HAZARD IDENTIFICATION CHECKLIST: OCCUPATIONAL SAFETY AND HEALTH (OSH) RISKS IN THE WIND ENERGY SECTOR

Part A: Introduction

This checklist aims to help identify the potential hazards to workers engaged in the activities associated with the wind energy sector. It considers the activities and the specific hazards to workers across the entire life cycle of wind turbines, from the manufacturing and transportation of parts, through their installation, operation and maintenance, to emergency rescue and waste treatment. The checklist covers the most common hazards associated with large-scale wind energy installations but in no way does it mitigate the need to undertake a systematic and thorough risk assessment of the wind farm.

Wind energy is a mainstream renewable power source and, if the right steps are taken, this source will be essential in meeting Europe's 2020 renewables target, tackling climate change, strengthening energy security and creating new jobs. It is renewable and clean and produces no greenhouse gas emissions. In 2013, it accounted for 13% of the EU's power capacity and 32% of all new power capacity in Europe. As the EU power sector continues its move away from oil, coal and nuclear fuels, wind energy has experienced tremendous growth over the past decades, and this is expected to continue. In 2010, there were 70,488 onshore wind turbines and 1,132 offshore turbines across the EU. By the end of 2009, the European wind energy sector provided jobs for 192,000 people, and many more well-trained workers are needed in areas ranging from manufacturing to project management. It has been predicted that by 2020 there will be 446,000 jobs in the wind energy sector in Europe

Although wind energy is considered 'green' and good for the environment, it does not necessarily mean it will be good for the health and safety of workers. Wind energy workers can be exposed to hazards that can result in fatalities and serious injuries during the various phases of a wind farm project. Wind turbines are installed both onshore, including inland and costal installations, and offshore, those installations that are located away from the coast. Wind energy workers both onshore and offshore may be exposed to common hazards throughout the entire life cycle of a wind turbine for example exposure to harmful substances; lone working; working at height; working in confined spaces; moving parts; falling objects; slips trips and falls; physical load from climbing towers; musculoskeletal disorders (MSDs); psychosocial issues; work organisation; communication issues; and inexperienced workers. For offshore wind farms the working at sea and the extreme weather conditions leads to additional and more specific hazards.

Wind energy is a relatively new industry, and some of the workers may not be fully aware of the hazards that exist in this work environment. In addition, the speed at which the EU wind industry is expanding has led to a skills gap, with inexperienced workers involved in processes for which they have not been trained, and therefore putting their safety and health at risk.

More detailed information about risks and prevention can be found in EU-OSHA's "Occupational safety and health in the wind energy sector" report and e-fact 79.

1.1 How to use a checklist

- This checklist is not intended to cover all the risks associated with the life-cycle of every large-scale wind energy installation, but to help to start the hazard identification process and put effective prevention measures into practice.
- A checklist is only a first step in carrying out a risk assessment. Further information or expert help may be needed to assess more complex risks.

- You should adapt the checklist to your particular workplace and to the characteristics of your workforce as specific environments and personnel may have their own specific needs. Some extra items may need to be covered, whereas other points may be irrelevant.
- For practical and analytical reasons, this checklist presents problems/hazards separately, but in workplaces they may be intertwined. Therefore, you have to take into account the interactions between the different problems or risk factors identified. Indeed, a preventive measure designed to tackle one risk factor may also help to prevent the occurrence of another.
- Conversely, it is equally important to check that any measure aimed at reducing exposure to one risk factor does not increase the risk of exposure to other hazards.

- **Important issues that need to be addressed**
  - Are managers and workers aware of the potential risks associated with the various activities in the life cycle of large-scale wind energy installations and are they committed to minimising such risks?
  - Does the organisation encourage workers to report issues and involve them in problem-solving activities?
  - Are workers appropriately trained and has a competent person carried out risk assessments?
  - Are any reported cases of accidents and incidents being managed?
  - How is the effectiveness of the measures taken to prevent risks caused by large-scale wind energy installations being evaluated and monitored?

Part B: Checklist for the prevention of accidents and damage to health in the wind energy sector (large-scale installations)

For example:

- Does the hazard exist at the workplace?
- Are the hazards controlled to minimise negative influences on safety and health of all workers?

Answering '**NO**' to one of the following questions indicates a **need for improvements** to be made in the workplace.

Questions		YES	NO
1	**Site management (references: 1, 2, 3, 4, 5, 6 and 7)**		
1.1	**Safety Co-ordination onsite**		
1.1.1	Has a competent safety coordinator been appointed to coordinate and oversee safety actions and to update disseminated safety information?		
1.1.2	Has the safety co-ordinator received appropriate training to carry out his duties?		
1.1.3	Do supervisors provide leadership in addressing and promoting OSH in the wind farm? For example, do they conduct inspections and act quickly to deal with hazards?		
1.1.4	Is access to the site controlled and/or appropriate levels of supervision in place?		

