Maritime & Coastguard Agency

Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response (MGN 654 Annex 5)

Owner: Offshore Energy Lead, HM Coastguard, MCA
Author: Pete Lowson

Document Identity: OREI SAR Requirements v5

Version date: May 2026
Next review date: May 2028

Document revision

Revision	Date	Description	By
v2	11/2018	New paragraph on AIS beacon alerts and multiple AIS beacons New section on Far Offshore, Service Operations Vessels and Walk to Work New sections detailing requirements for adjacent developments, beacon registration and radio survey requirements CP&S section updated and added appendix and new section on UXO and Wreck Detailing SAR checklist requirement Clarification on refuge area requirement – min size	PL
v3	11/2021	Reformat, reorder and new content… SAR checklist incorporated into this document Noting other projects such as aquaculture should be fully aware of the contents of Annex 5 Updated HM Coastguard nomenclature Additional lighting parameters for ID marker boards and work lights Consideration of emergency towage, in certain circumstances Recognition of potential of migrant activity New high-level content on future technology Amended requirement on the use of walk to work vessels Further consideration regarding the potential impact of devices on leisure vessels and personal watercraft High level content related to test sites New reference appendices Other minor updates	PL
v4	01/2024	Clarification of terms ORED and OREI - updated throughout Updated nomenclature and other minor updates 1.3 Additional clarification on expectation of SAR impact assessment as part of NRA 2.3 Additional content for ERCoP expectations 2.5 New floating offshore wind content 2.8 Clarification of OFTO ERCoP requirements 3.6 Reference added to an additional turbine position 3.8.3 Reference to single resource operations 3.15.5 Consideration over ORED impact to CAT helicopters 3.16 Additional PLB content 4.1.2 Note regarding layout rules 4.3 Minor clarifications to helicopter refuge area guidelines 5.3.6 Clarification of expectation for nacelle roof marking 6.1.1. Reference added to Ex Sancho recommendation 6.12 New section on maritime security 7.1 and Annex C Additional content and amendments	PL
V5	05/2026	General grammatical updates and minor amendments 2.5 Additional content for floating offshore wind 2.8 New section for decommissioning References added to OREEF documentation 4.2. Minor additions related to floating offshore wind 7. Updated information relevant to new MPCP guidance	PL

Contents

Executive Summary

This document provides a description of the Maritime and Coastguard Agency's (MCA) policy and guidance, advice and specific requirements (where seen as necessary) to assist and enable Search and Rescue, and other emergency response e.g. Counter Pollution and Salvage operations, to, within, and in the vicinity of offshore renewable energy developments (ORED) – wind farms and areas generating power from wave action and/or water-current (surface, sub-surface and seabed located), floating solar and tidal lagoons, etc. OREDs are sites made up of several offshore renewable energy installations (OREI) – wind turbine generators, met masts, offshore substations (or equivalent), tide and wave generating devices, etc. In essence, OREIs are the individual 'structures' which collectively make up an ORED.

The document also forms part of MGN 654 (Annex 5). MGN 654 and MGN 654 Annex 1 set out how impacts of ORED on SAR should be assessed and options for mitigation, and this (Annex 5) provides more detail on these considerations. As set out in MGN 654 this must be assessed prior to application for consent/licence and the information submitted with an application, however, for some aspects, more detail on mitigation or refined project parameters may need to be provided post-consent where this information is not available at the application stage. Failure by developers to give due regard to the recommendations and mitigations proposed by the MCA in this document may result in objections to their planning proposals.

Scope

This document applies to any ORED within UK internal waters, territorial waters, the United Kingdom Search and Rescue Region and Exclusive Economic Zone (EEZ)..Developing and future technology such as offshore hydrogen are included within scope of this document, although specific content will be added as details on requirements are known.

This document is not exhaustive. Duty holders may provide additional or alternative emergency response measures in their area of operations so long as they meet the fundamental requirements outlined in this document and the Regulatory expectations for emergency response, written by the Health and Safety Executive (HSE) and MCA.

While out with the scope of this document, other marine projects e.g. aquaculture, do pose an additional risk and must have suitable emergency arrangements in place. The MCA will use this document to outline principles and requirements for these industries and therefore developers should be fully aware of these expectations and discuss them early with the MCA.

Constraints

The EU sponsored ACCSEAS Project[1] made the following statement in its final report (May 2015):

Planned wind farms by various countries provide a simple introduction to the nature of growth in offshore renewable energy installations. It is apparent that large areas of the North Sea could be dedicated to this utilisation thereby reducing the sea space for ships to navigate and manoeuvre. When taken together with the trend in the growth in shipping – both in numbers and size of vessels – it is clear that higher density of ships may be forced to navigate in more restricted sea areas, which could correlate with greater risk of grounding and collision, hence impacting the safety and efficiency of access to the region's ports.

The UK concurs with this assessment and notes that the consequences would likely increase the emergency response requirement to vessels and/or persons in distress within, close to or around OREI.

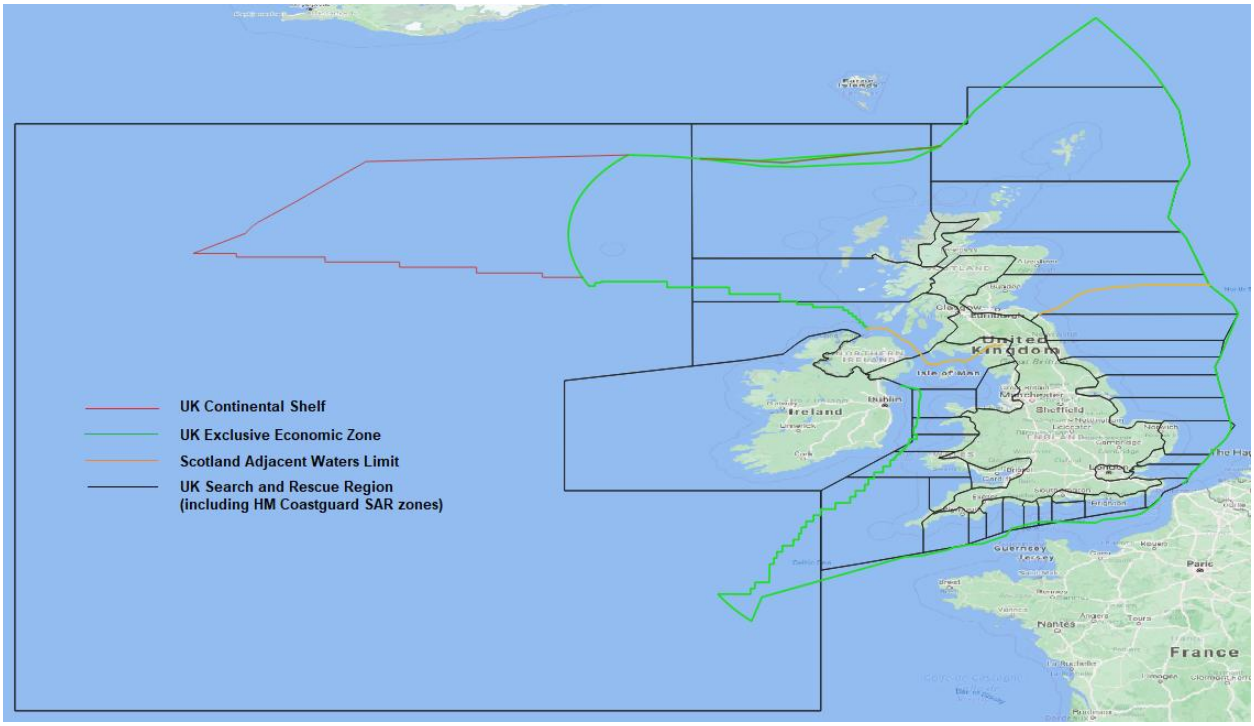


Figure 1: UK marine areas

[1] Accessibility for Shipping, Efficiency Advantages and Sustainability, a three-year part EU-funded project, ended in February 2015 having successfully demonstrated the potential for e-Navigation in the North Sea Region

Strategic environment and background

1 Strategic Environment

1.1 Organisational overview

The MCA is an Executive Agency of the Department for Transport (DfT) and is the UK's principal civil maritime organisation. It is dedicated to protecting the public and those working at sea, ensuring the safety and security of vessels, and preserving the UK's marine environment.

Safer lives. Safer ships. Cleaner seas

1.1.1 Every year HM Coastguard responds to more than 30,000 incidents at sea and on the coast. The coordination centres respond to calls for assistance initiated by a variety of means including voice, digital systems and beacon alerts, tasking appropriate resources in a timely manner. Prompt action prevents death and injury and protects the environment.

Shipping is vital to the global economy and transiting vessels in the UK EEZ need safe and unencumbered passage. The UK, which is dependent on ships and professional seafarers, requires a vibrant and safe shipping industry as an essential component in the supply chain for goods and services we use on a daily basis. The MCA works closely with the maritime industry to enhance shipping safety and prevent pollution, with ships operating safely and seafarers properly qualified and competent to work on ships.

The MCA aims to reduce pollution from shipping and minimise its effects on our waters, coastlines and economy and have comprehensive emergency response procedures to deal with pollution from ships, or the threat of pollution.

1.2 HM Coastguard

1.2.1 UK Maritime SAR

The MCA provides maritime SAR and emergency response co-ordination through the national maritime emergency service, HM Coastguard.

The co-ordination of maritime SAR by HM Coastguard is a statutory responsibility and confirmed in a statement to parliament (recorded in Hansard) by the Secretary of State for Transport in March 1992:

"HM Coastguard is responsible for the initiation and coordination of civil maritime search and rescue within the UK search and rescue region. This includes the mobilisation, organisation and tasking of adequate resources to respond to persons either in distress at sea, or to persons at risk of injury or death on the cliffs or shoreline of the UK."

HM Coastguard carries out this role through a national network of nine Maritime Rescue Coordination Centres (MRCC), one Maritime Rescue Sub Centre (MRSC)

and the UK Joint Rescue Coordination Centre (UK JRCC) which acts as the strategic command and control centre for HM Coastguard throughout the UK.

Each Rescue Coordination Centre (RCC) carries out a number of Coast Guard Functions and this includes the co-ordination, direction and management of Search and Rescue operations at sea and on the coast.

