those workers inside;
- Provide information on posting of safety information at each wind turbine;
- Provide information on security of the computer system which may be critical in protecting the tower from failure (including preventing runaways);
- Provide information on establishing processes to review and update the security plan.

6.5.13 Simultaneous and Combined Operations

Contractor or 3rd party activities may introduce hazards into the workplace (or affect existing hazards), because of joint or simultaneous operations. Prior to these operations, the safety management interfaces will be assessed, and responsibilities and authorities clearly defined and documented in a Bridging Document (see Appendix C).

The following would demonstrate that these expectations are achieved:

- Provide information on internal arrangements for creating, agreeing and implementing safety management interfaces including defining the boundaries of responsibility and limits of authority (e.g. with a number of vessels in the field during construction, define who has the authority to direct a particular vessel to take an injured person ashore for an emergency, or who has authority to direct one set of workers to standoff until another set of workers has completed their work);
- Provide information on the Bridging Document that provides for change of authority for the Person-In-Charge;
- Provide information on arrangements for communication of relevant information about joint activities to operating personnel and the workforce.

6.5.14 Marine Operations and Site Assessment

It is anticipated that suitable arrangements are in place to ensure all marine operations will be carried out safely and effectively and with minimum impact to the environment.

The following would demonstrate that these expectations are achieved:

- Performing location specific assessments e.g., seabed for structure being installed and/or the installation vessels, mooring etc. to assure suitability of the equipment for the operating environment (See Appendix A for guidance);
- Ensuring personnel involved in marine operations are qualified, competent and trained to do the work;
- Providing relevant Marine Procedures for the operation (See Appendix B for details);
- Providing supervision for critical/hazardous marine activities.

6.5.14.1 Adverse Weather

It is expected that there are clearly defined adverse weather policies.

The following would demonstrate that these expectations are achieved:

- Provide information on the arrangement for systematically estimating probable meteorological and oceanographic extremes that may be encountered;
- Provide information on the established criteria for implementing precautionary measures and imposing operational limits, for example on the weather conditions to be on or near the offshore wind towers, conditions to be embarking or disembarking as well as limitations on the installation and other operational activities.

6.5.14.2 Support Vessels

It is expected that safety critical/hazardous activities associated with support vessels (installation, supply, personnel transport, repair etc.) are effectively managed.

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements for coordinating support vessels activities;
- Provide information on bridging documents developed;

- Provide information on arrangements for involving the support vessels in regular drills and exercises.

6.5.15 Engineering Management

It is to be expected that safety is a key consideration in engineering of the wind farm project.

The following would demonstrate that these expectations are achieved

- Description of the engineering project management process, which details the hazard and aspect identification, risk and environmental impact assessment requirements and develops relevant safety information.

6.5.16 Logistics Management

6.5.16.1 Personnel Tracking

It is expected that there are administrative arrangements in place to control and co-ordinate the movement of people to/from/ and in the offshore wind turbines.

The following would demonstrate that these expectations are achieved:

- Provide a description of the administrative arrangements for maintaining personnel movements and people on board (POB) data recording arrivals and departures from vessels, and within wind turbine structures and provide related information.

6.5.16.2 Helicopter Operations

It is expected that suitable arrangements are in place to ensure all helicopter operations on, or in connection with, the wind farm will be carried out safely and effectively.

The following would demonstrate that these expectations are achieved:

- Provide Information on the helicopter operation arrangements, weather limits;
- Provide helicopter procedure manuals addressing both routine and emergency helicopter operations (if any planned);
- Provide information on maintenance and inspection of any safety equipment associated with helicopter activities at the wind farm.

6.5.17 Oil and Hazardous and Radioactive Substances

It is expected that suitable arrangements are in place for handling and using oil products and hazardous and radioactive substances.

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements for ensuring relevant Material Safety Data Sheets are supplied with all oil and hazardous and radioactive substances;
- Provide information on arrangements for storing, handling and using chemicals and other hazardous substances (including radioactive materials);
- Provide information on arrangements for carrying out suitable risk assessments on the storage, usage and transportation of oil and hazardous and radioactive materials to minimize potential exposure;

- Provide information on arrangements for tracking and documenting usage and discharge of oil and chemicals in compliance with regulatory requirements;
- Provide information on arrangements for the selection, maintenance and use of Personal Protective Equipment (PPE) (including training) when appropriate.

6.5.18 Procurement Management

It is expected that purchased goods and services meet the relevant safety management requirements and are compliant with Original Equipment Manufacturer specifications.

The following would demonstrate that these expectations are achieved:

- Provide information on arrangements for selection and monitoring of vendor performance so far as safety and quality assurance arrangements for safety critical equipment purchased/leased;
- Provide information on arrangements for reviewing purchased goods and services against standards particularly for safety critical equipment;
- Provide description of spares philosophy for safety critical equipment;
- Provide arrangements for reporting design or manufacturing defects to vendors.

6.5.19 Maintenance Management

It is expected that arrangements are in place which ensure that the wind turbine, its equipment and in particular the equipment/systems which are safety critical, are effectively maintained.