	Questions	YES	NO
1.2	**Emergency Procedures**		
1.2.1	Are there written emergency procedures and plans in place that consider any major incident within a wind turbine, how the rescuing of workers will be undertaken and the co-ordination with the emergency services?		
1.2.2.	Do these procedures take into consideration the remoteness of onshore wind farms or if the facility is offshore? For example what to do in the event of: ▪ Person overboard when being transferred to and from the wind turbine. ▪ Vessel collision. ▪ Helicopter crush. ▪ Fire, explosion or collision on turbine or accommodation module. ▪ Stranded workers on turbines due to weather conditions. ▪ Diving emergencies.		
1.2.3	Do all personnel, contractors and visitors receive training and information on the emergency procedures?		
1.2.4	Have competent fire marshals been appointed to coordinate evacuations and communicate with any emergency services that may attend an incident onsite?		
1.2.5	Are there effective and reliable ways of raising the alarm for all employees? Are emergency numbers displayed in the wind turbine?		
1.2.6	Are emergency drills carried out at the wind farm as a minimum twice a year?		
1.3	**First Aid**		
1.3.1	Has an appropriate number of first aiders been appointed? Have the following been considered when determining this number: ▪ Size of the wind farm (e.g. number of persons on site simultaneously). ▪ Location of the wind farm. ▪ Response time for emergency services to reach the wind farm. ▪ Type of work carried out in the wind turbine. ▪ Presence of vulnerable groups (e.g. young workers, pregnant women, visitors, people with special needs etc.) ▪ Wind farm being in a remote site. ▪ Lone working. ▪ Requirements for travel. ▪ Other parties / subcontractors working on the wind farm. ▪ Records of previous incidents. ▪ Adequate coverage by first aiders at all times.		
1.3.2	Are the first aiders' identities displayed in the wind turbine?		
1.3.3	Are there sufficient first aid kits available?		
1.3.4	Is the content of the first aid kit in date and complete?		
1.3.5	Are all workers made aware of the accident reporting system?		

	Questions	YES	NO
1.4	**OSH Management**		
Hazard Management			
1.4.1	Are there defined systems, procedures and documentation in place to manage Health and Safety? For example do they cover: ▪ The objectives and goals for health and safety being set for the project. ▪ An organisation structure that clearly defines health and safety roles and responsibilities of all responsible persons and site personnel. ▪ Description of the defined systems, procedures and documentation in place to manage health and safety. ▪ Procedure for the development of method statements, risk assessments and safe systems of work for all activities throughout the entire life cycle of the wind turbines, for example construction, operation, maintenance, demolition etc. ▪ The resources that have been allocated to ensure all necessary OSH information, instruction and training is being provided.		
1.4.2	Are there clearly defined methods and procedures in place for conducting risk assessment? Is a system in place that ensures all risks to all persons working in the wind turbine have been identified, assessed and are adequately controlled?		
1.4.3	Have workplace hazards linked to the organisation of the work and work-related stress been assessed as part of the work-place risk assessment? Do these cover: ▪ Workload. ▪ Deadlines. ▪ Support from supervisors and colleagues. ▪ Autonomy. ▪ Monotony. ▪ Working offshore. ▪ Working day/night rotating shifts. ▪ Working at height for several hours at a time either in harness or confined within the nacelle. ▪ Work-life balance.		
1.4.4	Are there measures in place to avoid a high work load and tight deadlines?		
1.4.5	Have the specific needs and risks of the different worker groups (for example migrant workers, young and older workers or female workers) been addressed?		
1.4.6	Is there a procedure in place that allows employees to report hazards in the wind turbine as soon as they are detected?		
1.4.7	Are all workers aware of these risk management mechanisms and procedures? Do workers have easy access to a site-specific safety manual and task-specific risk assessments?		

	Questions	YES	NO
1.4.9	Is the use of sub-contractors appropriately managed? Are contractors/visitors to the wind turbine briefed on workplace hazards before entering? For example is the following information provided before work commences: ▪ Wind farm layout. ▪ The hazards they can encounter in the wind turbine. ▪ Information on site rules and safety procedures including incident reporting process. ▪ What PPE is required when working in the turbine. ▪ Any special equipment that needs to be used onsite. ▪ What to do in the event of an emergency. ▪ Clearly understand their responsibilities and restrictions. Are procedures in place (for example are contractors escorted) to ensure the management and supervision of sub-contractors whilst they are onsite?		
1.4.10	Is lone working avoided or are there adequate procedures in place to protect lone workers? Are employees working on their own / remotely issued with personal first aid kits and personal communicators / mobile phones etc.?		
1.4.11	Is appropriate Personal Protective Equipment (PPE) available and being used and maintained correctly? For example: eye, head, ear, and hand protection or safety harnesses when working at heights.		
	Training		
1.4.12	Are training needs for staff at all level identified?		
1.4.13	Is OSH training made available to all employees?		
1.4.14	Are all employees fully trained in the skills required to work in a wind turbine?		
1.4.15	Are training records maintained?		
	Communication and Employee participation		
1.4.16	Are relevant safety rules and regulations including information from wind associations or federations appropriately communicated to the workers including temporary workers, sub-contractors and visitors? For example OSH information should be communicated and passed on to: ▪ Site personnel and the management team. ▪ Third parties. ▪ The public. ▪ Shared workplaces. ▪ Emergency services.		
1.4.17	Are any safety critical turbine faults communicated to the industry and are turbine manufacturers/the industry consulted regularly to share good practice and identify potential issues?		
1.4.18	Does a health and safety committee exist?		

