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WP 6: Operation and Maintenance
Task 2: Labour safety (health and safety)

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Acknowledgement/Preface

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Abstract

The investigation of Labour safety at offshore Wind Energy installations has been focussed on aspects like licensing, health and safety, and labour safety influencing the wind turbine design. In other words: are there any regulations that determine e.g. the turbine design, or limit certain design solutions?

The investigation resulted in the following general conclusions:

1. Uniform guidelines for all European countries having an Exclusive Economic Zone (EEZ) on the North Sea are not possible at the moment. Every country has his own licensing authorities.
2. New HSE (Health, Safety and Environment) procedures have to be developed, based on the existing knowledge of offshore oil companies and maintenance companies and institutes.
3. It could not be concluded that health and safety provisions will have (limiting) influence on the design of the offshore wind turbines. All measures, procedures, and provisions that deal with health and safety, need to be assessed and approved individually.
4. There is an urge to uniform offshore wind turbine access facilities and procedures.

CONTENTS

1. INTRODUCTION

As part of the RECOFF project RECommendations for OFFshore wind turbines, Task 6 has been defined with the objective to investigate if aspects like licensing, health and safety, and labour safety have influence on the design of the turbines. In other words: are there any regulations that determine e.g. the turbine design, or limit certain design solutions?

To answer this question, the process for obtaining permits is briefly described in Chapter 2. In Annex A and B, two examples of offshore wind farms and their licensing aspects are given; one for a Dutch wind farm and one for a Danish wind farm.

In Chapter 3, an inventory has been made of the types of work that need to be carried out in the various stages of an offshore wind project. Each type of work has classified as “new” for offshore wind applications, or “existing” in other branches of offshore industry. In the latter case, health and safety procedures can be easily adopted. Furthermore, Chapter 3 presents the existing and missing health and safety information for the different types of work and it presents the national and international authorities for health and safety.

Finally, in Chapter 4, the new types of work, which are specific for large application of offshore wind energy, will be discussed in more detail with special attention to the health and safety aspects.

2. OFFSHORE LICENSING

With respect to the legislative authority the Exclusive Economic Zone (EEZ) of a European country is divided in two distinct areas: the twelve miles zone and the further part of the EEZ. Inside the twelve-mile coastal area the national laws for Health and Safety are automatically in force and connected to the licence for building and exploitation of wind farms. Outside the twelve-mile coastal area but inside the EEZ very few national authorities have formal rights and little national laws are available. Therefore all conditions connected to the building and exploitation of wind farms are demanded in the licence. These licence conditions for the EEZ, inside and outside the coastal twelve-mile area, can be different for each European country.
In general it can be said that for each offshore project, so not only wind farms but also for oil and gas exploration, health and safety plans shall be available for the day-to-day work and for emergency situations.
In general, the project developer is responsible for the health and safety plans. In the "main" health and safety plan, reference is made to the plans of the different sub contractors who perform certain tasks.
The total package of health and safety plans needs to be assessed and approved by the licensing authorities responsible for the specific offshore location. The approval is also necessary for financing and insurance.

3. WORK ACTIVITIES AND EXISTING H&S REGULATIONS

3.1 Classification

Most of the types of work in the installation, operation, maintenance and dismantling of offshore wind energy are well known activities. They are either common practice in onshore wind energy or in other branches of offshore industry. However, when applying these well-known activities to the new branch of industry, viz. offshore wind energy, the following remarks have to be made. From feasibility studies, it appeared that offshore wind energy is at present not cost effective. To reduce the cost price of offshore wind energy, all parties involved are developing innovative solutions to carry out some types of work. Two examples can be mentioned here.

The installation of oil and gas platforms is usually a unique event where heavy equipment is involved. The installation of a wind farm consists of a large number of identical events. As compared to the oil and gas platforms, the size of the turbines (towers, rotors) is more important than the weight. In principle, it is possible to use the same equipment and techniques as used in the oil and gas industry. However, this is very expensive and there is a trend going on that new vessels are being designed and build that are able to install large numbers of turbines very quickly and more cost effective.