The following would demonstrate that these expectations are achieved:

- Provide a description of the documented maintenance management system;
- Provide information on the arrangements for identifying the safety critical systems and determining their performance requirements;
- Provide information on performance requirements for each safety critical system/ pieces of equipment;
- Provide information on arrangements for implementing Management of Change procedures when safety critical equipment/systems do not meet performance standards;

6.5.20 Contractor Management

It is expected that contractor safety performance is effectively managed.

The following would demonstrate that these expectations are achieved:

- Provide arrangements for ensuring safety management interfaces between the Owner and their contractors are identified and agreed upon;
- Provide information on arrangements for monitoring and auditing contractor safety performance.

6.6 PERFORMANCE MONITORING

Performance monitoring is carried out to ensure that the safety management system is maintained appropriately and the safeguards are effectively implemented.

Periodic Monitoring is set up by the wind farm owner and carried out by supervisors and other line management to ensure that plans and operations are implemented and maintained, that workplace hazards associated with daily operations are addressed and for measuring safety performance (incident reporting and analysis, behavior-based observation, etc).

Audit and Audit Compliance assesses through an independent source (although can be employed by owner except that it is performed by personnel not directly responsible for the Wind farm's operation and ideally has the characteristic of being able to give an unbiased and independent opinion of operations) the overall effectiveness of the Safety Management System.

Verification of Safety Critical Activities and Equipment for implementation and effectiveness and assuring that certification, when appropriate, is in date.

6.6.1 Periodic Monitoring

It is expected that arrangements are in place for monitoring safety performance.

The following would demonstrate that these expectations are achieved:

- Provide information on line manager's and supervisor's activities in continuous monitoring of compliance with safety procedures and standards;
- Provide details of workplace inspection schemes;
- Provide details of arrangements for recording and analyzing safety performance;
- Provide details of the arrangements for discussing and reviewing safety performance at field and senior management levels within the organization from both a technical and human performance perspective;
- Provide details of listing, documenting and tracking to closure safety issues which have raised both those where action has been taken and those where it has been decided not to take action.

6.6.2 Incident Reporting and Analysis

It is expected that there are arrangements for reporting, analyzing and learning from incidents and work related illnesses.

The following would demonstrate that these expectations are achieved:

- Provide information on the incident reporting, trending and investigation arrangements for safety incidents including near misses as well as those involving chronic health and environmental issues (e.g., noise, repetitive strain, frequent spillages, waste non-conformances, etc.);
- Provide information on the methodology adopted to identify incident causes (the failed barriers) and underlying system level weaknesses that result in significant incidents;
- Provide a description of the arrangements for tracking action items arising from investigations to completion.

6.6.3 Environmental Monitoring and Measurement

It is expected that the environmental impact of discharges and emissions are being adequately monitored and measured.

The following would demonstrate that these expectations are achieved:

- Provide details of the arrangements for monitoring, measuring and reporting discharges and emissions which have the potential to cause adverse environmental impacts.

6.6.4 Audit and Audit Compliance

It is expected that effective arrangements are in place for internal and external (as applicable) auditing of the safety management system.

The following would demonstrate that these expectations are achieved:

- Provide details of the audit program including details of the audit process including:
 - Audit Team Selection - Roles and Responsibilities
 - Audit Data Collection - Document Record Examination
 - Observation of Work Activities - People and Equipment
 - Record of Testing, Sampling and Observations
 - Audit Analysis - Trends, etc.
 - Reporting of Audit Findings
 - Corrective Action Follow-up and Closeout
 - Management Review of Findings
 - Audit Record Retention
- Provide information on criteria for selection of and guidance to the audit team members to ensure competent and independent (external to the location) auditors are appointed to lead audits;
- Provide details of the arrangements for planning, execution and reporting of safety audits;
- Provide details of the arrangements for tracking actions arising from audits and closing them out;
- Provide details of communicating audit results to senior management and to the personnel in the locations audited.

6.6.5 Verification of safety Critical Activities and Equipment

It is expected that the arrangements are in place for verifying that safety critical activities and equipment remain effective.

The following would demonstrate that these expectations are achieved:

- Provide a list of the safety critical activities and equipment;
- Provide details of the arrangements for internal and external verification of the effectiveness of all safety critical activities and equipment, against the established performance standards, by personnel not directly responsible for the offshore wind farm's operations;
- Provide details of the arrangements for tracking actions arising from verification to completion.

6.6.6 Certification

It is expected that at the pre-construction phase that the equipment on the lease for monitoring measurements of metocean and environmental parameters, soils investigation, construction, installation including lifting comply with certification requirements for safety.

For operations it is expected that the turbines, towers, and foundations and their equipment comply with certification requirements for safety.

During the construction and installation process the equipment installing the wind farms comply with certification requirements for safety.

The following would demonstrate that these expectations are achieved:

- Provide a list of required standards that the equipment at the offshore wind farm is to meet for each of the pre-construction, transportation, construction, installation and operations;
- Provide details on current status of offshore wind turbine and equipment certification citing the standards to which the vessels on the lease and their equipment is certified, and providing copies of the applicable certificates.