	Questions	YES	NO
1.4.19	Are workers consulted on all workplace changes that may affect the OSH of employees in the wind turbines? For example are workers consulted in the development of: ▪ Safety rules and procedures. ▪ Risk assessments including their results and method statements. ▪ The introduction of any measure which may substantially affect workers health and safety at work. For example the introduction of new equipment or new systems of work. ▪ Information you must give your employees on the risks and dangers arising from their work, measures to reduce or get rid of these risks and what employees should do if they are exposed to a risk. ▪ The planning and organisation of health and safety training. ▪ Changes within the workplace.		
	Welfare		
1.4.20	Is there a suitable way to access the site e.g. suitable roads and walkways? Is there a system in place to check for the safe access to the wind turbine?		
1.4.21	Are adequate welfare facilities/amenities provided for all employees?		
1.4.22	For offshore wind farms have appropriate accommodation platforms or vessels been provided?		
1.4.23	**Are lighting levels in and around the wind turbine suitable? The lighting must:** ▪ Allow people to notice hazards and assess risks. ▪ Be suitable for the environment and the type of work (for example, it is not located against surfaces or materials that may be flammable). ▪ Provide sufficient light (illuminance on the task). ▪ Allow people to see properly and discriminate between colours, to promote safety. ▪ Not result in excessive differences in illuminance within an area or between adjacent areas. ▪ Not pose a health and safety risk itself. ▪ Be suitably positioned so that it may be properly maintained or replaced, and disposed of to ensure safety. ▪ Include, when necessary, suitable and safe emergency lighting.		
1.4.24	Are workers protected from extreme weather and extreme temperatures?		
1.4.25	Are relevant safety signs displayed in the wind turbine?		
2	**Manufacturing (references 7, 8, and 9)**		
2.1	**Hazardous substances**		
2.1.1	Is there a system that identifies all hazardous substances used in the manufacturing of wind turbine components? Have risk assessment been carried out?		

	Questions	YES	NO
2.1.2	Are exposures to chemicals and dust eliminated or, if not possible, reduced to the minimum, giving priority to measures at source according the hierarchy of control measures as indicated in the legislation on hazardous substances? Please note that national legislation on dangerous substances may have stricter provisions and should be checked)		
2.1.3	Are material safety data sheets obtained for all the substances used and are these made available to all workers?		
2.1.4	Is mechanical ventilation provided throughout the fabrication area at sufficient rate?		
2.1.5	When risk reduction measures at source are not sufficient, is personal protective equipment (PPE) provided, used, and maintained whenever necessary?		
2.1.6	Are workers trained to use the PPE provided?		
2.1.7	Are flammable or toxic chemicals stored in appropriate containers in a well-ventilated area, when not in use?		
2.1.8	Are there procedures in place for safe maintenance and cleaning of manufacturing installations where exposure to chemicals and dust could occur?		
2.1.8	Is the control of exposure to hazardous substances monitored in the workplace? Is the quality of the air and exhaust air monitored?		
2.1.10	Is the health surveillance of workers carried out in the workplace?		
2.1.11	Do workers have access to information on safe working procedures?		
2.2	**Manual handling**		
2.2.1	Is work arranged so that manual handling operations such as lifting and carrying or repetitive manual handling of even light items are avoided, and where not possible, reduced to a minimum?		
2.3.2	Have workers been trained on safe manual handling techniques?		
3	**Transportation (Reference 3, 11, 12, 13, 14 and 15)**		
3.1	**Onshore - General**		
3.1.1	Has a route survey that describes the transport route and points of transfer been carried out? The survey should have highlighted: ▪ If vehicle routes are sufficiently wide for the purpose. ▪ If there are any restricted access routes, steep gradients, confined road corridors, road traction, or limited turning points. ▪ If ground conditions on which vehicles operate are suitable for the purpose, properly constructed and well maintained. ▪ If vehicle routes are free from obstructions and other hazards. ▪ If there are poor sight lines or visibility problems on the route. ▪ The form of communication that is best suited.		