Duty holders will be advised (in their Emergency Response Cooperation Plan (ERCoP)) how to make routine and emergency contact with HM Coastguard.

1.2.2 UK Aeronautical SAR

Through the JRCC Aeronautical Rescue (JRCC AR), the MCA is responsible for the provision of civil aeronautical SAR coordination for UK airspace, and control of the deployment and direction of SAR fixed wing aircraft and helicopters. The JRCC AR meets the UKs commitment to International Civil Aviation Organization (ICAO) Annex 12 (Search and Rescue) requirements.

Additionally, the MCA is responsible for the management of all dedicated UK Search and Rescue aircraft, which operate as 'HM Coastguard' aircraft and provide rescue for land, air and sea incidents within the UK Search and Rescue Region.

1.2.3 Maritime Assistance Service

The MCA is also responsible, through HM Coastguard, for the provision of Maritime Assistance Services (MAS) in accordance with IMO Resolution A.950 (23). International Maritime Organization (IMO) defines this service as when '*the circumstances of a ship's operation that involve a MAS are not those requiring rescue of persons'*

Three situations can arise:

- the ship is involved in an incident (e.g., loss of cargo, accidental discharge of oil, etc.) that does not impair its seakeeping ability but nevertheless has to be reported;

- the ship, according to its master's assessment, is in need of assistance but not in a distress situation (e.g. about to sink, fire developing, etc.) that requires the rescue of those on board; and

- the ship is found to be in a distress situation and those on board have already been rescued, with the possible exception of those who have remained aboard or have been placed on board to attempt to deal with the ship's situation.

1.3 Business need

The MCA has an obligation to provide SAR response in all of the sea area occupied by OREIs. It is a policy requirement that SAR aircraft and rescue boats/lifeboats, as part of an effective national SAR response capability, are able to operate anywhere within the UK search and rescue region (UK SRR) and this includes amongst and

around any structures, including OREI, without significant risk or restriction or degradation to their normal operation. SAR resources will, unavoidably, suffer a degradation to their normal operations/performance simply due to the OREI's presence.

Therefore, the MCA has a significant interest in their development and operations. To this end it is necessary for OREIs to be located, constructed, equipped and operated in such a way as to minimise impacts and effects upon SAR and emergency response. Duty holders should compare and quantify any impact on SAR against that which exists prior to construction/deployment and demonstrate how they plan to address any reduction in capability. These results should be included within their Navigation Risk Assessment (NRA), as required by MGN 654, alongside an assessment of potential industry incidents from the new ORED and what increase in SAR cases this may have.

Duty holders may also be required to provide suitable mitigations, as outlined in this document, to help alleviate these impacts.

The MCA recognise that there are several key stakeholders and interested parties in relation to offshore renewable energy SAR and emergency response including emergency services, SAR resources, Government organisations, regulators and industry. Engagement and inclusion with all parties is important to ensure effective and robust emergency arrangements.

1.4 Restrictions on vessels assisting in SAR operations

1.4.1 MCA MGN 372 Amendment 1 provides advice and guidance to ships regarding navigation around and within offshore renewable energy installations. It states, in particular:

4.11 Options

4.11.1 In taking account of this guidance there are, in simple terms, three options for mariners:

(a) Avoid the OREI area completely

(b) Navigate around the edge of the OREI, or

(c) Navigate with caution through the OREI.

4.8.2 The choice will be influenced by several factors including the vessel's characteristics (type, tonnage, draught, manoeuvrability etc.), OREI type the weather and sea conditions.

4.8.3 Mariners should be aware that radar targets may be obscured when close to a wind turbine field.

4.8.4 These notes do not provide guidance on a safe distance at which to pass an OREI, as this depends upon individual vessels and conditions. However, where there is sufficient sea room it is prudent to avoid the area completely (option (a) above).

4.8.5 When choosing to navigate around or through the OREI, mariners should keep a close look out for hazards as outlined within this document and in all instances, mariners should passage plan accordingly.

1.4.2 International practice for SAR response to persons in distress at sea includes alerting and notifying the nearest vessel(s) (this includes small vessels e.g. fishing vessels and leisure craft) to an incident location and asking them to render assistance in accordance with the Safety of Life at Sea (SOLAS) regulations. OREDs may cause a significant navigational and/or operational safety risk to the use of such vessels within OREDs. The person in charge or master of any vessel/craft can decline to assist if such a risk is considered by them to exist. A vessel operator's company policy may also not allow a ship/craft to deliberately enter or make passage through any ORED.

1.4.3 These factors will, in some cases, mean that OREDs can only be entered by their dedicated operations support craft and/or specialist search and rescue boats/vessels and helicopters. This places a constraint on the options normally available to the SAR Mission Co-ordinator, and so SAR response within OREDs may, unless well supported by developer/operator resources, be consequently limited or prevented. Vessels responding under SOLAS, which cannot enter an ORED, may be able to provide some assistance from outside, by virtue of their own rescue boats.

1.4.4 If restrictions on SAR response to a particular ORED are considered by the MCA to be substantial, or particularly difficult, the MCA may request the licensing authority place a marine licence condition on the developer or operator of the ORED to remove or otherwise alleviate the risk.

1.4.5 This may necessitate an ORED developer/operator providing sufficient mitigations to ensure that SAR is possible – so far as it can be practicably and technically undertaken given the presence of physical obstacles (wind turbines and tide and current devices, structures, etc.). These measures must be able to withstand public scrutiny.

1.5 ORED support to SAR and emergency response

1.5.1 The growth and expansion of the industry into active sea-spaces means that the probability of SAR operations occurring within or close to an ORED is likely to increase. Having offshore renewable energy installations that meet, as far as practically possible, UK SAR requirements, ensures that SAR operations can be conducted across the entire sea-space of the UK SRR. This is a public benefit in support of the MCA's strategic mission.

1.5.2 However, the MCA also recognises that, by the nature of its operations and locations around the UK, the offshore renewable energy industry can offer valuable support to

search and rescue and emergency response. This can be through the provision of rescue response by ORED support resources (when available), by extending offshore radio communications and the enhancement and expansion of maritime surveillance by the establishment of Automatic Identification System (AIS) transceivers and radar (on some OREIs). The development of emerging technology, including unmanned vessels, vehicles and sensors, is also likely to provide significant support in future. It is important that the industry maximise the opportunities to enhance SAR and emergency response provision wherever possible through the planning, construction and operations phases of any development. Doing so will complement the national SAR service and mitigate many of the risks posed by offshore developments.

1.5.3 The industry has also been instrumental in the development of the Integrated Offshore Emergency Response document, in cooperation and partnership with the HSE, the MCA, the police and other organisations and authorities with a stake in offshore emergency response. Such documentation is of considerable benefit to the overall understanding and standardisation of emergency response in the offshore renewable environment.

1.6 Dependencies

There are no critical dependencies other than new technologies, procedures or processes may be developed and/or marine traffic volumes and/or behaviours and/or practices may change, that reduce or increase the SAR demand and/or risks to SAR delivery. The MCA may be required to apply retrospective requirements if operational circumstances, within or around the site, or legislative changes create a new or previously unidentified risk to SAR operations. Conversely, if a change removes or reduces risk, then requirements may be removed or reduced. If this is required, the MCA will open a dialogue with the relevant duty holder to work toward, wherever possible, a practical and cost-effective solution or alternative mitigations to any additional or increased requirement.

General Requirements, Guidance, Advice and Mitigations

2 General principles

2.1.1 The following sections contain information and guidance which, when followed, will significantly assist developers satisfy MCA requirements, relating to emergency response for at-sea renewable energy installations and may be applied to similar projects at sea or on the coast.

2.1.2 Guidance, advice and general information is offered so that duty holders can understand the context and reasons for MCA requirements, assessed by MCA subject matter specialists as necessary, and to consider their residual risks and assess the need to provide solution(s) to mitigate or remove them.

2.1.3 Duty holders are required to use this information in formulating their proposals to the MCA for layout, design, operations, emergency response planning, mitigations and Safety Management Systems.

2.1.4 Principal mitigation measures required for any ORED are:

- Linear layouts
- Clear and unique identification markings visible to surface craft and aircraft
- Hover reference marking of wind turbine blades
- Aviation hazard and aviation SAR lighting of wind turbines
- Lighting and marking of OREIs in accordance with the UK General Lighthouse Authorities requirements
- Rapid control and shutdown of individual and groups of OREI devices (wind turbines in particular)

2.2 SAR Checklist

2.2.1 During pre-construction conversations with developers, the MCA will request a SAR checklist is completed. The SAR checklist is a record of discussions regarding the requirements, recommendations and considerations outlined in this document and should be agreed by the developer and MCA on a case-by-case basis prior to construction commencing.

2.2.2 The content of the SAR checklist will apply throughout the life cycle of the development and will be used by the MCA to ensure actions agreed pre-construction are correctly implemented.

2.2.3 There are no additional requirements contained within the checklist other than a reflection of this document, or those which are agreed at the time with the developer.

2.2.4 Further information and content of the checklist is contained in Appendix D.

2.3 Emergency Response Cooperation Plan (ERCoP)

2.3.1 The MCA requires that Emergency Response Cooperation Plans (ERCoP) be developed and put in place for the construction, operation and decommissioning phases of any ORED. These plans are designed to ensure that HM Coastguard, SAR resources, police and the duty holder have necessary information about the fundamental details of an ORED and that both the duty holder and HM Coastguard have access to emergency contact numbers to permit rapid contact, information sharing and effective cooperation during an emergency situation.

2.3.2 If an ORED changes ownership, is leased by another duty holder, or implements any significant change, then an updated ERCoP for that site will be required to be submitted for approval by the HM Coastguard Offshore Energy Team. A template and instructions for completion of ERCoPs can be found on the GOV.UK website.

2.3.3 An ERCoP must be in place ready for the start of construction operations[2] and an operations phase ERCoP must be prepared for activation when the ORED becomes operational. Extreme care must be taken to ensure an operational ERCoP contains correct positional information of OREIs e.g. to account for any microsighting during construction.

2.3.4 Only one ERCoP and one Emergency Response Plan (ERP) should be in operation at a development at any one time, as per guidance contained in the HSE/MCA regulators expectations document.