The second example is the access to offshore wind turbines. If failures occur at oil and gas platforms, the revenue losses are so high that the use of helicopters for transferring personnel can be justified. The revenue losses per day are usually much higher than the repair costs. For wind turbines however, cheap solutions need to be developed to carry out repair actions since the revenue losses per day are usually less than the actual repair costs.

The above examples show that new solutions for existing types of work are being developed for offshore wind energy. This implies that for these new ways of working, new procedures need to be developed, assessed and approved.

In this section, first of all the different types of work have been identified, and secondly, they have been classified as "*e*" which means "*existing*" or "*n*" which means "*new*". The class "*n*" also includes the types of work mentioned in the two examples above: already existing types of work but "new" in the application of wind energy.

Building, operating, maintaining, and dismantling of offshore wind farms can be split up into different project activities such as:

- site preparation; bottom characterisation; foundation building;
- installation of the infra structure as cabling and power stations;
- installation of the turbine on the foundation;
- inspection and maintenance of the turbine;
- small repair of the turbine;
- large repair and mid life overhaul;
- dismantling of the turbine, the foundation and the infrastructure.

The project activities are divided in different types of work such as: 'wet' offshore work, 'dry' offshore work, transfer of materials and personnel by boat or by helicopter and hoisting of materials on high towers. One of the project aspects is Health and Safety combined with Emergency and Calamity. Like project and work activities have to be organised ahead of an offshore project also the Safety and Emergency aspects have to be organised before the work is started. The results are summarised in Table 3.1.

Table 3.1: *Classification of types of work in relation with safety and emergency*

		Work		Materials				Personnel				
Project phase		Wet marine	Dry marine	Transport by boat	Hoisting to turbine	Hoisting (internal crane)	Hoisting (external crane)	Transport by boat	Embark/disembarkment	Transport by Heli	Hoisting	Stay overnight
Building and installation	Site preparation	e		e				e				
	Building foundation	e		e				e				
	Infrastructure installation	e	e	e			e	e				
	Turbine installation		n	e	n		n	e	n			n
Preventive maintenance	Inspection	e	e	e				e	n			n
	Maintenance actions	e	e	e	n	n		e	n			n
	Modifications	e	e	e	n	e		e	n			n
	Overhaul	e	e	e	n	e	n	e	n			n
Corrective maintenance	Small repair / inspection	e	e	e	n	e		e	n	e	n	n
	Large repair	e	e	e	n	e	n	e	n			n
	Projects	e	e	e	n	e	n	e	n			
Dismantling	Dismantling turbine		n	e	n		n	e	n			
	Dismantling infrastructure	e		e	n		e	e				
	Dismantling foundation	e		e	n		e	e				

e: Existing
n: New

In the following sections, it will be indicated in which branch of industry the existing health and safety procedures can be found. The new activities that require new safety and health procedures will be discussed in Chapter 4.

3.2 Activities During Building and Installation

During building and installation, the following activities and sub-activities can be roughly identified.

1. Site preparation
   - Characterisation of bottom
   - Site preparation (gravel mattress)
2. Building Foundation
   - Mono pile driving
   - Installation transition piece
   - Installation cable ducts
   - Protective gravel
3. Infrastructure installation
   - Cable laying between turbines and substation
4. Turbine installation
   - Erection of tower
   - Installation of rotor / blades

In Table 3.2, it is mentioned which types of existing safety procedures are applicable.

Table 3.2: *Types of work and the available safety procedures*

	Work activities:	**Safety procedures:**		**Procedures available:**
		New	**Existing**	
'Wet' marine:	Site preparation		x	Offshore oil industry Hydraulic engineering
	Foundation construction: - Steel - Concrete		 x x	 Offshore oil industry Hydraulic engineering
	Cables installation		x	E-Power industry
	Substation installation		x	E-Power industry
Dry marine	Tower installation	x		
	Nacelle, rotor installation	x		
Material transport:	Transport by boat		x	Offshore oil industry
	Hoisting (high) from boat to turbine	x		
Personnel transport	Transport by boat		x	Offshore (oil) industry
	Step over boat⇔turbine	x		
	Stay overnight in turbine	x		Emergency
	Stay (overnight) on vessel		x	Offshore (oil) industry

3.3 Activities During Operation and Maintenance

During regular operation and maintenance, the following activities and sub-activities can be roughly identified.