	Questions	YES	NO
3.1.5	Are clear and appropriate hazard warning signs prominently displayed in the vicinity where vehicles manoeuvre e.g. directional, speed limit, give way, no public entry?		
3.1.6	Are additional safety controls provided e.g. provision of escorts? Escorts should be used: ▪ To provide and apply an element of control on road users along particular section of the route, for example when a load must impinge upon the centre like if a road or move along the wrong side of a roundabout. ▪ To provide an element of warning and information for other road users about the imminent proximity of the convoy. ▪ Assess and warn of potential hazards such as clearance, low hanging branches, junctions etc.		
3.2	**Onshore – Vehicle suitability and selection**		
3.2.1	Are assessments carried out to ensure that suitable vehicles and attachments have been selected for transporting wind turbine components? Has the assessment considered: ▪ Height, weight and width of the turbine components to be transported. ▪ Weight and dimensions of the vehicle. ▪ The maximum working load of the vehicle to be used. ▪ How will the components be secured. ▪ Maintenance record of the vehicle. ▪ How far will the vehicle travel. ▪ Conditions the vehicle will be used. ▪ Vehicle route conditions, for example access routes to the site, gradients, road restrictions. ▪ The need for additional equipment such as trailer units with hydraulic dynamically balanced suspension system.		
3.2.2	Do vehicles have good direct visibility or devices for improving vision where reversing cannot be eliminated and where significant risk still remains?		
3.2.3	Do vehicles have effective service and parking brakes?		
3.2.4	Do vehicles have seats and seatbelts where necessary?		
3.2.5	Are there guards to prevent access to dangerous parts of the vehicles, e.g. power take-offs, chain drives, exposed exhaust pipes?		
3.2.6	Do drivers have protection against bad weather conditions, or against an unpleasant working environment, i.e. the cold, dirt, dust, fumes and excessive noise and vibration?		
3.2.7	Is there a safe means of access to and exit from, the cabs and other parts that need to be reached?		
3.2.8	Are surfaces, where people walk on vehicles, slip resistant?		

	Questions	YES	NO
3.2.9	Are there measures in place that offer protection to drivers against injury in the event of an overturn or being hit by falling objects?		
3.2.10	Is there a vehicle preventative maintenance programme in place whereby vehicles are inspected at predetermined intervals of usage or mileage? Does the programme consist of: ▪ Checklist of maintenance service tasks performed. ▪ Maintenance service interval or frequency to perform tasks. ▪ Driver written-up inspections and/or complaints. ▪ An automotive facility with trained professional automotive technicians — either in-house or outsourced. ▪ Scheduling and recordkeeping, either manual or electronic.		
3.2.11	Is there a vehicle defect reporting system in place?		
3.3	**Onshore – Driver competence & training**		
3.3.1	Have drivers received adequate training, instruction and supervision to carry out their duties safely?		
3.3.2	Are drivers fully aware of the company's safe systems of work and their responsibilities in maintaining a safe workplace?		
3.3.3	Are driver's standards regularly monitored and are they recorded?		
3.4	**Offshore – Vessel suitability and selection**		
3.4.1.	Has a suitability assessment been carried out to ensure that the vessel selected is suitable for the intended operation? Has the suitability assessment been verified through a fit for purpose assessment? The selection of a Fit for Purpose vessel should take into account a wide range of operational factors including: ▪ The activity it will be carrying out - type, frequency, scale and complexity. ▪ The conditions likely to be encountered at the site of the activity and during transit to/from the site. ▪ The duration of the work. ▪ Station keeping requirements. ▪ Area of operation. ▪ Number of project crew. ▪ Vessel endurance / time offshore. ▪ Crew comfort factors e.g. fatigue, vibration, and other occupational health aspects. ▪ Transit times. ▪ Sea, tide and wind operational limits.		
3.4.2	Is there an inspection regime in place that ensures that the vessel is fit for purpose for the life cycle of its operations? This regime should cover:		