2.3.5 When extensions or new developments are constructed adjacent to, or in the vicinity of, older developments, any existing ERCoPs must be updated to reflect the change.

2.3.6 The content of ERCoPs, particularly positions and emergency contact information, is critical to a timely and appropriate response to any incident. Errors or inaccurate information contained within the ERCoP can create frustration and ultimately delay, and HM Coastguard considers this to be unacceptable.

2.3.7 In addition, emergency response telephone numbers provided must be 24 hours, either as one number or a combination of multiple numbers. These must be operational and answered by an individual able to respond to likely scenarios such as a request for turbines to be shutdown, information on Personal Locator Beacons (PLB) or operational queries about the relevant site.

2.3.8 To ensure compliance, regular checks of ERCoPs will be undertaken by HM Coastguard and emergency and alternative phone numbers for the ORED, held in the ERCoP, will be frequently tested.

2.3.9 Duty holders must ensure that regular checks of the validity of the ERCoP are carried out and that updated versions are sent to HM Coastguard at least annually.

[2] In this context, construction operations means the offshore activity onsite, usually piling or subsea/cable work. Onshore/coastal, survey or UXO type work is not considered to be part of construction for the purposes of requiring the ERCoP. It may be beneficial though, to discuss emergency response arrangements with the MCA for these activities.

2.4 Weekly notices

2.4.1 To maintain situational awareness of a changing maritime domain, developers must ensure that HM Coastguard is included in their distribution of a weekly update notification. These should be sent to oelo@mcga.gov.uk and to offshoreenergy.notifications@mcga.gov.uk.

2.5 Floating offshore wind

2.5.1 While it is expected that the risks and benefits to SAR and emergency response of floating offshore wind will be much the same as that for fixed bottom, there are additional areas of consideration for the MCA.

2.5.2 There is a risk of floating turbines breaking free, listing or sinking, which could cause a hazard to navigation and result in challenging emergency response. Should personnel be on board a turbine when these eventualities occur, there could be additional complexity in the evacuation and escape options for them due to an unsteady platform and additional risk to responding vessels and aircraft. The duty holder is expected to have plans and capabilities to respond to these foreseeable incidents, including but not limited to alternative evacuation methods, blade control measures and emergency towage capability.

2.5.3 In a scenario where a turbine breaks free from a mooring, it is expected that the duty holder will have a capability to arrange emergency towage in a timely manner. This would be commensurate with the risk assessment of the site, with those closer to shore or near traffic lanes at a higher expected risk. The floating structure should be designed to allow for emergency towage.

2.5.4 Consideration should be given by the duty holder to any complications of emergency towage, or a response to a turbine drifted to the shoreline, where the blades are de-energised and idling round.

2.5.5 Layouts are covered in more detail at section 4, however, there may be a specific additional consideration and/or requirement when considering floating turbines which will by design, move. For a site which only includes floating turbines, this impact may be minimal, assuming all turbines will move generally in a uniform direction. However, where floating and fixed turbines exist in the same site (or adjacent sites), additional mitigation may be required to account for a variable separation. The developer must engage with the MCA on any required mitigation as part of wider layout discussions.

2.5.6 Considerations should also be given to items such as towage arrangements, ballast water, certification and survey requirements. These will differ depending on the originating port, particularly if the port is overseas.

2.6 Wet Storage

2.6.1 Wet storage areas are being proposed as part of construction and/or during major maintenance of floating offshore turbines and may be proposed as part of a new ORED or as a standalone development.

2.6.2 The MCA will require full and early discussion on any wet storage areas and would expect the area to be fully assessed as per MGN 654 (and this document), including:

- An assessment of impact to SAR, to be discussed with HM Coastguard
- The type and number of units to be stored
- Status of the units to be stored
- Appropriate layout
- Consideration of mooring arrangements
- Any pollutants stored
- Security of structures
- Control of turbines
- Any personnel transfers while turbines are in storage.

2.7 Test sites

2.7.1 Much of the content of this document will apply to test sites, however, there may be additional or amended requirements.

2.7.2 The requirements and principles contained within this document are generally the responsibility of the duty holder, or their delegated principal contractor. However, with test sites, this may vary and therefore it must be clear through robust emergency arrangements, who has responsibility for emergency response and on supporting arrangements such as the provision of vessels.

2.7.3 The site owner will generally be expected to have responsibility for emergency response unless this is delegated to the individual developers, with devices deployed at the test site. This arrangement must be discussed with the MCA and recorded within the relevant emergency response documentation.

2.7.4 The Emergency Response Cooperation Plan template for test sites and the associated developer information document template should both be consulted, in addition to discussing with the MCA.

2.8 Decommissioning

2.8.1 While it is recognised that decommissioning will be a complex process with many variables, the MCA considers the general principles, for the purposes of this document, to be broadly similar to ‘construction in reverse’.

2.8.2 A new version of the ERCoP will be required for decommissioning and it will likely be beneficial to revisit, or create a new, SAR checklist.

2.8.3 Consideration should be given to coordination and communication challenges during the decommissioning phase, particularly if OREDs are familiar with utilising technology or processes which may not be available once equipment starts to be removed.

2.9 Offshore Transmission Owner

2.9.1 It is important for effective integrated emergency response that prior arrangements are agreed between the duty holder and the Offshore Transmission Owner (OFTO), regardless of the commercial and/or operational agreement.

2.9.2 In an emergency involving facilities belonging to the OFTO, or to which the OFTO is responsible, a clear and concise plan should be in place to show who is responsible for the emergency response. This should be completed to cover all likely scenarios, including where an OFTO may share a generators vessel for transit.

2.9.3 It is currently expected that all relevant OFTO detail and emergency response arrangements will be included within the development ERCoP. Any deviation from this will require careful consideration and final agreement of any alternative arrangements must be given by the MCA, to ensure no confusion is inadvertently introduced.

2.10 Offshore Search and Rescue Management (OSARM) courses

2.10.1 The MCA provides offshore emergency management courses for the industry to enable marine coordinators, installation managers, senior management, Crew Transfer Vessel (CTV) and operations support boat crew and any other individuals who may be involved in the management of and response to emergencies, to be trained and made aware of the correct procedures and processes to be followed in SAR situations and other emergencies.

2.10.2 The course provides an overview of the SAR system and how it operates, and course delegates will be involved in tabletop exercises to increase understanding and awareness of their role and contribution to emergency response and to increase cooperation with national SAR coordinators and responders.

2.10.3 These courses will be run throughout the year and it is highly recommended that every organisation involved in operating ORED should ensure appropriate competence is established by arranging attendance by a suitable number of staff and vessel crew to attend them. Those that attend should be directly or indirectly involved in operational activities, or the management of those activities. Deputy operation managers, supervisors, and marine co-ordinators would find the course content directly applicable in their roles. Senior managers and health and safety personnel would benefit from understanding the content, leaving them in a better position to support those directly involved in SAR operations. Attending a refresher course every five years is encouraged.

2.10.4 Future course dates will be available on the OSARM gov.uk webpage.

2.11 Points of note

2.11.1 This document, and the Emergency Response Cooperation Plan (ERCoP) template, are subject to change in light of experience, lessons learned, the development of new technologies or procedures, or legal or regulatory requirements.

2.11.2 This document will be subject to review every 2 years but may be updated more frequently at the discretion of the MCA, should key amendments be identified and required.

2.11.3 Potential users should contact the MCA to ensure complete understanding before making use of the information. Reference should also be made to relevant Marine Guidance Notices and additional MCA information contained on the GOV.UK website and marine licensing requirements and consent processes.

2.12 Routine contact for HM Coastguard

2.12.1 Questions about this document can be addressed to:

Offshore Energy Lead T: +44 (0)7970 156149

E: oelo@mcga.gov.uk

2.12.2 NOTE: The above details are not for emergency notifications – if you have an emergency, please contact the relevant Rescue Coordination Centre directly.

3 Emergency Response

3.1 Windfarm effects on SAR operations

3.1.1 The early generation of wind farms were small in both overall size, number of installed turbines and geographical coverage, and so SAR resources had little apparent difficulty in responding to incidents within or around them.

3.1.2 Later generations of wind farms are of vastly increased scope. Their distance from shore, physical size and height, number of turbines in use, and the geographical space occupied by them e.g. tens of miles in width and breadth combine to increase the size of the 'box' of low-altitude airspace that is affected. This presents new problems for SAR resources, in particular for SAR helicopters, because of the longer transit distances/times, increased possibility of having to operate amongst turbines to conduct searches and/or rescues from the sea surface, and with SAR helicopters possibly unable to operate safely above turbines due to the presence of low cloud and/or where blades and/or nacelles may also be covered wholly or partially by cloud.

3.1.3 Any windfarm is a complex environment for a SAR resource to operate within, but the more irregular the layout, the higher probability that a resource may not be able to safely operate within the development, particularly a SAR helicopter. Helicopter crews must consider 'what if' scenarios at all stages and have a plan for a variety of technical failures. An engine failure, for example, may require a straight-line exit, to build speed before climbing out of the windfarm.

3.1.4 Search patterns used by HM Coastguard are in accordance with international standard practice contained in the International Aviation and Maritime SAR Manual (IAMSAR). All search patterns are essentially linear in that they are composed of patterns of (normally parallel) straight lines to ensure that a search-area is covered to a consistent 'coverage factor'. Therefore, non-linear ORED layouts may not necessarily provide an effective and 'safe' search-unit environment for SAR resources, or for when SAR helicopters have to operate at low altitude e.g. because straight-line paths cannot be flown without encountering physical obstacles on a desired track. This also degrades the effectiveness of a search due to crews needing to focus more of their visual attention on flight safety and manoeuvring around obstacles (which also changes the coverage factor), rather than looking out for SAR objects and survivors.

3.1.5 If SAR resources are required to conduct a search and/or rescue inside non-linear wind-farm layouts, there is a likelihood that these layouts will also significantly reduce the overall Probability of Detection (POD) of a search because resources may not be able to conduct a search at the optimum Sweep Width and Track Spacing for a particular SAR object[3]. The presence of turbines may also reduce the searchable space and may expand or otherwise vary the distances between 'sweeps' through a wind farm and so may affect the desired sweep width and increase the likelihood of not sighting a SAR object. In addition, non-uniform layouts present a flight safety hazard that may detract from the mission and/or preclude the use of SAR helicopters altogether.