1. Inspection
   - Internal and external / including blades
2. Maintenance actions
   - Yearly maintenance actions
   - Inspection / cleaning and adjustments
   - Lubricating
   - Replacement of parts / oil
   - Cleaning in splash zone
   - Cleaning of blades
3. Modifications
4. Overhaul
   - Replacement of rotor parts
   - Replacement nacelle parts

In Table 3.3, it is mentioned which types of existing safety procedures are applicable.

Table 3.3: *Types of work and the available safety procedures*

	Work activities:	**Safety procedures:**		**Procedures available:**
		New	**Existing**	
'Wet' marine (diving):	Foundation inspection: - Steel - Concrete		 x x	 Offshore oil industry Hydraulic engineering
	Cables inspection		x	E-Power industry
Dry marine	Turbine inspection		x	EN 50308
	Turbine maintenance		x	EN 50308
Materials:	Transport by boat		x	Offshore oil industry
	From boat to turbine	x		
	Hoisting with turbine crane	x		
Personnel:	Transport by boat		x	Offshore (oil) industry
	Step over boat-turbine	x		
	Stay overnight on turbine	x		

3.4 Activities During Repair

During repair (corrective maintenance), the following activities and sub-activities can be roughly identified.

1. Small repair and inspection
   - Adjustments
   - Replacement of small parts
2. Large repair
   - Replacement of parts via internal transport
   - Replacement of parts via wind turbine crane.
3. Projects
   - Large repair actions
   - Replacement of components larger than 800 kg

In Table 3.4, it is mentioned which types of existing safety procedures are applicable.

Table 3.4: *Types of work and the available safety procedures*

	Work activities:	**Safety procedures:**		**Procedures available:**
		New	**Existing**	
'Wet' marine (diving):	Foundation repair		x	Hydraulic engineering
	Cables repair		x	E-Power industry
'Dry' marine:	Turbine repair		x	Wind turbine industry
	Turbine inspection		x	E-Power industry
	Hoisting with external crane	x		
Materials:	Transport by boat		x	Offshore oil industry
	Hoisting (high) from boat	x		
Personnel:	Transport by boat		x	Offshore (oil) industry
	Step over boat-turbine	x		
	Transport by helicopter		x	Offshore oil industry
	Step over heli-turbine	x		
	Stay (overnight) on turbine	x		Offshore (oil) industry

3.5 Activities During Dismantling

During dismantling, the following activities and sub-activities can be roughly identified.

1. Turbine dismantling;
2. Dismantling infrastructure
3. Foundations dismantling

In Table 3.5, it is mentioned which types of existing safety procedures are applicable.

Table 3.5: *Types of work and the available safety procedures*

	Work activities:	**Safety procedures:**		**Procedures available:**
		New	**Existing**	
'Dry' marine	Nacelle, rotor dismantling	x		Compare with repair
	Tower dismantling	x		Compare with installing
'Wet' marine:	Cables dismantling		x	E-Power industry
	Foundation dismantling		x	Hydraulic engineering
	Diving		x	Offshore oil industry (Hydraulic engineering)
Material:	Hoisting (high) turbine to boat	x		
	Transport by boat		x	Offshore oil industry
	Transport rotor, nacelle		x	Offshore oil industry
	Transport tower		x	Offshore oil industry
	Hoisting buried see cables		x	E-power industry
	Transport cables		x	E-power industry
	Transport foundation		x	Hydraulic engineering
Personnel:	Transport by boat		x	Offshore (oil) industry
	Step over boat-turbine	x		
	Stay (overnight) on vessel		x	Offshore (oil) industry

4. NEW WORK ACTIVITIES

4.1 New Work Activities

New work activities for offshore wind turbines are among others:

1. The accurate hoisting of sizeable turbine parts to a height of 80 to 100 m.
   Accurate offshore hoisting up to 100 m can only be done from a standing so-called jack up. As soon as the jack up is standing on the sea floor the work activity is comparable with already existing offshore hoisting methods. Accurate positioning of large parts at the nacelle level is comparable with the on shore situation, although special provisions might be necessary. The large number of identical events causes the main difference.
2. The access from a boat to the turbine.
   This is a new work activity for offshore turbines related to on shore turbines having specific health and safety aspects. The main difference is caused by the fact that new vessels and methods are being developed to reduce the costs.
3. The access from a helicopter to the turbine.
   This is a new work activity for offshore turbines related to onshore turbines having specific health and safety aspects. The main difference is caused by the fact that a hoisting platform is located on top of the nacelle and there is no landing possibility for the helicopter.
4. The possible overnights stay on a turbine (in case transport fails or weather changes).
   This is a new work activity for offshore turbines related to on shore turbines.
5. The possibility of an accident during work activities on a turbine.
   Accidents can go with injuries. On an offshore location medical assistance and medical transport is not easy to get. This is a new situation as compared to onshore turbines. In case of calamities, evacuation of personnel might become difficult (fire downstairs and personnel in the nacelle, or vice versa).

4.2 New hardware facilities

The offshore turbine will be equipped with facilities (ladder / stage / platform) to allow safe access for personnel and goods to the turbine from a swaying boat. This facility can be a fixed ladder or a hooked on telescopic gangway. A ladder or stage in the splashing zone will be very slippery due to algae and seaweed. In case a specific turbine access system is installed that only can be used in combination with a matching boat system it shall be possible to access also on the 'classical' way for reason of unavailability of the matching boat.

4.2.1 Facilities for Access From Boats

For accessing offshore wind turbines from boats, several systems are available, which can be used within limited environmental conditions with respect to wave height and wind velocity. For access from boats, the following possibilities can be considered:

1. Access wind turbine from Zodiac / MOB / tender
   These kinds of vessels (see Fig. 4.1) are normally used as intermediate transport between a larger vessel and the offshore structure. This means, that there are more critical stages in the access procedure:
   -The vessel should be launched from the service vessel
   -Access to the offshore structure from the Zodiac
   -Access to the Zodiac from the offshore structure
   -Lifting the Zodiac on board of the service vessel
   This procedure can safely be executed at waves with a significant height of less than 1 meter. As an alternative, the Zodiac can also be lifted out of the water at the offshore structure. This requires more specific interfaces and an operating hoisting facility. Because the wind turbine

normally operates unmanned, and the period between subsequent visit is maximal 1 year, reliable operation of the lifting system cannot be guaranteed.

Fig. 4.1: *Zodiac*

2. Access wind turbine from Supply/service vessel
   Direct access to the offshore structure can be done by a basket or by a special access system (see Fig. 4.2). Both systems require special provisions on the wind turbine. In case of using a basket, a hoisting facility is required. This means that transport is only possible when the turbine is manned and the hoisting facility is operational. So it can be used for transport of parts, tools and extra personnel. For safe operation, a significant wave height of 1 meter is considered as a maximum. Critical stages in the procedure are:
   -Lifting from the (moving) vessel
   -Reliability of hoisting equipment on the turbine
   -Taking down of the basket on the (moving) vessel

Fig. 4.2: *Basket to hoist personnel from the vessel to the turbine*

Apart from access via a basket, there are new access systems under development, for example the OAS (Offshore Access System) of P&R systems (see Fig. 4.3). This system also requires interfaces at the offshore structure, however this is a passive one, so that an unmanned turbine can be accessed. This system can be used for significant wave height less than 2 meters.