	Questions	YES	NO
	▪ Pre operation – Including selection of the vessel, mobilisation of equipment and personnel to the vessel. This may include installation of equipment onto and/or modification of the vessel. ▪ During operations – Carrying out the activity e.g. surveys, installation of meteorological monitoring equipment and masts, transits, emergency support. ▪ Post operation – De-mobilisation of equipment and personnel including returning the vessel to its pre-hire configuration.		
3.4.3	Have passage plans and navigational risks been assessed to determine the existing densities and type of marine traffic in the wind farm development area?		
3.5	**Offshore – service vessel passengers**		
3.5.1	Has offshore working been considered in an appropriate risk assessment? The assessment should consider: ▪ If suitable arrangements are in place for the transfer of personnel and equipment to and from the vessels, and to the wind turbines/other offshore structures. ▪ The impact of whole body vibration. ▪ Access to the base of the wind turbines from a vessel, whether by mooring alongside a landing stage or via a personnel transfer system, to take account of tidal range and tidal streams. ▪ Transfer from vessel to boat landing ladder and vice versa. ▪ Emergency response arrangements, including the provision of first aid equipment, rations and equipment in the event of stranding. ▪ Provision of appropriate navigation aids. ▪ Practicality of access by helicopter. ▪ the need to remotely stop turbine blades in the appropriate formation to allow for access by helicopter		
3.5.2	Do all service vessel passengers have in their possession valid certification as appropriate to their access requirements? As a minimum all service vessel passengers should have in their possession valid certification as appropriate to their access requirements such as: ▪ First aid. ▪ Sea survival. ▪ Helicopter Underwater Escape Training (HUET). ▪ Working at height.		
3.5.3	Are the names of all the service vessels passengers that have authorisation to undertake work within the wind turbines recorded in a database?		
3.5.4	Is a procedure in place to addresses visitors who do not hold the required certificates?		
3.5.5	Are all vessels passengers provided with PPE? For example: ▪ Safety footwear. ▪ Safety helmet. ▪ Harness. ▪ Safety belt and lanyard.		

	Questions	YES	NO
	▪ Fall arrest systems. ▪ Life jacket. ▪ Personal locator beacon. ▪ Survival suit.		
3.5.6	Are vessels specific safety inductions carried out?		
3.5.7	Are rescue and emergency procedures in place?		
3.5.8	Are weather conditions and the tides monitored and appropriate interventions made? Do these consider: ▪ The weather limitations of the activity taking into account the site and duration of the work. ▪ The selected vessel must be capable of operations within the expected prevalent conditions with a safety margin to allow for changes in environmental conditions. ▪ The time to transit to/from the site and distance from a safe haven. ▪ Site specific and up to date weather forecasts need to be reviewed to allow planning of the operation. ▪ Local weather, wind, tide and sea state characteristics data must be taken into account at the time of carrying out the activity. ▪ Local conditions should dictate when operations are safe to continue.		
4	**Construction / Demolition (references 3, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27)**		
4.1	**Communication and coordination**		
4.1.1	Has the frequency and methods of communication between all parties involved in the wind farm project been considered and agreed?		
4.1.1	Does this include arrangements for emergency response?		
4.1.3	Is everyone involved in the project aware of the equipment to be used to post or deliver OSH communication information?		
4.1.4	Have specific measure been put in place to coordinate marine operations and vessel movements?		
4.1.5	Can contact be maintained with key personnel, e.g. by mobile phones or radios, at all times?		
4.1.6	Are there procedures in place for persons working alone in a tower or in remote areas?		
4.1.7	Are instructions and information made available and understood by workers regardless of their native language?		
4.1.8	Are there procedures in place for the management of vessel movements, especially when several may need to be in the vicinity simultaneously?		
4.2	**Weather conditions**		

	Questions	YES	NO
4.2.1	Is there an adverse-weather policy in place?		
4.2.2	Does this policy cover: high winds, effects on workers of inclement weather, risk of being snowed in or cut off, lack of visibility, risk of lightning strike, hot sunny weather, cold weather and additional weather-related PPE?		
4.2.3	Are all workers aware of when work will cease due to high winds, poor weather, or significant sea states?		
4.2.4	Are all vessels and equipment used capable of being made safe and/or are able to reach sheltered waters in adverse weather conditions?		
4.2.5	Are the cranes used offshore capable of withstanding abnormal wind loadings when not in use?		
4.3	**Temporary facilities**		
4.3.1	Have the location of temporary structures been assessed so as to consider ground conditions or the need to secure against strong winds?		
4.3.2	Have safe unloading and loading areas been identified?		
4.3.3	Is the installation of temporary services such as electricity or Liquefied Petroleum Gas (LPG) adequate and safe?		
4.4	**Working at Heights**		
4.4.1	Has working at height been considered in an appropriate risk assessment?		
4.4.2	Can working at heights activities be eliminated?		
4.4.3	Have activities such as use of ladders, access into tower and hub, working in nacelle, rope access activities, etc. all been taken into consideration?		
4.4.4	Has the assessment considered the various places of work and their means of access at height? Have the following been assessed? ▪ They are stable and of sufficient strength. ▪ Have sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials. ▪ Include suitable and sufficient means for preventing any falls of workers or objects.		
4.4.5	Are fall prevention provisions such as guard rails, suitable and sufficient and are they regularly inspected?		
4.4.6	Are fall arrest equipment suitable and sufficient? Has a risk assessment been undertaken that demonstrates that the work at heights can be performed safely while using such systems?		
4.4.7	Has the approval of the use of ladders been as a result of a risk assessment that has demonstrated that the use of more suitable work equipment is not justified because of the low risk of the activity, because the duration of use is short, or because of existing features on site which cannot be altered?		