6.7 MANAGEMENT REVIEW AND IMPROVEMENT

It is anticipated that senior management periodically reviews the effectiveness of the safety management arrangements against the policies, objectives and plans.

The following would demonstrate that these expectations are achieved:

- Provide details of how senior management becomes aware of safety issues arising in a timely manner;
- Provide details of the arrangements for carrying out the management review of the Safety Management System;
- Provide information on arrangements for reporting and documenting the review findings, and incorporating the findings into the safety management objectives.

7. FURTHER INFORMATION TO COMPLETE THE SAFETY MANAGEMENT SYSTEM SUMMARY

For each phase of pre-construction, construction, transportation, installation, operations and decommissioning:

- Provide description or diagram showing the documents and document hierarchy of Safety Management System documents;
- Provide a listing of titles of the Safety Management System documents, procedures, manuals etc.;
- Provide a list of procedures relevant to safety including marine safety and wind farm safety.

Appendix E provides an example of the hierarchy of documents.

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APPENDIX A: GUIDANCE FOR OWNER'S SITE APPROVAL PROCESS:

Site assessment criteria for pre-construction vessels, construction and installation vessel is addressed in the Design Basis report, however the SMS Template anticipates the owner will formulate the requirement to carry out a site assessment for each location as a Marine Procedure.

Pending issue of the BWEA, "Guidelines for the Selection and Operation of Jack-ups in the Marine Renewable Energy Industry", September 2009, the following may serve as guidance on developing the site-specific marine procedure for site approval.

Siting of Mobile Offshore Jack-ups and Floating Structures:

There is much guidance and several industry standards for placing jackups, floating platforms and fixed platforms on the OCS,. Such guidance has been adopted by MMS and other regulators and provides a basis for adapting the procedures for the owner's site approval process for offshore wind farms. This is one of the anticipated Marine Procedures in the Safety Management Template.

Although the guidance was primarily developed for Gulf of Mexico application, the principles also applies to other hurricane locations, and can be adapted to locations where winter storms are the governing extreme conditions.

A.1 MMS: 30 CFR 250.417

This document applies to floating and jacked-up vessels and although it applies to Mobile Offshore Drilling Units (MODUs) it can equally be applied to floating and jackup vessels for construction and installations purposes. It requires submission of information such as to confirm:

- Suitability for the location: maximum environmental & operating conditions (these may be found in a Marine Operating Manual, as per USCG requirements for MODUs or equivalent).
- Information to show that site specific soil & oceanographic conditions showing the location has suitable foundations for the work.

The details are quoted below:

Under current requirements, you must provide:

- *"information and data to demonstrate the drilling unit's capability to perform at the proposed drilling location. This information must include the maximum environmental and operational conditions that the unit is designed to withstand, including the minimum air gap necessary for both hurricane and non-hurricane seasons."*
- *"information to show that site-specific soil and oceanographic conditions are capable of supporting the proposed drilling unit."*

A.2 MMS: NTL 2008-G10 – Guidelines for Jack-up Drilling Rigs Fitness Requirements for the Hurricane Season

MMS Gulf of Mexico Region (GOMR) uses API RP 95J to review and evaluate the information submitted with each application for a permit to be on the lease. While these provisions are specifically for jack-ups and for hurricane season the principles can be applied with a few adaptations in the winter season and for rigs other than those engaged in drilling.

The requirements include:

- Provide shallow hazards survey or Mesotech for jack-up optimal siting
- Geotechnical (Soil) Information prior to going on location
- Site specific metocean or using Appendix D of API RP95J (Note: these values may need to be adjusted based on the specific location and season).
- Preloading procedures and holding times
- Air Gap Information including 3-5% wave crest uncertainty and settling allowance
- Securing procedures

The detailed requirements are quoted below which can be adjusted to use with offshore wind farm vessels/ structures and for all-year:

1. *"A statement documenting that you have provided or will provide appropriate bottom survey data (shallow hazards survey and/or bottom Mesotech scan) to the rig contractor to allow the best location for the rig to be established prior to moving on location.*
2. *A statement documenting that you have provided or will provide appropriate geotechnical data (sufficient to determine soil characteristics over depth and foundation strength of the proposed location) to the rig contractor prior to moving on location to facilitate adequate assessment of the foundation prior to preloading operations.*
3. *A statement documenting that you have provided or will provide site-specific metocean data using the criteria in Appendix C of API RP 95J, including winds, waves, currents, storm surge, and tides to the rig contractor prior to moving the rig on location to facilitate proper positioning of the rig on location and determine the appropriate air gap. In lieu of site specific data, the MMS GOMR will also accept the use of the more conservative generic data depicted in Appendix D of API RP95J.*
4. *The rig contractor's anticipated preloading procedures and holding times that are proposed to minimize the potential for further settlement from potential hurricane loading*
5. *The rig contractor's information on how the air gap determination was made for the site specific location. The MMS GOMR will accept a site-specific 100-year hurricane wave crest elevation (using available metocean data from 1950 to the present) with the addition of (a) a wave crest uncertainty allowance of 3 to 5 percent and (b) a settling allowance for the given rig type and soil characteristics and expected hurricane loading (see item no. 3 above relative to metocean data). As an alternative, the MMS GOMR will accept the more conservative air gap curve depicted in Appendix "A" of API RP95J.*
6. *Any additional information that would mitigate or otherwise alter these jack-up rig fitness requirements during the hurricane season."*