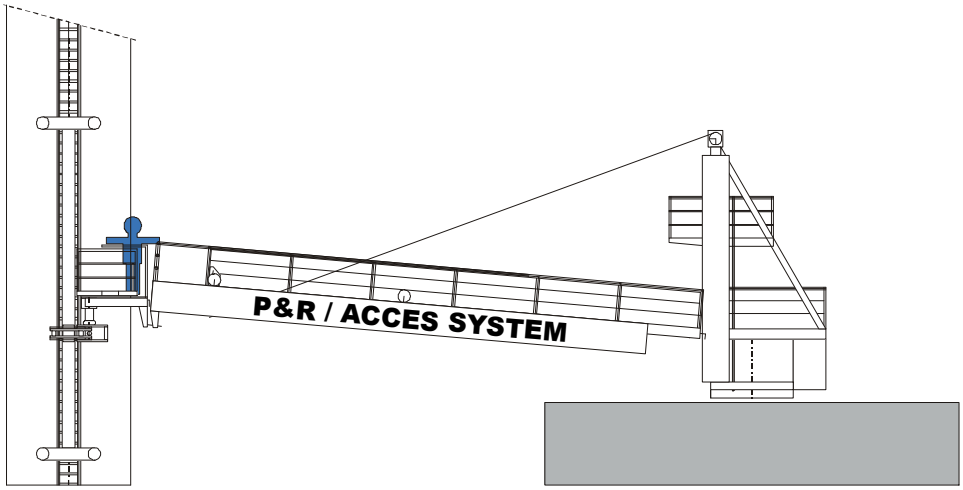

Fig 4.3: *OAS-system*

The license procedure prescribes that thoroughly safety analyses are to be made for the design and the use of the system(s) in combination with the procedures.

4.2.2 Facilities For Access From Helicopters

The offshore turbine might be equipped with facilities (deck) to allow safe access for personnel and goods to and from a hovering helicopter, see Fig. 4.4.

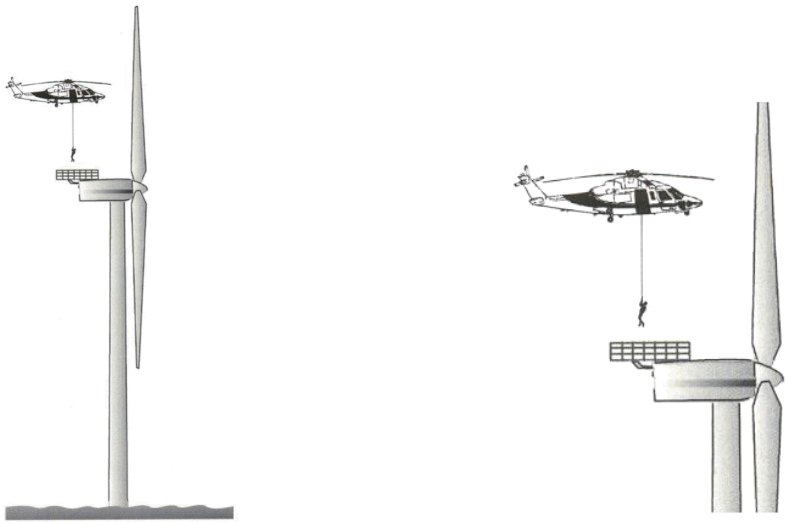

Fig. 4.4 : *Hoisting by helicopter*

Access from helicopter is foreseen for some wind farms in case of corrective maintenance during severe weather conditions and in case of emergency situations.
The design of the platform (dimensions, marking, lightning, distance from object) has to be judged by the aviation authorities and is part of the licensing.

When no hoisting platform is available, provisions are also compulsory for emergency access. These minimal provisions are e.g.:
- Dimensions of the platform
- Minimal distance from obstacles (rotor)
- Hook rail for safety line
- Hatchway, to be opened from inside and outside
- Lighting provisions
- Visible identification number
- Beacon lighting (in accordance with IALA-recommendations)

Limiting factors are among others:
- Wind speed during flight lower than 11 Beaufort
- Wind speed for working outside the nacelle is 15 m/s
- Sight limitations

4.2.3 General Facilities

General facilities that need to be available in the turbine for personnel are among others.