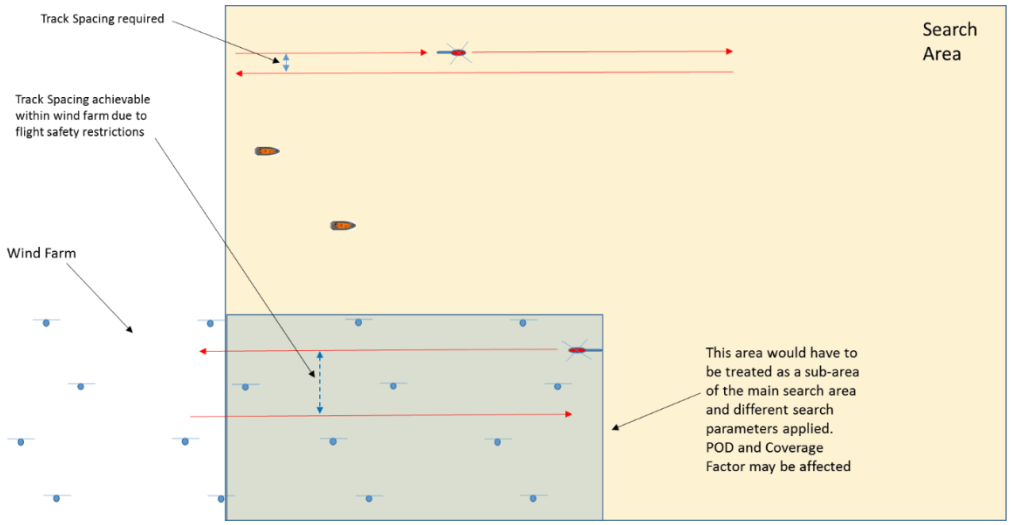


Figure 2: Effect of windfarms on probability of detection, track spacing and sweep width

[3] SAR targets, optimum Sweep Width values, are to be found in the IAMSAR Manual.

3.1.6 There is also a significant visual-distraction effect caused by the presence of the turbines, rotating blades and the relative movement of a SAR helicopter or rescue boat/lifeboat moving through the array.

3.1.7 Wind turbines may also cause the temporary blocking of SAR objects from sighting by SAR units. The turbine, or group of turbines, may come between the SAR unit and a SAR object at the moment that it might be sighted. This is more likely in rough sea states where SAR objects might also be temporarily hidden by sea swell and waves whilst a SAR unit passes and has a ‘detection opportunity’.

3.1.8 A 'non-linear’ or ‘non-uniform’ layout is one where there are no or few consistent lines of orientation, i.e. ‘straight’ rows and/or columns of turbines on at least two axes through, and on the periphery of, a wind-farm.

3.1.9 It should be noted that, upon notification of a person, vessel or aircraft in difficulty, a search is always required until they are located and rescued, regardless of whether the casualty has activated an emergency beacon or not.

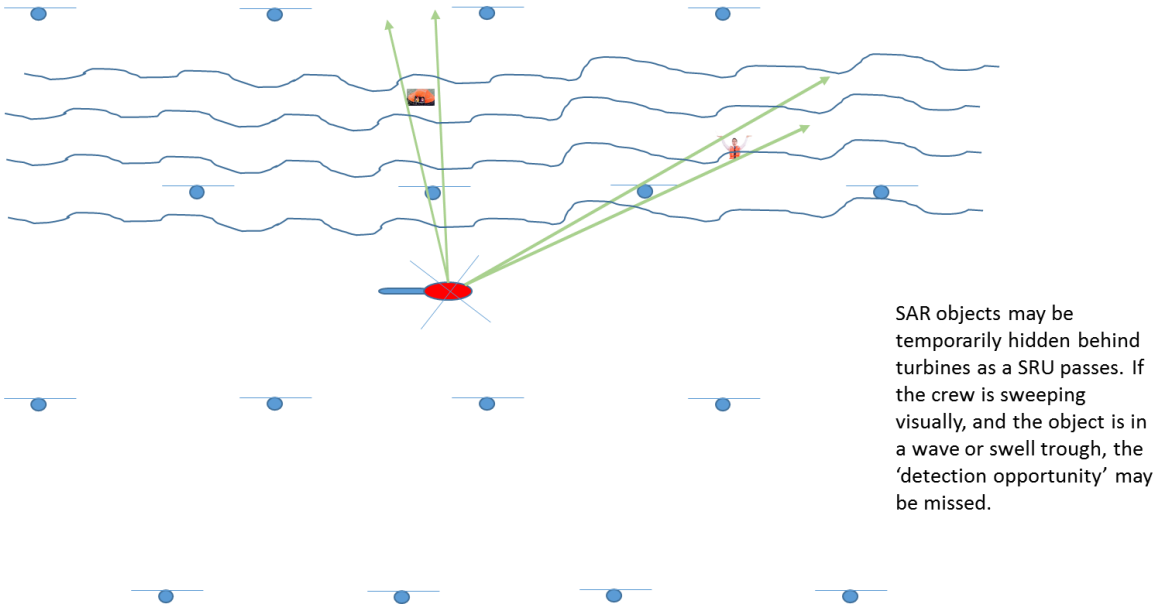


Figure 3: SAR objects may be temporarily hidden behind wind turbines at a critical 'detection opportunity'. Rough sea state may exacerbate this.

3.2 Tidal and wave devices

3.2.1 Many of the factors listed in 3.1 are also relevant to tidal and wave devices, including those devices which are sub surface and on the seabed.

3.2.2 The layout and shape of wave and tidal stream device ‘fields’ may impact on the use of rescue boats. Therefore, the layout of any array must allow SAR response by boat to take place safely and enable the operation of such boats amongst the devices. If the devices are on the surface or close to the surface, there should be consistent lines of orientation of such devices throughout the whole array area.

3.2.3 Sub-surface or seabed energy devices must provide a minimum water depth over the highest part of any device (above the seabed) so that rescue boats and other vessels can operate safely over them for SAR purposes. Under keel clearance requirements for seabed OREIs are published by the MCA in MGN 654 Annex 3.

3.2.4 However, in addition, consideration must be given to hazards and mitigations to minimise the risk to personnel in the water, with particular emphasis on those risks that may not be apparent from the surface, including any impact on other sea users including personal watercraft and small leisure vessels. Surface and sub surface devices are likely to create a hazard for these users including through collision, entrapment and/or water surface disruption e.g. wakes.

3.2.5 Where this hazard exists, the developer should consider relevant mitigations which may include:

- modification of device design to create fewer snagging hazards
- altering positions or layouts of devices to minimise collision risk
- ensuring moving parts e.g. turbine blades, are of sufficient depth below the sea surface to avoid small craft and/or person in the water collision and to minimise snagging possibilities
- provision of suitable additional emergency response equipment/provision, so long as in doing so, does not inadvertently create additional hazard.

3.3 SAR helicopters – general issues

3.3.1 Search and Rescue helicopters have specific requirements to allow them to operate safely within and around OREIs particularly where there are multiple tall structures, with moving blades.

3.3.2 SAR helicopters are a key tool for search and rescue. For example, it may be that surface rescue craft cannot conduct a rescue in the time available, cannot reach the site in a reasonable timescale, or that SAR helicopters are the best option or are needed to provide additional capability to a rescue operation. Also, in major rescue or search incidents, the greatest number of rescue units possible, surface and airborne, may be required. Where other vessels cannot enter an ORED for safety reasons, SAR helicopters may be the only resource available to conduct a rescue.

3.3.3 SAR helicopters are, in many cases, the quickest means of delivering a rescue response to a location offshore and to recover survivors back to shore or a safe location and can usually cover search areas faster than surface rescue craft.

3.3.4 Emergency evacuation of persons directly from a Wind Turbine Generator (WTG) nacelle or other OREI device, using a SAR helicopter may, depending on the situation, be the best solution. It is likely to be considered where risk to life or limb or likelihood of permanent injury or ill health is such that the speed of reaction to the incident and transfer of persons back to shore, or of injured persons directly to medical facilities, can best be achieved by use of a SAR helicopter.

3.3.5 If weather conditions are such that a SAR helicopter has to fly under Instrument Meteorological Conditions (IMC) flight rules, using instrument navigation techniques and electronic systems, the aircraft will not be able to enter any wind turbine lane that is less than 500 metres wide (measured between blade tips, that are transverse to the turbine lanes, unless the blades can be rotated away from the lane to increase the spacing to 500 metres or more).

3.3.6 When faced with the prospect of long transits to a SAR area, the presence of Wind Farms along the direct transit route may present obstacles to SAR helicopters if weather conditions do not permit transits to be flown above maximum blade height of windfarms on the flight path.

3.4 Rescue boat / lifeboat – general issues

3.4.1 Shore-based rescue boats or lifeboats may be used to conduct SAR operations within or around OREDs if they are within range and/or operational coverage. Such craft may be used either instead of or in addition to SAR helicopters.

3.4.2 Weather and sea state are major factors in any SAR operation and risks to rescue boats are exacerbated by the presence of structures. This may sometimes preclude the use of rescue boats/lifeboats.

3.4.3 Rescue boats or lifeboats may be used in cases such as where a shore-based boat is closer and may arrive at the scene of an emergency sooner than a SAR helicopter or other vessels nearby are able to respond. They might also be used, for example, to recover survivors or take an injured or ill worker from an installation to a location outside the ORED area where a SAR helicopter can winch them from the boat. This situation may be a preferred solution where an ORED poses a problem for SAR helicopter winching operations – either because of the weather and sea conditions at the time or because of a pre-existing restriction or risk. The decision on which type of rescue unit(s) to deploy will be taken by the SAR Mission Coordinator (SMC), at the time of the incident, in consultation with the rescue units and the ORED operations centre and/or incident manager/leader/controller.