	Questions	YES	NO
4.4.8	Are rescue procedures in place to recover workers who may become trapped or suspended at height?		
4.4.9	Are workers appropriately trained?		
4.4.10	Are tools or other objects / materials fitted with safety straps to prevent them being dropped?		
4.4.11	Are working areas free from slip and trip hazards?		
4.4.12	Are access areas directly beneath work at height restricted?		
4.5	**Lifting Operations**		
4.5.1	Are all lifting operations subjected to a full risk assessment?		
4.5.2	Do the risk assessments consider the activity, the load and the environment?		
4.5.3	Has a lifting plan been carried out?		
4.5.4	Has a lifting supervisor been appointed?		
4.5.5	For Onshore lifting operations that use mobile cranes have the following been considered? ▪ Condition of access roads and if they are strong enough to withstand. the axle load of the crane. ▪ Presence of underground or overhead services. ▪ Ground conditions - no potential for shifting or settling of outriggers. ▪ Wind conditions.		
4.5.6	For Offshore lifting operations have the following been considered? ▪ Type of construction vessel to be used - Vessel design. ▪ The impact of the vessel being subjected to different motions such as rolling or pitching. ▪ Vessel stability. ▪ Wind conditions. ▪ Tidal conditions. ▪ Lifting of larger components ▪ Crane position. ▪ Rated capacitor indicator to be set for appropriate sea-state. ▪ Visibility of vessel deck. ▪ Lifting done over the vessel deck. ▪ Personnel working near loading/unloading area.		
4.5.7	Is EN13000 (the requirements for limiting and indicating devices on mobile cranes) been applied to correctly calculate the drag coefficient (Cw) of loads?		
4.5.8	Are workers involved in lifting operations appropriately trained?		
4.5.9	Is lifting equipment regularly inspected and suitable for the specific task?		

	Questions	YES	NO
4.5.10	Are there effective means of communication (e.g. signals or radio) between the crane operator and banksman and/or those working at height?		
4.5.11	Are weather conditions monitored and appropriate interventions made if, for example, high winds or lightning are expected?		
4.6	**Diving Operations**		
4.6.1	Have risk assessments been carried out for all diving activities that use site specific information and that takes into consideration the diving activity and its location? For example: ▪ Turbine/cable maps, details on port of operations, ▪ Tidal restrictions, ▪ Facilities available to diving contractors, ▪ Access and egress arrangements to/from vessels, or contact details.		
4.6.2	Has the elimination of the diving operation been considered? Is it possible to use alternatives like remotely operated vehicles?		
4.6.3	Has a dive plan been produced that indicates the resources required to undertake the diving work safely? For example: ▪ Interface with crane operations, transition piece works, or barge operations. ▪ Tooling requirements and quality assurance requirements. ▪ Anticipated boundaries of the dive site. ▪ Historical information (technical and safety). ▪ Environmental conditions.		
4.6.4	Has the dive contractors' competence and capability been assessed?		
4.6.5	Is the dive team size sufficient for the project?		
4.6.6	Has a person been appointed to supervise the dive?		
4.6.7	Is there suitable and sufficient plant available to carry out the dive?		
4.6.8	Is there additional plant to address first aid and foreseeable emergencies connected with the diving project?		
4.6.9	Are checks carried out to ensure that weather conditions and the strength and depth of tides are suitable for diving to be undertaken?		
4.6.10	Is an 'A' (alpha) flag deployed or appropriate marine lighting used to show that a trial is in place?		
4.6.11	Can a diver be deployed safely into the water and recovered, including in an emergency?		
4.7	**Noise and Vibration**		
4.7.1	Have noise and vibration risk assessments been carried out for activities that expose workers to levels at or above the daily exposure action limit?		

	Questions	YES	NO
4.7.2	Has the type level and duration of the exposure been considered?		
4.7.3	Has the work activities been designed with appropriate work schedules and adequate rest periods to limit the exposure durations?		
4.7.4	Have all workers been provided with suitable and appropriate hearing protection?		
4.7.5	Are suitable and sufficient information and training provided to employees to ensure that work equipment is used correctly and safely?		
5	**Operation and maintenance (references 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, and 41).**		
5.1	**General issues**		
5.1.1	Have all operational and maintenance activities been risk assessed?		
5.1.2	Are all operational monitoring activities clearly defined?		
5.1.3	Are all operators appropriately trained and equipped to do their job safely and effectively?		
5.1.4	Is there a suitable preventative maintenance schedule in place to avoid catastrophic failures and to minimise the need for reactive maintenance?		
5.1.5	Are maintenance activities appropriately coordinated and supervised and are responsibilities clearly defined?		
5.1.6	Are maintenance workers appropriately inducted and trained with respect to the work they are expected to undertake?		
5.2	**Electricity-related risks**		
5.2.1	Is there safe system of work procedures in place to manage work activities on or near live electrical systems?		
5.2.2	Is there a permit to work procedure in place for electrical work?		
5.2.3	Is electrical work being carried out by a qualified and competent electrical engineer?		
5.2.4	Are effective safety measures and procedures for electrical isolation and earthing? LV isolation should be by the withdrawal of fuse links or other Isolating. Devices. Time switches, float switches, thermostats, sequence switching devices or similar automatic switching devices are not Isolating Devices. Are approved insulation tools being used?		
5.2.5	Is there an appropriate management system for the use and maintenance of switchgear?		