- *First aid kit:* The offshore turbine shall be equipped with a very complete first aid kit. Personnel educated for first aid educated shall always are members of the crew on the turbine.
- *Communication provisions:* Related safety and communication procedures are needed and communication with onshore shall always be possible.
- *Survival kit:* At least one life buoy goes with the turbine outfit. Personnel safety equipment for working at sea such as life jackets, survival suits (for low water temperatures) and high quality communication equipment for emergency co-ordination is to be prescribed in the turbine instructions for use. Consumables and drinking water should be available for a certain period, which depends on the locations and local provisions. In cold areas, heating facilities should also be available. The safety facilities need to have periodical tests and approvals. Perishable consumables need to be refreshed in time.
- Rescue and descent device
- Fire protection
  - Grid disconnection
  - Fire extinguisher

4.2.4 Additional Facilities For Overnights Stay

The offshore turbine shall be equipped with facilities to allow a safe overnight stay on the turbine for a complete maintenance crew including sufficient food, water and sleeping gear, if needed warmth (in cold areas), garbage containment and the accompanying safety procedures.

4.3 Safety Procedures

4.3.1 General

The licence for offshore activities mostly demands in general terms to build and equip the turbines in such a way that health and safety are guaranteed during activities as installation, operation and maintenance and during emergency situations. The licence demands to deliver safety procedures for all activities and situations. The use of all safety equipment and all the adjacent safety procedures need to be authorised by the licensing authority. The licensing authority thereby gets advise of organisations as coast guard and labour safety department. The

Licensing authority demands to analyse all possible safety related situations and cover these situations with hardware and procedures.
Personnel need to have repeated training for the work situations and the emergency situations that can arise.

4.3.2 Existing Safety Procedures (offshore)

In Denmark and in the Netherlands safety procedures for offshore work activities are written on a case-to-case basis and authorised by the licensing authority. The approach for new procedures is: analyse the specific safety cases, write the safety procedures, authorise the safety procedures.
Procedures for specific activities are not yet standardised or harmonised. At least outside the twelve-mile coastal area and probably also inside this zone due to lack of law the procedures are connected with the license for exploitation. This implies that each organisation or company in each country working in this area has its own set of licensed procedures.
This can be confusing and promote misunderstandings in case different (rescue) parties, national or even more international, get involved during emergencies. Nevertheless, there is an existing bunch of safety procedures extant for all types of work activities but scattered over companies and authorities.
Two ways are open to find existing procedures:
- find and inquire the national licensing authorities;
- find and inquire companies having already licenses in this area.

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. (see [7], A1, page 40 of 87). The main content of the training is given in Table 4.1.

Table 4.1: *Contents of the training*:

Survival:	Life jackets
	Hypothermia
	Protection against cold
	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 Pretection 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;
- Co-ordination of the different aid organisations as: stand by vessel or helicopter, coast guard, rescue organisation.

5. CONCLUSIONS

From the investigations that have been done on the health and safety procedures for offshore wind farms and their influence on the design of turbines, the following can be concluded.

- It is not possible to give uniform guidelines on health and safety procedures for all wind farms in all countries; they do not exist. On different locations, (within the twelve miles zone or further on in the Exclusive Economic Zone, EEZ) different licensing authorities need to approve the health and safety plans.
- Many health and safety procedures can be adopted from either onshore wind energy industry or from offshore oil and gas industry. New procedures are to be developed for e.g. accessing the turbines from supply vessels or installing turbines with new vessels. Especially for this type of activities, new health and safety plans need to be developed and approved by licensing authorities.
- From the investigations, it could not be concluded that health and safety provisions will have (limiting) influence on the design of the offshore wind turbines. All measures, procedures, and provisions that deal with health and safety, need to be assessed and approved individually. Examples of health and safety plans that have been approved are attached in the Annexes of this report.
- In situations where rescue organisations have to cover offshore installations of different design there is a strong urge to try to uniform the access facilities for the different designs, including the accompanying procedures.

ANNEX A: DUTCH EXAMPLE OF LICENSING

A.1 Licensing authorities

The Dutch authority for licensing in the EEZ is Rijkswaterstaat. The licensing includes Health and Safety aspects.