3.5 OREI control for SAR operations

3.5.1 Windfarms may be required to be shut down (individual turbines, a row or rows of turbines or part or whole field) to reduce visual distraction, physical collision and turbulence risk to SAR helicopters and/or rescue boats and/or other vessels during SAR or salvage operations e.g. during searches conducted within or passing through the windfarm or when winching persons from nacelles, boats or the water. There may also be a requirement for turbines to be yawed to a favourable position for SAR operations e.g. all hubs in adjacent rows rotated outwards, maximising the available space between blades[4].

[4] Developers should consider how they ensure that the turbines/devices specified and ordered are capable of being controlled to meet the MCA requirements.

3.5.2 Surface, sub surface or seabed OREIs, excluding cable arrays, unless these are compromised by the incident, may be required to be shut down or de-powered during surface rescue-boat/lifeboat operations to reduce the risks to these craft. Where a surface OREI is to be approached by a SAR helicopter, it may be that the device must be shut down or otherwise stopped (if they can be) to enable an effective or safer rescue to be conducted e.g. to rescue a person from the water near to or on a device.

3.5.3 The MCA will need to be aware of any constraints associated with control of turbines in the context of weather limitations, time delays for shut down, manoeuvring of turbine nacelles and the reliability of control and indication circuits. This information must be included in the ERCoP.

3.5.4 Control of all OREI devices must be available from a 24-hour contact point which has immediate access to control of the devices, and that can be quickly communicated with by the SAR Mission Co-ordinator and/or rescue unit.

3.5.5 Any request for shut down or position change of OREI must be actioned within a reasonable amount of time i.e. within 10 minutes. Any delays or failure to carry out the instruction will likely have an adverse impact on SAR operations with SAR helicopters and/or rescue boats potentially being unable to operate within or in the vicinity of the OREI(s).

3.6 Feathering, braking and orientation of wind turbine blades for SAR operations

3.6.1 The SMC will need to know how WTGs in a particular windfarm are shut down, feathered, orientated, and prepared for helicopter operations, and how long this process will take. This information must be included in the ERCoP. Failure to have control of turbines, as described below, may result in rescue not being possible in some situations.

3.6.2 If helicopter rescue is to take place from/to a WTG, the WTG blades will have to be feathered and the rotor brakes applied (and where feasible blades should be pinned). If the blades on a WTG cannot be braked, either due to technical failure or weather conditions, the SAR aircraft will be unable to conduct a winch from the nacelle.

3.6.3 It may be possible for a SAR helicopter to winch from a nacelle with the blades in a variety of positions, however, the Retreating Blade Horizontal position (Figure 4 – single blade downwind) or bunny ears (Figure 5 is normally preferred, depending on the type of SAR aircraft. It is also imperative that any automatic yaw control systems be disabled, where possible, or, that the SAR helicopter is informed that yaw control cannot be isolated before it arrives over or near to a turbine.

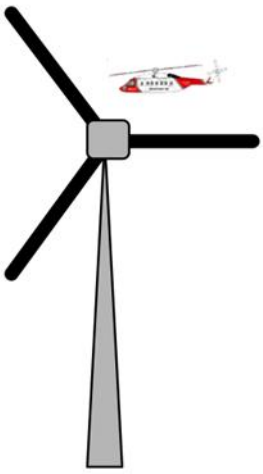
3.6.4 UK SAR helicopter rescue winches are located on the right-hand side of the helicopter. Therefore, the nacelle should normally be rotated so that the blades are at 90 degrees off the wind with the wind blowing on to the left side of the nacelle e.g.

if wind is blowing from 270 degrees, the nacelle will need to be rotated to the right so that the hub is facing 360 degrees. This should be described as the nose cone heading. Nacelles must be held in position so that downwash from the helicopter does not cause the nacelle to rotate.

3.6.5 The blades should be prepared and in position before the SAR aircraft arrives. Failure to do so may result in significant delay, particularly if repositioning the blades does not occur promptly. This could additionally require the aircraft to leave to refuel.

3.6.6 The feathering and braking of turbines may also be requested by rescue boats if e.g. turbulence, visual distraction or noise creates a problem for the boat and/or the rescue activities. This may also apply to larger vessels coming alongside a turbine, during an emergency, where an additional air gap is required.

Retreating Blade Horizontal Position:

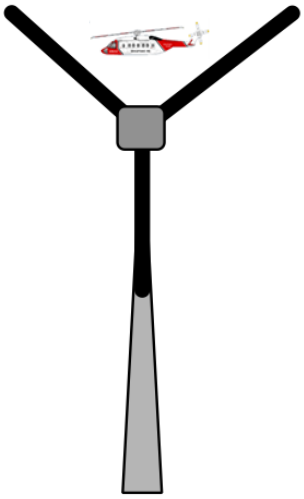


The retreating blade horizontal position provides good references with the blade in the pilot and winch operators 2 o'clock position whilst maintaining a clear area for the tail rotor should the crew wish to offset the aircraft for wind or to improve visual references or escape headings.

This is normally the preferred option for winch transfers to the turbine from a S92.

Figure 4: WTG blades set to Retreating Blade Horizontal position for winching

Bunny Ears (Y Blade) Position:

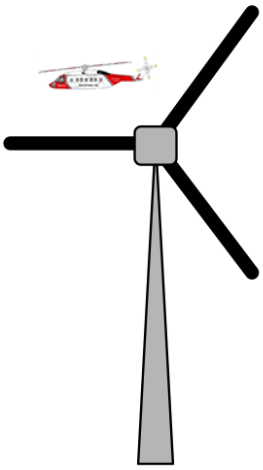


The Y blade position also offers good references with the blade in the pilot and winch operator's 2 o'clock position. The retreating turbine blade aft of the helicopter in the winching position slightly compromises the tail rotor area.

This position is commonly referred to as "Bunny Ears" or possibly the "SAR Position" and is often the preferred option for winch transfers to the turbine from the AW 189.

Figure 5: WTG blades set to Bunny Ears or 'Y' position for winching

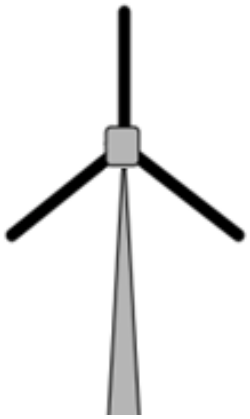
Advancing Blade Horizontal Position:



The advancing blade horizontal position is the poorest option for references with the retreating blade occupying the area closest to the tail rotor.

This position is also known as "Orientation Stop", "Heli-Stop" or "Lazy Y". This is the position usually selected for delivery/recovery of turbine technicians by wind farm helicopters.

Figure 6: WTG blades in Advancing Blade Horizontal position for winching



Upside down Y or Exclamation

The upside-down Y or exclamation orientation is not applicable for helicopter operations but may be beneficial should larger vessels require to operate close to the base of the turbine.

Figure 7: WTG blade in upside down Y or exclamation

3.7 SAR helicopter winching operations

3.7.1 If winching is to take place to/from a nacelle, wherever possible wind farm personnel should be in the nacelle to assist the winchman.

3.7.2 Most modern turbines will include a purpose-built winching basket which is a safe area for SAR crews to utilise. Duty holders should consider ways to mitigate the risks associated with winching operations and discuss these with the MCA. Considerations may include helicopter winching baskets/areas, safety rails, helicopter winch platforms, non-slip surfaces and winching area working lights. It should be noted that a SAR helicopter will not carry out a winch operation to a turbine that does not have a safe area to winch from. Without the safety devices and equipment explained above, it is unlikely that a winch rescue can be undertaken from a WTG. CAA document CAP 437 contains information about winching area requirements for wind turbines.

3.7.3 Winching from the surface of the sea, amongst wind turbines or other OREIs, may be possible depending on the incident situation, cloud cover and height, visibility and sea conditions and at the SAR aircraft captain's discretion on assessment of risk at the time of the incident. There is no guarantee that a SAR helicopter will be able to conduct a winch rescue from the sea surface or from a vessel that is operating amongst wind turbines or other OREIs[5].

3.7.4 Operations to, or in the direct vicinity of wind turbines, where no direct communications with the turbine operator exist and it is not possible to reposition the turbine blades, will be prohibited.

[5] When winching from a vessel, and where possible, the target vessel should maintain a course into wind and aligned as far as possible along a lane. If unable to maintain headway, the vessel should anchor such that the vessel is in a clear area amid the turbines or vacate the field by the quickest means

3.8 Emergency response capabilities provided by duty holders

3.8.1 The HSE and MCA document https://www.hse.gov.uk/offshore/infosheets.htm outlines what duty holders responsibilities are for the prevention of major hazard accidents and protecting persons from the effects of any which do occur; and securing effective response to emergencies affecting persons on any offshore renewable energy installation or engaged in activities in connection with it (including marine and aviation) and which have the potential to require evacuation, escape and rescue from the installation.

3.8.2 ORED duty holders should consider in-house provision of relevant equipment, resources, training, personnel and procedures to provide a good prospect of initial rescue and recovery for their own, and contractor personnel in an emergency situation. This should include a relevant level of medical response capability. Additional resources may also be useful for routine operations (e.g. transfers) and duty holders should consider all options which may be available. This may include specialist resources, platform/SOV launched rescue vessels, dedicated SAR helicopters and/or refuelling facilities, some of which may be more feasible/realistic as more windfarms are constructed far offshore, or in specific examples such as where parts of older windfarms may now dry out e.g. due to sand banks.

3.8.3 Where routine operations at sites are conducted using a single resource, whether that be a CTV, SOV, helicopter or other asset, the duty holder must fully consider their emergency response requirements and ensure sufficient response arrangements are available for all foreseeable emergencies.

3.8.4 National SAR resources may be available to provide assistance to and/or recovery of survivors/injured/ill persons but are necessarily some time from the scene and so must not be factored into emergency plans as a first response. Any incident under the co-ordination of the ERP or incidents to personnel and/or assets, on or around OREIs, must always be immediately reported to HM Coastguard and a dialogue established to determine and agree what response, if any, is required.

3.8.5 Such in-house capabilities can also aid vessels and persons in danger at sea but who are not connected with the work or operations of the ORED. This in-field capability provides a response in accordance with the general principles of the Safety of Life at Sea (SOLAS) Convention as they apply to any marine support or other craft engaged in the work of an ORED.