	Questions	YES	NO
5.2.6	Has the fault level of the generator, transformer and cable layout been appropriately calculated and adequate circuit breakers installed?		
5.2.7	**Are methods of frequency and voltage control suitable and sufficient?**		
5.2.8	Are wind turbines and their associated hardware compatible with the relevant Distribution Network Operator's distribution code and their technical recommendations and safety rules?		
5.2.9	Have common standards for warning signs and for labelling and annotating electrical plans been agreed and is all equipment clearly and accurately labelled?		
5.2.10	Are the electrical tools/equipment approved for work in wet areas?		
5.2.11	Are workers provided with suitable PPE when risk reduction measures at source are not sufficient? For example rubber gloves / insulating gloves.		
5.3	**Fire prevention**		
5.3.1	Are turbines equipped with comprehensive lightning and surge protection, which is appropriate for the individual type of turbine and based on risk assessment or set in accordance with the International Standard for Protection against lightning, IEC 62305 LPL 1? For example: ▪ Compact circuit breakers. ▪ Semiconductor protection fuses. ▪ Differential current monitoring devices. ▪ Residual-current devices.		
5.3.2	Is appropriate fault protection in place to selectively disconnect faulty components?		
5.3.3	Are combustible materials kept to a minimum and are hydraulic and lubricant oils non-combustible or have significantly higher flash points than operating temperatures?		
5.3.4	Where hot work cannot be avoided, are fire precautions taken prior to, during and after it is carried out? Are hot work permits in place?		
5.3.5	Are smoke detectors and fire alarms installed and regularly tested?		
5.3.6	In case of fire or strong winds, are the shutdown procedures and engineering controls suitable and sufficient?		
5.3.7	Are suitable fire extinguishers regularly checked and appropriately located, and are workers trained to use them?		
5.4	**Ice throw/blade failure / tower collapse**		
5.4.1	Are systems in place, such as vibration sensors, to assess the condition of rotor blades and detect the presence of ice build-up?		

	Questions	YES	NO
5.4.2	Are systems in place to alert workers of the threat of ice/blade throw and ice fall from the nacelle?		
5.4.3	Are there adequate exclusion zones (at least 150m in all directions from the wind turbine) that will become effective when the threat of ice /blade throw is detected?		
5.4.4	Are the turbines designed to cope with foreseeable weather conditions?		
5.4.5	Are blades equipped with lightning protection systems?		
5.4.6	Are systems in place to prevent the turbine being restarted with the blades locked in a hazardous position after maintenance work?		
5.4.7	Are there redundant “fail-safe” control systems in place to avoid wind turbine operation under over-speed conditions?		
5.4.8	Is there a suitable and sufficient inspection and preventative maintenance regime in place? For example to check integrity of the tower fastening system or the condition of blades.		
5.5	**Harmful substances**		
5.5.1	Are the hierarchy of controls defined in Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents used to ensure worker exposure to harmful substances is reduced to a minimum and within the relevant national Occupational Exposure Limits (OEL)?		
5.5.2	Are Safety Data Sheets provided and are harmful substances risk assessment carried out?		
5.5.3	Is appropriate storage provided for gas cylinders and flammable or toxic chemicals?		
5.5.4	Are there provisions for the neutralisation or disposal of spills or overflows of hazardous chemicals?		
5.5.5	Are adequate washing facilities provided and has the need for eyewash stations and emergency showers been considered?		
5.5.6	Has the need for mechanical ventilation been considered and if in use, is its effectiveness regularly checked?		
5.5.7	Are all workers made aware of the exposure risks of for all hazardous substances used? Are they informed of the precautions they need to take?		
5.5.8	If used, are respirators inspected, cleaned, sanitised, and maintained regularly?		
5.5.9	Is air quality monitored and appropriate gas detectors used in confined spaces?		
5.6	**Musculoskeletal issues - manual handling / awkward postures / static postures / repetitive movements**		