Licence for offshore installations:

The National organisations are involved in regulation of health and safety aspects:

- Ministry for Social Affairs (Arbeidsinspectie):
  Authority for work activities related to:
  - a moored ship;
  - loading and unloading a moored ship, a standing helicopter;
  - transfer of workers or passengers to their (offshore) work location:
  ⇒ a standing platform;
  ⇒ a standing turbine;
  ⇒ a standing substation.
  - Arbeidsinspectie: demands a risk analysis and a Safety Plan for each of the work activities. All the analyses and the accompanying Safety Plans have to be authorised and signed by this authority and also by the other authorities connected to the execution of the plans.
- Scheepvaartinspectie (Maritime inspection) (based on Scheepvaartwet): Valid for any work activity on a sailing ship, also when wind turbine personnel already executes work during sailing.
- Luchtvaartdienst (Dutch Aviation Authority); valid for helicopter flights, if applicable.

A.2 Example for offshore windfarm

Project: Offshore windfarm Q7-WP (E-connection Project B.V.)
License demands:

- Safety and Calamity Plan
- Safety and Health Plan

Safety and Calamity Plan
This plan includes the identification of plans, requirements, procedures and risk analysis, to be prepared during construction as well as during operation and maintenance of the wind park. The following items are addressed:

Safety and Clamity Plan Offshore Wind Farm Q7-WP
- Safety plan during building
- Safety plan during maintenance
- Calamity plan during building
- Calamity plan during maintenance
- Drawings
- Health, Safety and environmental bridging document
  - Introduction
  - Objectives
  - Organisation
  - Health / medical
  - General safety procedures
  - Emergency
  - Risk management
  - Environment protection
  - Project organisation chart
  - Emergency communications
- Smit (= sub contractor) safety manual
- Smit diving manual
- Safety Q7-WP offshore windfarm

Purpose and contents:

- The licence for construction, maintaining, repairing and removing of offshore wind farm Q7-WP has a paragraph concerning Health and Safety.
- The paragraph concerning Health and Safety refers to a Safety and Calamity plan that includes several annexes.
- The Safety and Calamity plan:

  Safety plan:
  - refers to the concerning documents of sub-contractors for the safety of construction personnel
  - defines to write and implement safety plans for the constructive subprojects
  - writes the demands for personnel skills and training for the wind farm construction
  - writes the safety demands concerning subcontractors
  - defines to perform a preliminary Risk Analysis and Hazard Identification
  - refers to the plan for maintenance
  - refers to Appendix E for the specific Q7-WP safety plan
  - analyses the different work activities during maintenance
  - analyses the safety cases during personnel transfer by boat or by helicopter
  - refers to the specific safety plans in Appendix E for helicopter transfer

  Calamity plan:
  - analyses calamities during construction and during maintenance and repair

Activities to be covered:

Safety and Calamity Plan for Q7-WP (document no. Q7WP.OP.MER-R03, Safety Plan)

Safety Plan:

- during Installation:
  - Organisation of project and work activities (document Q7WP.OP.MER-R01, Safety & Maintenance document)
  - Safety Plans
  - Personnel demands
  - Subcontractors
  - Risk analysis / Hazard Identification
- during Operation and Maintenance:
  - Organisation of work activities in Q7WP.OP.MER-R06
  - Transfer of personnel:
  - By boat
  - By helicopter in 'Safety Offshore Windpark Q7-WP' Appendix E

Calamity Plan:

- during Installation:
  - Organisation: contacts
  - Procedures: to be written for sub-projects, general description
- during Operation:
  - in wind turbine or in transformer platform
- during Maintenance: procedure

Annex A: drawings

Annex B: Health, Safety and Environment (HSE) Bridging document
Health, Safety, Emergency:

- Objectives and Philosophy
- Health, Safety and Environment Protection Policy: management objectives
- Organisation of:
  - responsibilities of personnel and managers
  - emergency communications
- Personnel selection and training
- Health certificate and Medical examinations
- General safety procedures
- Emergencies: communications, first aid, evacuation
- Emergencies, communications, health, medical
- Risk management: assessment (Hazard & Risk Assessment Report)
- Environment protection
- (Subcontractor) Dive manual
- (Subcontractor) Safety Manual