3.8.6 Duty holders are recommended to consider the following when assessing their choice of support vessels/installations/aircraft. Notwithstanding the requirements of a duty holder detailed in the document mentioned above, if the MCA deem a dedicated rescue capability to be necessary for the development, these would be a requirement for the chosen vessel(s).

3.8.7 The following are over and above that which is required in “The Workboat Code: Industry Working Group Technical Standard” and would apply to the operations and maintenance phase as well as during construction.

3.8.8 The duty holder should ensure that, during operational hours[6] there is at least one vessel available, and that it can be mobilised (unless sea state is outside of vessel operating limits) to respond to vessels, aircraft or persons in distress, within or near to the windfarm.

3.8.9 The duty holder to provide the MCA (to be included in the ERCoP) the sea state and weather operating limitations of its support vessels. This should include both the personnel transfer and general operating limitations of the craft, if these are different. The MCA would require the duty holder to provide vessels which are capable of operating in conditions of at least 95% of the average annual maximum significant wave height for the area which they are operating[7].

3.8.10 The duty holder to provide the MCA the normal operating hours or working time-periods for the support vessels and how long it would take a support vessel to respond from its shore base to the windfarm, if it is able to do so.

3.8.11 The duty holder should consider whether a crew for a support vessel can be mobilised outside of normal working hours to assist with an emergency response, if requested by HM Coastguard. Support vessels will often be the most effective and appropriate vessels to respond to any emergency nearby or within a windfarm and may be able to assist from their base port or harbour. Duty holders should consider this response time when choosing their operational base/port.

3.8.12 The duty holder must ensure that any support vessel has sufficient crew to enable it to successfully respond to a search and/or rescue situation or incident, and that all the crew are fully trained in the use of any on board rescue equipment and in Search techniques and Rescue techniques. Duty holders should consider the document OREEF CTV Crew Recommendations, available at www.oeer.uk/oreef.

3.8.13 In addition to the above, to ensure effective SAR capability is provided, the MCA may[8] require the following equipment to be fitted to the vessels:

- Visual search enhancement equipment (e.g. fixed or hand held image enhancers e.g. thermal imaging/night vision imaging systems – at least two available on board vessels offshore at any time that vessels are operating).
- Searchlights (at least two for redundancy).
- Radio frequency homing equipment (Very High Frequency (VHF) Direction Finding) to enable a support vessel to locate Emergency Position Indicating Radio Beacon (EPIRB), PLB and Emergency Location Transmitter (ELT) homing signals (121.5MHz radio signal) and general marine band VHF transmissions.

[6] Operational hours means the hours by which the vessel would normally be working, even if there is no offshore activity.

[7] Based on information from "Guidelines for the Management of Emergency Response for Offshore Installations (Appendix 4, 78)" and extracts from "Wind and Wave Frequency Distributions Around the UKCS".

[8] These requirements will be assessed on a case-by-case basis depending on the e.g. OREI location, size, shape, layout, distance from and availability of shore based SAR resources, availability and capability of support craft or other in-field facilities, context, adjacency to other OREI, navigational risks, sea traffic density and routes, etc.

- Additionally, vessels will need to carry homing equipment for any non-GMDSS (Global Maritime Distress and Safety System) personal locator beacons or devices that the windfarm personnel carry.
- Vessel radar (marine type) and appropriate for the type of vessel and sea environment of the area of operation.
- Vessel AIS display (enables location and monitoring of other vessels and the detection and location of AIS-equipped man overboard/personal locator beacons (using the 972-prefix Maritime Mobile Service Identity (MMSI) number) and future AIS-EPIRB beacons (fitted with AIS as a homing signal)).
- At least two VHF Digital Selective Calling (DSC) radios, to enable the vessel to act as On Scene Coordinator (OSC) to simultaneously listen-for and communicate with vessels and aircraft on scene, and the SAR Mission Coordinator at the coordinating Coastguard centre.
- A single MF DSC Radio to enable communications to take place in the absence of VHF radio availability or coverage or as a backup means of communication with other vessels and/or the coordinating Coastguard centre.
- A secure means of voice communication e.g. satellite and mobile telephone, to enable confidential conversations to be held.
- Sufficient and effective rescue equipment capable of recovering persons from the water, using a horizontal lift (hypothermic lift technique), in all conditions the vessel would be expected to operate.
- Suitable equipment and consumable items to protect and manage survivors until they are delivered to a place of safety or passed to another rescue unit.
- High level of first aid and casualty care capability, and appropriate equipment and materials. The MCA recommends at least one member of the crew holds STCW Proficiency in Medical Care.
- Ability to provide emergency towing capability up to similar sized vessels, or a floating WTG.
- Carriage by the vessel of an up-to-date copy of International Aeronautical and Maritime Search and Rescue (IAMSAR) Volume III (Mobile Facilities).

3.8.14 Where developments are constructed/installed near busy shipping routes and/or where risk of allision is higher, consideration should be given by duty holders on any requirement for emergency towage, which may be requested by the MCA. This could be in the form of a dedicated vessel or more likely, agreements with local vessels which could support during an incident. Any choice of vessel should take account of acceptable availability and be capable of safely towing a size of vessel which is typical of traffic in the area. This could also include requirements for emergency towage within a floating ORED, as detailed in 2.5.

3.8.15 All the above requirements must be recorded within the relevant Emergency Response Cooperation Plan (ERCoP) within the section covering support vessel details.

3.9 Migrant activity

3.9.1 Windfarms and/or their resources may come across migrants transiting through, or making for the development, particularly in areas closer to the European continent. Many migrant vessels and/or the persons aboard will not be in a very safe environment and therefore HM Coastguard treat these as a SAR event until they can all be accounted for.

3.9.2 Should migrant activity be observed, HM Coastguard should be notified immediately with as much information regarding the position, status and numbers as possible, and where safe to do so, assistance rendered by the resource(s).

3.10 Rescue/recovery of medical cases by rescue boat/lifeboat

3.10.1 Duty holders must ensure that they can recover injured/ill persons from within any structure to the transition piece platform, or other landing stage/platform (for floating wave/tide/sea current devices) ready for transfer to rescue boats/lifeboats.

3.10.2 Shore based, volunteer-crewed, rescue boats or lifeboats may be used to evacuate injured or ill persons from wind turbines or other OREI installations. They can normally only recover persons from sea-level, via the Transition Piece Platform or landing/boarding stages of installations. Lifeboat crew will not climb structures or enter other OREIs to carry injured/ill persons to the landing stage because the crews are not trained on the particular installation and its risks.

3.11 Far offshore and service operation vessels

3.11.1 As developments are constructed further from shore, it is likely that specific additional emergency response arrangements are required. As detailed in this document, these arrangements must include a response plan utilising operator resources and not be purely reliant on SAR.

3.11.2 Far from shore developments are also likely to utilise more helicopter operations and may include Service Operations Vessels (SOV) or other accommodation vessels or installations. These resources will have to provide some form of emergency response to ensure safe operations.

3.11.3 SOVs and their workboats can provide an excellent source of support e.g. search, medical, accommodation, communications during SAR and full details of capabilities must be included in the ERCoP.

3.11.4 If there are attendant vessels also operating within far offshore developments, they must be capable of operating in conditions normally expected in the area and when forming part of the emergency arrangements, be able to reach casualties within the development as per the requirements of the HSE/MCA regulator expectations document and those outlined within the site's performance standards.

3.11.5 Where these vessels/installations do form an integral part of the emergency arrangements, operators must consider alternative plans should the

vessels/installations be away from the development e.g. bad weather or planned rotation.

3.11.6 Consideration must also be given to circumstances when an SOV or other installation has an emergency and it is integral to the emergency arrangements e.g. collision, propulsion failure.

3.11.7 Given the complexities of emergency response far from shore, duty holders should discuss their plans with the MCA at an early stage.

3.12 Crew transfer vessels

3.12.1 Duty holders may use CTVs or boats to take personnel to OREIs from shore, or offshore accommodation platforms/vessels. These craft should be considered for use as a means of providing emergency response for OREI personnel or for other vessels or aircraft in distress within or near to the ORED.

3.12.2 Such vessels, or other windfarm vessels, should be able to communicate with any SAR helicopters, aircraft or surface craft dispatched or diverted to the incident and should also be able to communicate directly with HM Coastguard's RCCs on VHF DSC radio and (where required by distance from land and/or assessed risk) MF radio, satellite and/or mobile telephone. The MCA can advise on the appropriate communications equipment fit to achieve this.

3.13 Walk to work

3.13.1 Walk to work is becoming more popular with the increased number of SOVs operating and planned. The MCA welcomes the use of these vessels/installations however consideration must be given to the emergency arrangements utilising walk to work.

3.13.2 Where walk to work is used as the primary means of transfer to and from a turbine, there must be a separate and independent way of evacuating the installation in an emergency, which may be achieved using the same vessel. Vessel capabilities, numbers of personnel, work activity, weather conditions and emergency response arrangements will all have an impact on an applicable risk assessment.

3.13.3 Consideration should be given to a situation where the walk to work vessel/installation has an emergency of their own which may impact the recovery of personnel.

3.13.4 Where walk to work and alternative transfer means are utilised at a windfarm, it may be acceptable to the MCA for the turbine to be constructed without ladders, but this must be approved on a case-by-case basis. Assurance must be provided regarding the effectiveness and reliability of the proposed transfer methods and an assessment of any risk posed by not having a ladder available, including to any third party.

3.14 Duty holder provided rescue boats

3.14.1 ORED duty holders may consider that the risks posed to their own personnel and operations and to those vessels and aircraft passing through, over or by the ORED, are such that they could assist in moderating them by provision of in-field surface rescue craft.

3.14.2 Such rescue craft should be suitable for the sea and weather conditions likely to be encountered throughout the year at the location and in the area of the ORED, should conform at least to the Workboat code and/or UK Rescue Boat Code and/or national and international regulations and relevant Health and Safety Executive guidance. Vessels should also provide adequate equipment, systems and trained crew to conduct effective search and rescue operations.

3.14.3 Rescue boats would need to provide a high level of readiness to ensure that rescue cover within and around the ORED was maintained continuously during the period of declared operational availability. Where a duty holder provides rescue boat capabilities to mitigate the wider risks posed by their ORED, they may need to consider 24hour availability. Rescue boat response would need to be capable of reaching any part of the ORED, and areas around it, in the shortest time possible. This calculation would help to determine the number and types of craft required and may imply the positioning/basing of such rescue boats within or close to the ORED.