THE MMS GOMR encourages you to:

1. *Provide the United States Coast Guard with read-only access to the Emergency Position Indication Radio Beacon (EPIRB) data for your jack-up rig fleet before hurricane season begins; and*
2. *Review and update your Coast Guard Marine Operations Manual to minimize the possibility of adverse consequences of any tropical system.*

A.3 API RP 95J

The following summarizes the requirements of API RP 95J. This guidance can be used to develop the owner's requirements for submission of a suitable marine procedure for the safety management system. While specifically developed for jack-ups it can be applied with appropriate changes to floating vessels

1. Site Data

- Coordinates, Topography, Waterdepth (CD or LAT)
- Previous rigs on location
- Soil disturbance from previous activity
- Pipelines and Debris

Geotechnical Data

- Provided by the Operator
- Suitable for shallow depth assessment (to a minimum of 1 spudcan diameter beyond likely leg penetration)
- Leg Penetration Prediction determined
- Sand lenses or layered soil identified
- Mud slide area

Metocean Data

- Provided by the operator
- Site Specific wind, wave, currents, storm surge, and tide.
- Crest elevation
- Or generic airgap information

2. Preloading Process

- Maximum possible leg reaction; appropriate preload holding time. (typically 1-2 hours from last occurrence of settling with full preload on board).

3. Airgap

- 100 year crest elevation plus uncertainty allowance of 3-5%, plus settling allowance. Or use Appendix A which includes a 4 ft settlement allowance for most cases

4. Preparations and Evacuation

- Marine Operating manual Procedures, leg position optimization; time to secure for safe evacuation

Author's Note: There is no explicit requirement for any Structural Calculations; Calculations are necessary, however, to determine settlement and thus air gap. The airgap return period is specified as 100-year or greater; the return period for settlement for jack-up preload evaluation and capability limit is not stated. The offshore wind farm owner's procedure should state the return period that the jack-up can survive, or that the mooring system can survive with and without appropriate safety factors.

A.4 RECOMMENDED PRACTICE FOR SITE SPECIFIC ASSESSMENT OF MOBILE JACK-UP UNITS: GULF OF MEXICO ANNEX Rev 0, September 2007. (also known as the GoM Annex).

Below is a summary of the requirements of the Gulf of Mexico Annex to the Recommended Practice of SNAME T&R Bulletin 5-5A. The standard SNAME T&R Bulletin 5-5A is a suitable reference, however, this document is specifically for Gulf of Mexico and appropriate adjustments should be made if anticipated to be applied for winter season, for vessels other than jackups, and for locations other than the Gulf of Mexico.

This is the only guidance document that requires a structural evaluation be undertaken. Loads have to be generated to develop the penetration figures to determine that the airgap is not compromised by four (4) feet settlement allowed for in API RP95J.

The annex “assumes a 48-hour evacuation period prior to a Tropical Rotating Storm exceeding the jack-up’s site assessment criteria”. This is a voluntary standard at the time of writing of this Template.

There is a specific requirement of a return period for the jack-up to survive (the 50 year sudden hurricane is for manned/demanning operations) considering structure allowables and settlement aspects.

There are 3 “gates” that a jack-up assessment has to pass to comply with this GOM Annex:

Assessment Case – within “design loads” – for the unit to be manned at the location at the end of a 48 hour period after declaration of a tropical revolving storm (TRS) which is likely to pass near or over the jack-up. Standard load factors and resistance factors are used with this case

Contingency Case – a 50 year return period of a sudden tropical revolving storm, with 72 hrs or less notice that the jack-up should survive. The Contingency case is to provide some reserve in case normal evacuation was delayed for some unforeseen reason. No load factors are used but resistance factors still apply (0.85).

Survivability Case - an event anticipated to allow the rig to survive however structural damage may occur. The environmental criteria are based on agreement between stake holders. This is a case when the jack up is unmanned. There are no load factors or resistance factors in this calculation.

The more precise details are quoted below:

Assessment Case: The curves and tables define the wave height, wind speed, and current speed curves that represent a sudden TRS condition for manned operations. The data are based on 50-year sudden TRS independent extreme metocean criteria that will affect the location with less than 48-hour warning (see OTC17879). A standard 5-5A analysis, as modified by this Annex, will be used to evaluate the site with standard load and resistance factors applied.

Contingency Case: These curves and tables define wave height, wind speed, and current speed curves that represent a special case of sudden TRS. The data are based on 50-year sudden TRS independent extreme metocean criteria that will affect the location with less than 72-hour warning (see OTC17879). The storm is more intense than that implied in the “Assessment Case”, reflecting storm strengthening during the time between intended evacuation and impact. The “Contingency Case” has more severe metocean criteria than the “Assessment Case” but the load factors used in the assessment are reduced.