ANNEX B: DANISH EXAMPLE OF LICENSING

Information (general) from Søren Vestergaard (Techwise):
Department DEA for Danish Oil exploration and production is not involved with offshore wind activities.
Involved are:
- National Working Environment Authority (NWEA)
- Danish Aviation Authority (DAA)
- Danish Marine Authority (DMA)

Workers:
- during the workday: NMEA overall responsible for any safety of workers
- vessel is moored in harbour: workers under NWEA
- vessel has left the quay: workers on vessel under DMA

Transport of passengers by boat:
- passenger traffic: normal Danish and international rules
- passenger working on board when sailing: he is no more a passenger: DMA responsible
- as soon as passenger has solid ground (onshore, seabed) NWEA is responsible authority
- specific requirement for training when using MOB-boat for passenger transport
- 1 day sea safety course to get familiar with MOB-boat, survival suit, liferaft, hypothermia

Transport of passengers by air:
- DAA responsible authority
- worker in the air or connected to helicopter with hoist line: DAA responsible authority
- 1 day sea safety training + 1 day helicopter hoist training

Transfer of goods by boat:
- not different from other goods transport

Transfer of goods by helicopter:
- commercial helicopter hoists: regulation JAR-OPS 3.005(h) is in force
- goods inside closed cabin: rules as for civil aviation
- transport in sling: aerial works: operator needs permission from DAA for each case

Transfer of goods from vessel to turbine:
- use of jack-up or barge: normal regulations for ship based cranes

Overnight (emergency) stay on turbine:
- for 4 persons in every turbine: sleeping bags, food and water

General safety for technicians:
- basic first aid
- helicopter hoist platform has 1,5 m railing around

NWEA requirements for technicians in case of accident:
- same medical service offshore as onshore
- some kind of pain relief until rescue helicopter arrives (availability of morphine injectors)

DK, NegMicon A/S:
Emergency Response Plan, Yttre Stengrund Offshore Turbine Park, Service Phase
Prepared by Esbjerg Safety Consults A/S (www.safetyconsult.dk) for this specific offshore wind turbine park.
Abbreviations:
- SWEA (Swedish Work Environment Authority)
- SVB (Stand By Vessel)
- MOB (Man Over Board)

Description of the:
- exact location of the 5 turbines
- platform outside the tower, grating according EN ISO 14122-1 and –2
- capacity and safety factor of the platform crane according DNV Rules for Certification of Lifting Appliances and SWEA AS 1983:5, 1987:3, 1994:40
- harbour that has the base facilities, the nearby harbours
- boat to be an SVB and providing MOB standby assistance
- procedures and guidelines for the handling of predictable emergencies occurring during service and repair of the turbines
- plan to be the minimum requirements and never overrules official regulatory requirements
- compliance of all visiting personnel and contractor personnel with the requirements
- compliance with more rigorous contractor requirements or procedures
- contractors health and safety documentation to be reviewed and approved by NEGMicon before start
- contractors equipment and boats including personnel transport boats to be examined and approved by NegMicon
- contractors to describe and demonstrate above requirements accordance assignment

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Title	RECommendations for OFFshore wind turbines Task 2: Labour safety (health and safety)
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Abstract

The investigation of Labour safety at offshore Wind Energy installations has been focussed on aspects like licensing, health and safety, and labour safety influencing the wind turbine design. In other words: are there any regulations that determine e.g. the turbine design, or limit certain design solutions?
The investigation resulted in the following general conclusions:

1. Uniform guidelines for all European countries having an Exclusive Economic Zone (EEZ) on the North Sea are not possible at the moment. Every country has his own licensing authorities.
2. New HSE (Health, Safety and Environment) procedures have to be developed, based on the existing knowledge of offshore oil companies and maintenance companies and institutes.
3. It could not be concluded that health and safety provisions will have (limiting) influence on the design of the offshore wind turbines. All measures, procedures, and provisions that deal with health and safety, need to be assessed and approved individually.
4. There is an urge to uniform offshore wind turbine access facilities and procedures.

Key words offshore wind energy, labour safety, licensing

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