3.14.4 If rescue craft are provided by an operator, they should be made available to respond to emergencies, if requested by HM Coastguard, in accordance with operational requirements agreed with the MCA. Any changes to the stated capability and availability must be passed to the relevant RCC.

3.15 Commercial Air Transport helicopters

3.15.1 Duty holders might make use of commercial helicopters for the transport of personnel to and from shore, ORED hotel/support vessels and/or offshore accommodation platforms and/or to conduct commercial air transport hoisting of personnel between OREIs for operations and maintenance. If such aircraft are used, they may be useful in the event of an emergency, within the bounds of their normal operational constraints. If intended to be used, the capabilities and restrictions of the aircraft and its crew should be included in the ERCoP. If a SAR helicopter is tasked to the scene it will normally assume control of air operations (as Aircraft Coordinator – ACO) and the duty holder's aircraft should be prepared to act as directed.

3.15.2 As with all resources within this section, duty holders operating helicopters must ensure they have robust emergency response and contingency arrangements in place.

3.15.3 Duty holders who use commercial helicopters should carefully consider the constraints set by UK aviation regulators for moving injured or ill personnel. If commercial helicopters are to be used for this purpose, then an explanation of the pre-planned procedures and processes should be included in the ERCoP.

3.15.4 All medical incidents should be reported to the coastguard so that, if external assistance is required, a rapid response can be provided to ensure that the injured/ill person(s) are taken to medical facilities as soon as possible. A Telemedical Assistance Service is available from HM Coastguard.

3.15.5 While somewhat out of scope of this document, the increasing number of windfarms is likely to create a hazard for other CAT aircraft, particularly those servicing the oil and gas industry. Operators of these aircraft would be responsible for raising any concerns with a windfarm developer during the consultation phase, but developers should consider these operators when reaching out to relevant parties. The MCA may request mitigation measures in line with the requirements of this document, if a heightened SAR risk is identified in relation to existing helicopter routes.

3.16 Emergency beacons

3.16.1 Emergency radio beacons are a vital resource to aid search and rescue, should a person or persons find themselves in distress. There are many different varieties of beacon available.

3.16.2 Good practice would suggest operators provide 406MHz Personal Locator Beacons (PLB's) as all modern beacons are dual frequency and transmit on a 'homing frequency of 121.5MHz'.

3.16.3 AIS beacons (Automatic Identification System) primarily serve as a man-over-board device and cannot be relied upon to send an alert to HM Coastguard[9], while those which also transmit on 121.5MHz is only a homing frequency. AIS, if activated, would only work to around a 2 to 5 mile vicinity/range of other receiving vessels and would require the ships to be monitoring their AIS. There is also no requirement for them to respond to an AIS alert although other signals may be utilised simultaneously e.g. radio broadcast.

3.16.4 PLBs transmitting on AIS transmit using a 972-prefix Maritime Mobile Service Identity (MMSI) number. Practice has found that many AIS receivers do not trigger an alarm / alert on receiving this signal and alternatively display the beacon as any other vessel[10]. This may not be recognised as an emergency signal therefore windfarm vessels must be able to trigger a MOB alert upon receiving an AIS MOB signal (using the 972-prefix MMSI number).

3.16.5 Multiple AIS beacons activated in a small area may 'mask' each other or provide clutter on an AIS display. Operators should consider this fully before any decision is made on their use.

3.16.6 All 406MHz beacons should be registered (and deregistered) with the MCA beacon registry. Companies should assign responsibility for registrations to one person, or team, and to list a 24/7 telephone contact. This will save time and effort and avoid

[9] HM Coastguard may identify an AIS beacon alert, should the device be within range of an AIS receiver, however, they are not a recognised distress alert under the Global Maritime Distress and Safety System (GMDSS)

[10] Ref: IMCA M234 Research on personal locator beacons – October 2016

the need to change records when a person moves on. Ideally, the company should advise the MCA that they own the beacons, but they should keep the logistics internal to save having to regularly update MCA records simply to change details of the employee currently using the beacon. Duty holders should ensure they are aware of all beacons allocated to their own organisation and any associated with personnel, vessels or aircraft of their contractors.

3.16.7 Beacon records should include the Hex IDs[11] and beacon manufacturers serial numbers, the person they are allocated to and that person's whereabouts. The beacons battery expiry dates should also be listed as a reminder when to service and replace batteries at regular intervals.

3.16.8 AIS beacons are becoming more popular within the industry and while they do not require to be registered with the MCA, the duty holder must hold a record of what beacons are in operation at their site.

3.16.9 Duty holders should be fully aware of all the beacons being used, including those of any contractors, and ensure contact details are available to immediately identify them. They should develop site plans for the management of beacons and actively promote good practice in their use.

3.16.10 Should any beacons be activated by accident, HM Coastguard should be contacted without delay, with registration/identification details of the beacon, to ensure no SAR response is inadvertently initiated.

3.16.11 Duty holders should be aware of, and promote the principles contained within the OREEF emergency beacon use good practice document, which includes ensuring beacon maintenance and testing procedures minimise the potential for accidental activation.

4 Layout

4.1 Layouts – general comments

4.1.1 The MCA requires earliest possible discussions with developers on proposed turbine/device layout options for any ORED, before decisions are made on the final layout design. Failure to do this may result in the MCA formally objecting to a project. MGN 654 contains information on the MCAs requirements for layouts.

4.1.2 It is not uncommon for developers to utilise layout rules or principles at the pre-consent stage to supplement this document in the creation of their layouts. While the MCA does not necessarily object to this, they can be time-consuming to create and ultimately, any rules or criteria can be open to interpretation and misunderstanding. Therefore, indicative layouts provided at an early stage are far more helpful in the layout assessment and any identification of required refinement. Ultimately, should a

[11] A hexadecimal string of 15 characters used to identify each beacon

developer follow the guidance contained within this section, pre-agreed rules or principles should not be necessary.

4.1.3 To assist the MCA in evaluating the safety and effectiveness of SAR response within a proposed layout, developers are required to provide the MCA with detailed plans and drawings. In addition, to enable the fullest possible assessment of a layout proposal, developers are encouraged to offer computer models, artist impressions, computer generated images and animations of the layout, or scale models of the ORED, as soon as they have firm ideas for layout proposals and options. This will enable SAR unit operators, and SAR subject matter specialists at the MCA, to carefully consider a layout's SAR implications and compliance.

4.1.4 If provided, computer modelling simulations, that can be controlled by the user, and which include the ability to 'fly-through' a layout and show SAR objects e.g. life rafts, persons in the water and vessels, and change the displayed environmental conditions to imitate e.g. reduced visibility, rough sea states, low cloud (of varying coverage) and night time, are most useful. Such simulations should allow the MCA/SAR unit operator to move through a layout at surface level and at variable altitudes and speeds so as to simulate surface craft and aircraft operating amongst and through a layout. Turbine or device 'model' simulations should be as close to the type and size of turbine proposed to be built.

4.2 Layouts for SAR operations

4.2.1 With the previous paragraphs in mind, for wind farms and surface located ORED, developers should start with a layout option with at least two consistent lines of orientation (which may include perimeter turbines with smaller spacing than internal turbines) and then be refined as appropriate for the project. The layout of a wind farm or other ORED should also be as regular as possible e.g. a grid pattern, and take into consideration any lateral movement of floating devices. This regularity will also benefit the safer navigation of surface rescue craft both within and outside a wind farm. Developers are urged to communicate their proposal to the MCA as early as possible.

4.2.2 For windfarms, the SAR access requirement is so that a SAR helicopter can fly from one side of a windfarm to the other, or Helicopter Refuge Area in the case of larger windfarms, entering from outside the windfarm at altitudes below 500 feet, to either conduct searches amongst turbines or to access a location or turbine within the field, from low altitude e.g. in bad weather where cloud base and/or visibility is poor. SAR aircraft would be highly unlikely to descend into a windfarm from above, other than in occasions with large uniform spacing. The lanes also provide safer and more predictable paths through a windfarm for surface rescue vessels. These paths through an ORED will be termed 'SAR access lanes'. For practical purposes this means that, depending on type and size of turbine used, the overall shape, size and geographical coverage of a wind farm, and any proximity to other wind farms, there shall be no OREIs, or other structures, in the wind farm or on the boundary that present an obstacle or risk to SAR helicopters flying along such 'SAR access lanes'.

The spacing between internal turbines, and those on the boundary at the end of 'SAR access lanes', must be discussed with the MCA prior to final design of a layout.

4.2.3 In situations where an aircraft captain is solely reliant on instruments to navigate through a windfarm, the aircraft will not enter the windfarm where turbines are located less than 500m apart (between blade tips, transverse to the turbine lanes unless nacelles can be rotated away from the lane to increase the distance to more than 500 metres).

4.2.4 For surface located and surface-piercing devices, the requirement is to allow a SAR surface craft to enter the array area from outside and to proceed on a consistent track to exit the array without encountering any devices or structures on or close to that track. Minimum spacing between devices will depend on the type and size of devices used, the overall shape, size and geographical coverage of the array and any proximity to other wave/tide arrays. The spacing between devices will therefore need to be discussed with the MCA before final design approval of a layout.