Survivability: The Survivability assessment is for a demanned event only and evaluates the risk of damage to the global structural system due to a severe event that exceeds the environmental conditions for manned operation. In a survivability assessment the objective is for the rig to survive the event, however structural damage may occur. The environmental criteria shall be based on agreement between stake holders.

If the warning periods of 48 hrs and/or 72 hrs are not appropriate for the potential demanning of the vessels than appropriate adjustments should be made.

Note: For many offshore wind farm vessels the extreme case will be a winter storm for which there are unlikely to be provisions to avoid being on-board. The accepted criteria for these vessels will be based on the ISO and other industry standards. For oil and gas facilities that is a 50-year return period winter storm.

A.5 API INT-MET

Site-specific extreme metocean methods set out in this document is suitable for site specific approval of offshore wind turbines, and their construction/installation vessels and any metocean towers, however, the metocean data needs to be developed for the relevant site. This document only applies to Gulf of Mexico. The methods may be suitable for application to other locations.

A.6 MMS: NTL 2008-G06 Shallow Hazards Program

This NTL is established to ensure that industry conducts exploration, development etc according to sound engineering principles. *“This NTL describes the surveys, reports, analyses, and mitigation that will ensure that the objectives of the shallow hazards program are met”*. Additionally Section VI part B lists the information required: *“Before you conduct any OCS operations using MODUs, jack-up or liftboatsor any other bottom founded or supported vessels”*.

A.8 ISO Standard Info (Ref A.11)

Currently an international standard (ISO 19905) is under development which specifically addresses site assessment of jack-up drilling units internationally. This document has not reached the FDIS (Final Draft International Standard). When issued, the relevant sections of this standard may be useful guidance for jackup vessels with use with offshore wind farms.

This standard calls for the following information in Clause 6.5

Geophysical and geotechnical data

Site-specific geotechnical information applicable to the anticipated range of penetrations shall be obtained. The type and amount of geotechnical data required depends on the particular circumstances such as the type of jack-up and previous experience at the location, locations within the site, or nearby sites. Such information can include shallow seismic survey (sub-bottom profiler) data; boring/coring data; in-situ and laboratory test data; side-scan sonar data; magnetometer survey data; and diver's survey data.

The site shall be evaluated for the presence of geohazards as described in Table A.6.5-1 (see source document at www.mms.gov).

For sites where previous operations have been performed by jack-ups of the same basic design, it may be sufficient to identify the location of, and hazards associated with, existing footprints and refer to previous site data and preloading or penetration records; however, it is recommended that the accuracy of such information should be verified.

At sites where there is any uncertainty, borings/corings and/or piezocone penetrometer tests (PCPT) data are recommended at the planned location. Alternatively, the site may be tied-in to such data at another site by means of shallow seismic data. If data are not available prior to the arrival of the jack-up, it may be possible to take boring(s)/coring(s), etc., from the jack-up before preloading and jacking to full hull elevation. Suitable precautions should be taken to ensure the safety of the jack-up during this initial period on location and during subsequent preloading.

The site shall be evaluated for potential scour problems. These are most likely to occur at sites with a firm seabed composed of non-cohesive soils and where the penetration is low. Certain sites prone to mudslides can involve additional risks. Such risks should be assessed by carrying out specialist studies.

This document (Ref A.11) contains sufficient information for evaluating foundations for independent leg jack-ups.

A.9 Other Procedures/ Standards

API RP2A – Recommended Practice for Planning, Designing and Installation of Fixed Offshore Platforms

This is useful guidance for Metocean Towers and other structures. The return period appropriate to the installation may vary from those proposed in this standard, and should be stated in the owner's procedures.

API RP2 SK – Design and Analysis of Stationkeeping Systems for Floating Structures

API RP2 SK – Commentary Gulf of Mexico Mooring Practice for Hurricane Season 2008
For site-specific mooring analysis

BWEA, "Guidelines for the Selection and Operation of Jack-ups in the Marine Renewable Energy Industry", September 2009.

The references below may be helpful in developing the Marine Procedures for the owner's site assessment of offshore wind farms on the OCS.

A.1 References: Site Specific Assessment

A1. "Gulf of Mexico Jack-up Operations for Hurricane Season – Interim Recommendations, API Recommended Practice 95J", First Edition, June 2006.

A2. "Interim Guidance on Hurricane Conditions in the Gulf of Mexico", API Bulletin 2 Int-Met, First Edition May 2007.

A3. Stiff, J., Roper, R., V.J. Cardone, A.T. Cox and D.R. Lewis, 2006. OTC 17879: Metocean Criteria for Jack-Ups in the Gulf of Mexico. 2006 Offshore Technology Conference, Houston, Tx., May 2006.

A4. NTL 2008-G10 June 1, 2008- Dec 1, 2013 Guidelines for Jack-up Drilling Rig Fitness Requirements for Hurricane Season.