	Questions	YES	NO
5.6.1	Have manual handling, repetitive movements and awkward postures been considered in an appropriate risk assessment?		
5.6.2	Is work arranged so that the heavy lifting is kept to a minimum?		
5.6.3	Are workers trained in safe handling techniques and are aware of the risks associated with awkward (i.e. non-neutral) postures?		
5.6.4	Are loads easy to lift or are mechanical assists available?		
5.6.5	Can the task be done without lifting of the arms above shoulder level?		
5.6.6	Are provisions in place to ensure workers avoid static postures (i.e. being in the same posture for long periods)?		
5.6.7	Are tools ergonomically designed and comfortable to use?		
5.6.8	Are tool belts provided and used when climbing and descending the wind turbine ladder?		
5.7	**Confined spaces**		
5.7.1	Have all the confined spaces in the wind turbine been identified? For example nacelle or inside blades.		
5.7.2	Is there a record of all identified confined spaces?		
5.7.3	Have all workers been informed of the existence of these confined spaces and warned of the possible hazards?		
5.7.4	Has a risk assessment been conducted to identify, evaluate and control all risks arising from entry or work in confined spaces?		
5.7.5	Are safe work procedures established for all confined space work, both routine and non-routine in the wind turbine?		
5.7.6	Do the safe work procedures for confined space cover the following key areas? ▪ Evaluation of the need to enter or carry out work in the confined spaces identified. ▪ A confined space entry permit. ▪ The types of atmospheric testing required and the interpretation of test results. ▪ The safety and health precautions to be taken during entry into the confined space and during an emergency situation. ▪ The provision and safe use of safety equipment and personal protective equipment. ▪ The means to prevent unauthorised entry into the confined space including the display of warning signs.		
5.7.7	Are the following information provided in the confined space entry permit? ▪ The location and identity of the confined space. ▪ The purpose of entry into the confined space.		

	Questions	YES	NO
	▪ The results of the gas testing of the atmosphere of the confined space. ▪ The validity of the confined space entry permit.		
5.7.8	Are safe means of access and egress provided for movement of workers to and within the confined space?		
5.7.9	Are all confined space openings effectively covered to prevent objects from falling through?		
5.7.10	Is there sufficient and suitable lighting provided for entry into and work in confined space?		
5.7.11	Are all moving parts and equipment inside the confined space locked out and tagged?		
5.7.12	Has a written rescue plan been established for work activities in confined spaces in the wind turbine?		
5.7.13	Have sufficient supplies of rescue equipment been provided/made readily available? Are the rescue equipment properly maintained?		
5.7.14	Are regular drills conducted?		
5.7.15	Have the persons entering the confined space received adequate safety and health training pertaining to the hazards associated with entry/work in the confined space?		
5.7.16	Have all appointed rescue personnel received adequate training in rescue operation, including first aid and proper usage of personal protective equipment and other rescue equipment?		
5.8	**Working at height**		
5.8.1	Have all the relevant points raised above, in Section 4.4, been considered from an operational and maintenance perspective and have these activities been risk assessed?		
5.9	**Lifting operations**		
5.9.1	Have all the relevant points raised above, in section 4.5, been considered form an operational and maintenance perspective and have these activities been risk assessed?		
5.10	**Exposure to noise**		
5.10.1	Have all the relevant points raised above, in Section 4.7., been considered from an operational/maintenance point of view?		
5.11	**Slips, trips and falls**		
5.11.1	Have slips, trips and falls been considered in an appropriate risk assessment?		
5.11.2	Are walkways clean, even, and free from clutter and potholes?		

	Questions	YES	NO
5.11.3	Are floor surfaces adequately slip resistant, bearing in mind the possible contaminants or wet surfaces that may be present, the type of work being undertaken and the angle of any slopes?		
5.11.4	Are there suitable provisions in place to minimise and/or clean up floor surface contaminants, e.g. suitable cleaning equipment and cleaning regimes?		
5.11.5	Are changes in level (i.e. small slopes and steps that could present a trip hazard but cannot practicably be removed) clearly defined by using contrasting floor colours?		
5.11.6	Are lighting levels sufficient?		
5.11.7	Are suitable handrails provided on stairs and are step dimensions reasonable and consistent?		
5.11.8	Are contrasting stair no sings installed to define the edge of each step?		
5.11.9	Is appropriate slip resistant footwear provided and if so, is its condition regularly checked?		
5.11.10	Is the condition of footwear and flooring regularly checked?		
5.11.11	Are workers conscious of slip and trip hazards and work responsibly?		
7	**Disposal and recycling**		
7.1.1	Is worker's exposure to airborne dangerous substances, micro –organisms or the generation of dust and aerosols avoided?		
7.1.2	Are these exposures reduced to a minimum giving priority to control measures at source according to the hierarchy of control measures indicated in the legislation on hazardous substances?		
7.1.3	Are adequate washing facilities available for all workers?		
7.1.4	Is the exposure to noise eliminated, or if not possible reduced to a minimum and kept within the limit of 85 dB(A) by implementing control measures at source?		
7.1.5	Is appropriate PPE provided, properly maintained, and are workers trained in their correct use?		

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