A5. Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - API RP 2A.

A6. Rehtin, E.C., Steele, J.E., and Scales, R.E., "Engineering Problems related to the Design of Offshore Mobile Platforms", SNAME Annual Meeting, November 1957.

A7. UKOOA Guidelines for Conduct of Mobile Drilling Rig Site Surveys Volumes 1 & 2 March 1997.

A8. Dier A., Carroll B., Abolfathi S., "Guidelines for Jack-up Rigs with particular Reference to Foundation Integrity", HSE Research Report 289, 2004.

A 9. Offshore Information Sheet 3/2008: Jack-up (self-elevating) installations: review and location approval using desk-top consequence assessments in lieu of undertaking site soils borings, UK HSE, May 23, 2008.

A10. Recommended Practice for Site Specific Assessment of Mobile Jack-up Units Gulf of Mexico Annex, Revision 0, September 2007.

A11. Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 1: Jack-Ups, ISO/CD 19905-1.9, ISO TC 67/SC 7/WG 7 Draft.

A12. Hirst T.J., Evans D.J., Scales R.E., Remy N.D., Steele J.E., Foundation Analysis and Performance History of Bethlehem Mat –Supported Drilling Platforms on Soft Soils. Bethlehem Report 1978.

A13. Hirst T.J., Steele J.E., Remy N.D. and Scales R.E., Performance of Mat –Supported Drilling Rigs, OTC 2503, OTC 1978.

A14. NTL 2008-G06 April 1, 2008 – March 31, 2013 Shallow Hazards Program.

APPENDIX B1: MARINE PROCEDURES AND DOCUMENTS

The Safety Management System should reference a number of Marine Procedures which are required for safety. The following are examples of procedures which are often used by the offshore MODU community and it may be appropriate to consider some of those marine procedures as suitable for the transportation, installation, construction operations and decommissioning of Offshore Wind Farms on the OCS.

Marine Procedures - Examples

- SOLAS Training Manual – explaining how to use the safety equipment
- Going onto and coming off location – (construction vessels, and temporary vessels)
- Mooring procedure including anchor running
- Towing Procedures
- Seafastening criteria and procedures
- Detailed Lifting Procedures (if not covered elsewhere)
- Jacking up and Jacking Down
- Weight Control
- Stability Control
- Inclometers
- Emergency Signals
- Emissions to Atmosphere
- Watchkeeping
- Refuelling (Boats and Helicopters)
- Helicopter landing
- ISM Code/ Identification
- Noise Survey
- Communication Procedure

Many of these marine procedures may be included in the Marine Operating Manual of individual vessels.

Marine Procedures going and coming off location should include information about any jack-up vessels used in the construction or repair processes since leg spacing may vary, and cause issues with subsequent jackups arriving on location and sliding into the holes of the previous construction jack-up.

Other Documents that may be relevant to produce include:

Marine Operations Manual – Guidance per 46 CFR 109

Emergency Evacuation Plan – 33 CFR 146.210 –this should include Hurricane Evacuation plans if appropriate.

Security -

APPENDIX B2: LIGHTNING PROTECTION

Due to the nature of the lightning issue, the following is guidance on issues the SMS should cover including procedures for the detection of lightning, warning to the personnel working in the field, and if at all possible abandonment of the wind turbine structures and any control stations. The SMS system should designate safe areas for lightning protection and provide guidance and signage for the work crews to understand what is safe and what is not in regard to location for safety if in the field when lightning occurs. The following guidance from IEC 61400-24 is quoted:

“Wind turbines are in principle safe to work in. However, during thunderstorms, personnel working on wind turbines can be exposed to additional risks. For unprotected wind turbines all lightning flashes are potentially harmful to personnel, therefore lightning protection should be part of the turbine design. Work should not be performed on wind turbines during thunderstorms. Safe operating procedures

should include precautions for personnel safety during thunderstorms.

The risks related to personnel safety at the different locations in a wind turbine during thunderstorms are addressed below.

10.1.1 Nacelle

When lightning strikes a blade, current will flow through the nacelle to the tower. Part of the current may enter the nacelle through the low impedance path of the drive train. For wind turbine structures more than 60 m high the risk of receiving side flashes on the nacelle also has to be considered. Protection of personnel inside the nacelle can be provided for as follows:

when side flashes are to be expected due to the height of the turbine, an air termination system on the top of the nacelle may be insufficient to protect personnel inside. It is recommended that an air termination system be installed which encircles the interior of the nacelle like a Faraday cage;

for wind turbines having an insulated drive train, provisions to install heavy earth connections to the drive train when entering the nacelle need to be available;

personnel outside the protection area of the air termination system are endangered by a direct flash since they are in LPZ OA. It is highly recommended that provision is made to shelter any personnel in minimum LPZ 0B;

personnel inside the nacelle may be at risk when touching or being close to metal parts.

10.1.2 Tower

A large part of the tower itself and structures outside the tower can be struck by lightning directly and be part of the current path to earth. During a thunderstorm, protection of

personnel on or inside the tower can be provided for as follows:

personnel inside closed towers (steel or reinforced concrete) are protected against a direct flash. The safest locations to be during a thunderstorm are on one of the tower platforms or inside at ground level. The use of ladders, even inside tubular towers, should be minimized;

personnel on the outside of a tower can be endangered by a direct flash. Substantial protection cannot be provided in this case and the situation should be avoided;

personnel climbing inside a lattice structure are endangered by parts of a lightning current, the resulting voltage differences and the shock wave resulting from a nearby flash;

personnel on or inside a non-conductive tower structure are most endangered.

10.1.3 Ground level area

The ground level areas of a wind turbine are:

*inside or outside the wind turbine tower;
inside or outside a building associated with a wind turbine.*

The lightning current flowing into the turbine structure will disperse from the tower into the foundation, the cabling and the earth. Depending on the shape and dimensions of the earth termination system, the current will cause a voltage gradient at ground level around the turbine tower. During a thunderstorm, protection of personnel at ground level can be provided for as follows:

personnel near open electrical panels are endangered during the flash by any catastrophic failures inside the panels. This situation should be avoided;

personnel outside but near the tower are protected against a direct flash but endangered by the voltage gradient on the ground during the flash. Standing in the area of a high voltage gradient can cause a potentially hazardous current to flow through the body;

personnel inside a protected building or shelter are safe; personnel inside a fully enclosed metal vehicle are safe.

If a lightning flash causes a power system failure, this should not lead to extra danger to personnel. This should be dealt with by proper power system design.

10.1.4 Instructions for personnel

Safety instructions and warning procedures for site personnel during thunderstorms must be available. It should be made clear that personnel should only be in a safe location during a thunderstorm. The safety procedures should be included in an operations manual and provided for in standard operator training.

It should be noted that the level of danger is even higher during construction when a complete lightning protection system is not yet functional and special instructions may be required.”

APPENDIX C: GUIDANCE ON BRIDGING DOCUMENT BETWEEN 2 OR MORE SAFETY MANAGEMENT SYSTEMS

The stakeholders on site that have separate management systems record the decisions in a “bridging document”. This document establishes which policies govern the work at site for each of the stakeholders, their employees, and contractors/subcontractors. The intention is to have these interfaces such that personnel understand their roles, responsibilities, organizations, operating and reporting structures for each of the safety management systems and decide which procedures are relevant so that there are no conflicts. (e.g. if an emergency arises on a site with multiple vessels some of which are engaged and not able to transit to shore, who is in charge to order the injured person to be taken to shore, which vessel is commanded to go, and who has the authority to dispatch it).

Bridging documents are signed by both parties (Companies) indicating that the bridging document reflects the safety aspects of their joint operation and the safety management process of the joint operation and that the parties understand how the interfaces will work.

The document should state who the custodian of the document is, how changes are made and results promulgated. Additionally it should state how often the document is reviewed and revised if revisions are necessary.

The Bridging document between an owner and contractor may give rise to a further bridging document between contractor and sub-contractor.

A key part of the document will be a diagram showing the interfaces between the companies/ stakeholders. It may be appropriate to have the diagram in 2 sections, one showing the office organization interfaces and one showing the field organization interfaces which should include the control system site for the offshore wind farm if appropriate.

A convenient way to show the governing procedure may be to list the various procedures that are applicable to the joint operations: when there exists compatible and complementary policies and procedures, the selection should determine which policy/procedure is to be followed.

Training on the policies and procedures may be required if the workforce is unfamiliar with the selected procedures.

Some typical policies which may need to be selected based on the owner’s or other stakeholders safety management system:

1. Substance abuse
2. Fitness for work
3. Smoking
4. Emergency Response
5. Contractor/ Sub-contractor management
6. Management of Change
7. Crane and Lifting Standard
8. Fall Prevention and Protection
9. Hearing Protection
10. Personal Protective Equipment
11. Welding/Burning inside Tower/Nacelle
12. Permit to Work Requirements
13. Confined Space Entry Requirements
14. Environmental Compliance

.....and so on.

Many of policies vary from country to country and from company to company so the manufacturer's representatives may suggest different procedures from the owner's procedures: this would need to be addressed by the Bridging Document.

Everyone on the OCS site should be familiar with whose procedures and policies govern work on the site.

The bridging document needs to result in a clear understanding of safety management interface roles and responsibilities for all parties at the site. All parties at site will then be on board with an agreed safety process.

The Bridging Document would be expected to have a section giving the Document Review/Revision history containing Revision Number, Date, By Whom the Revisions were made, and Actions performed.

APPENDIX D: SAFETY MANAGEMENT SYSTEM APPLIED TO VESSELS AND STRUCTURES ON THE OCS

	Potential Vessels on the Lease												
Likely Documents related to Safety Management System subject to Review (may depend on site arrangement details)	Jackup to Install Data Tower	Jack-up for Observations	Floating Construction Vessel to Install Data Tower	Seismic or soil Sampling Vessel	Installation Jackup	Installation Floating Vessel	Transportation Vehicles/ Vessels	Crew Vessels	Maintenance Vessels Incl. Diving Support	Monopile	Jackup Wind Turbine	Floating Wind Turbine	Cable Laying Vessel (Floating)
BRIDGING DOCUMENT (with appropriate other vessel)	-	-	X	-	X	X	X	X	X	X	X	X	X
SAFETY MANAGEMENT SYSTEM (as applicable)													
SAFETY POLICIES OF COMPANY	X	X	X	O	X	X	O	O	X	X	X	X	O
ORGANIZATION RESPONSIBILITIES & RESOURCES	X	X	X	O	X	X	O	O	X	X	X	X	O
COMPETENCE AND TRAINING	X	X	X	O	X	X	O	O	X	X	X	X	O
STANDARDS AND PROCEDURES	X	X	X	O	X	X	O	O	X	X	X	X	O
SAFE WORKING PRACTICES	X	X	X	O	X	X	O	O	X	X	X	X	O
PERFORMANCE MONITORING	X	X	X	O	X	X	O	O	X	X	X	X	O
ASSOCIATED PROCEDURES													
Site Assessment for Suitability of Bottom Founded Structures	X	X	-	-	X	-	-	-	-	X	X	-	-
Site Assessment for Suitability (Mooring /Survival) of Floating Structures	-	-	X	-	-	X	X	-	-	-	-	X	X
Marine Procedures as applicable	X	X	X	O	X	X	X	X	X	X	X	X	X
Emergency Evacuation & Response Plans	X	X	X	O	X	X	X	X	X	X	X	X	O

INDEX
X - Expected
O - Expected if not covered by USCG or similar authority

APPENDIX E: EXAMPLE OF HIERARCHY OF DOCUMENTS

EXAMPLE: HIERARCHY OF DOCUMENTS

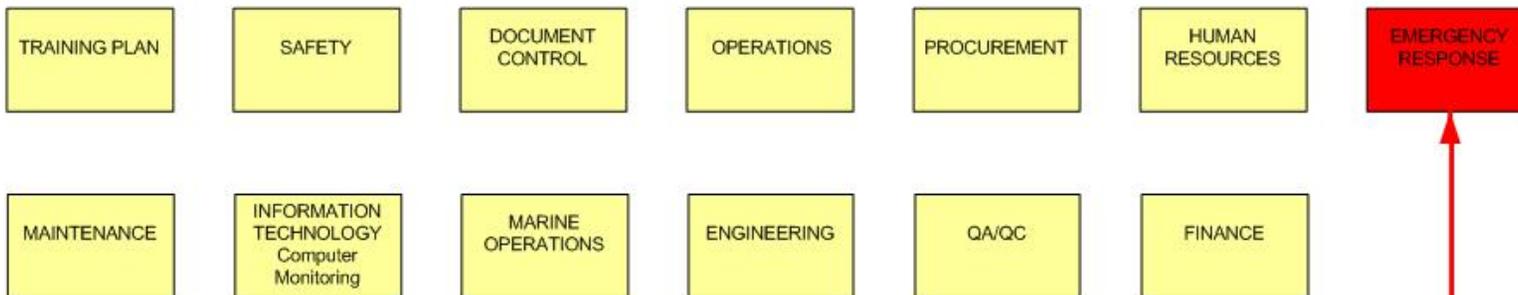
(Document Owner may also be Specified)

Connecting Lines Omitted – from this example

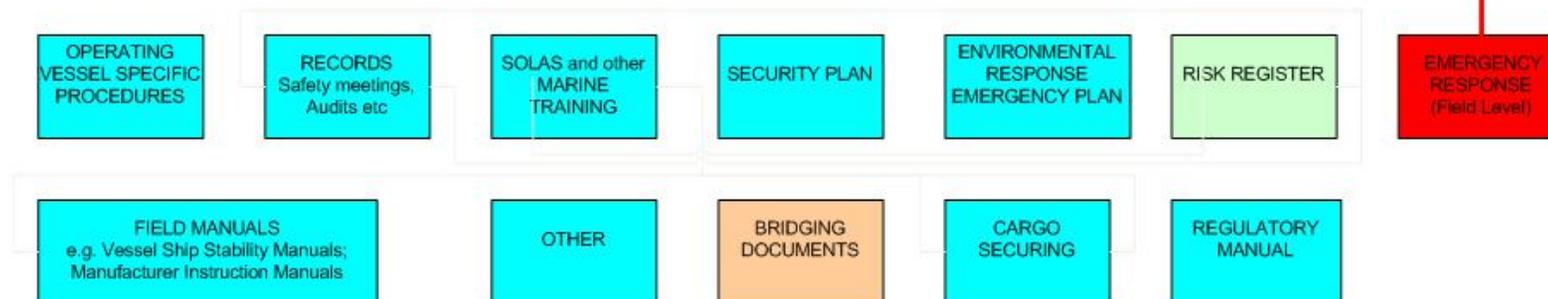
TIER ONE DOCUMENTS



TIER TWO DOCUMENTS - OFFICE



TIER THREE DOCUMENTS - FIELD



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