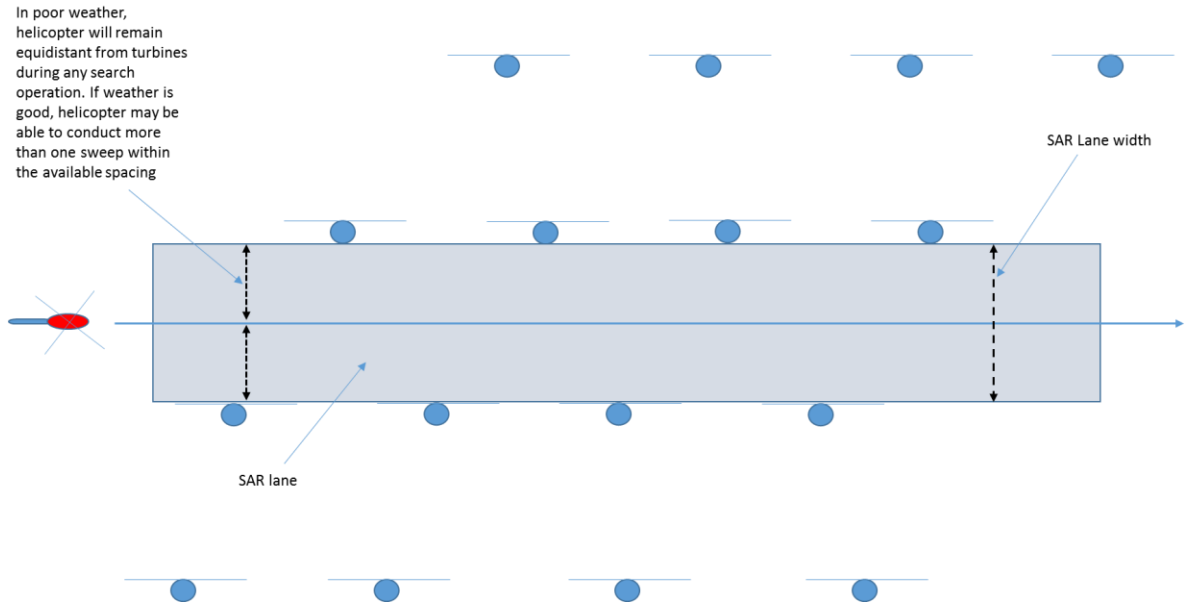


Figure 8: SAR Access Lane concept.

4.2.5 Figure 8 demonstrates a SAR lane where the blades have been rotated parallel to the lane, maximising available space. If this is not possible due to technical or operational reasons, it may limit access to the lane, particularly in reduced visibility. Any request would be discussed with the coastguard at the time of an incident.

4.2.6 Floating devices, including wind turbines (anchored to the seabed), may 'swing' on their moorings and some mooring system design proposals can permit an operator to adjust tension and therefore move a turbine a small distance, which may decrease the spacing between rows/columns of turbines. Such adjustments or swing-

tolerances must be advised to the MCA and discussed in detail during the design and layout planning process, before construction decisions are made, so that SAR access is not overly restricted. This is particularly relevant when floating and fixed turbines may co-exist, either in the same site or adjacent sites.

4.2.7 In the above case, mitigations for a variable separation may include a larger spaced overall SAR access lane or sufficient alternative lines of orientation to allow a greater probability of safe and successful access options.

4.2.8 If a device or devices are being decommissioned, and new ones being installed nearby or close to the original foundations or locations, the duty holder must discuss this with the MCA before design approval is completed to ensure that SAR response and/or navigational safety is not overly degraded or prevented, both during construction and following completion of works.

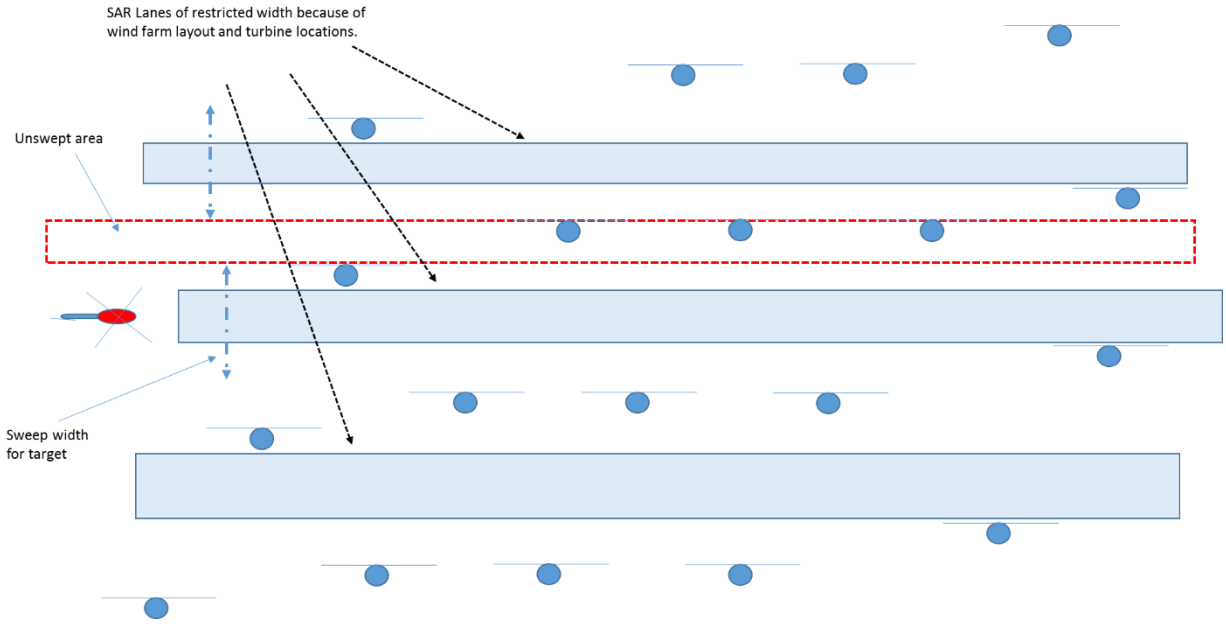


Figure 9: SAR Access Lanes effect on search Sweep Width and reduced Probability of Detection

4.3 Windfarm helicopter refuge areas

4.3.1 Where wind farms are proposed to become very large e.g. more than c.10 NM in any direction, a requirement may be imposed for helicopter refuge areas to be built into the design within the wind farm area. A helicopter refuge area can also be beneficial between two closely constructed windfarms, or where an extension is proposed adjacent to another. This is outlined further in 4.5.

4.3.2 Helicopter refuge areas are to allow SAR helicopters access to a defined area of safe airspace to: manoeuvre in preparation to enter or when exiting wind farms, to safely turn within a windfarm or, in the event of an emergency requiring the helicopter to escape from the wind farm.

4.3.3 SAR helicopters will not normally be requested, or attempt, to turn within a windfarm, however, they may do so if the spacing and conditions allow.

4.3.4 This requirement will have to be assessed during discussion with the MCA on layout design. The minimum helicopter refuge distance required will be evaluated on a case-by-case basis and will depend on the context of the development, but distances less than 1nm are unlikely to be considered acceptable.

4.3.5 The required distance for the helicopter refuge area has been calculated by trials conducted by SAR helicopters based on their turning radius at set speeds, exercises within windfarms and training in simulators[12].

4.3.6 Where a wind farm cannot meet the requirements described above, the MCA reserves the right to object to a wind farm layout, on the basis that the likelihood of a rescue not being effected / possible will be increased.

4.4 Wave/tide safeguard zone

4.4.1 Where wave/tide devices are close to other such arrays, the MCA will wish to assess the available space between each array to determine if this creates any SAR response difficulties. This may require that a minimum safeguard zone spacing will have to be set.

4.5 Adjacent developments and extensions

4.5.1 Windfarms which are extended, or adjacent developments which are constructed close to each other, could be perceived by an external observer as one windfarm. It is important therefore that all mitigations outlined in this document are carefully considered and discussed with the MCA.

4.5.2 All developers involved must undertake to ensure that layouts are harmonised and of the same general orientation so that they meet the requirements above. Where this is not possible or where layout discussions are commercially confidential, adjacent developers (in the case of two new windfarms being constructed in a similar timeline) should agree to include a helicopter refuge area between their developments, to ensure different layouts of each individual windfarm are acceptable.

4.5.3 It is highly likely that a helicopter refuge area will be required between adjacent developments, unless full alignment of the layouts is achievable. Consideration should be given to boundaries which are not parallel as this may require a greater spacing should the MCA assess this as a limiting factor.

4.5.4 A helicopter refuge area between an existing windfarm and an extension, can provide a developer with more flexibility with the new layout, without having to ensure the layouts are harmonised across both developments.

[12] Live trial undertaken by the Inverness based S92 SAR helicopter over Loch Ness in January 2018.
Simulator trials undertaken over a period of months and concluded in April 2018. Exercises conducted in 2016-2019.

4.5.5 Adjacent developments may create anomalies in both orientation and numbering, which might create confusion or distraction during SAR operations. The MCA will expect developers to provide mitigation or a solution for such occurrences.

4.5.6 Should a developer expect an adjacent windfarm to be constructed in the near future, consideration could be given to numbering which may be continued. E.g. starting with turbine A01 at the opposite side to the next development.

4.5.7 Navigation and aviation lighting must meet the requirements within Section 5, and where required, the developments are lit as one windfarm.

4.5.8 Developments should consider the sharing of resources for emergency response. Having awareness of available resources and relevant contact telephone numbers may provide an invaluable support and this response should be tested during emergency exercises.

4.6 Chart and position information

4.6.1 Accurate charts and positions (in WGS84 datum in decimal format latitude and longitude of degrees, minutes and decimal minutes e.g. DD MM.M) of all turbines/devices and structures within an ORED are vital to safe SAR response. Duty holders are required to provide HM Coastguard, the UK SAR helicopter service and lifeboat/rescue boat providers with accurate charts of the ORED, and its immediate area, with all turbines/devices clearly marked and with critical distances e.g. between turbines/devices and structures, and heights/depth of structures, marked.

4.6.2 Finalised layouts (as constructed) must also be provided to HM Coastguard, as per the format outlined in 4.6.1) as a vector file e.g. shapefile including OREI positions and SAR lanes.

4.6.3 Positional information must also be shared by the developer in a format that is compatible with the Flight Management System (FMS) of all aircraft of the UK SAR helicopter service, and the lifeboat/rescue boat service providers' electronic chart plotting systems, so that turbines'/devices and structures' coordinates can be programmed in to the FMS/Nav Plotter for use during SAR operations. MCA can advise on requirements.

4.6.4 Such data should also be provided, where required, to any aviation and maritime charting service that HM Coastguard and/or the UK SAR helicopter and rescue boat/lifeboat service providers require and to the UK aeronautical and maritime charting services if requested.

4.6.5 Specific positional information required is:

- Clear indications on paper and electronic charts of the spacing between turbines/OREI devices in lateral and vertical planes and turbine and other structures heights/depths.

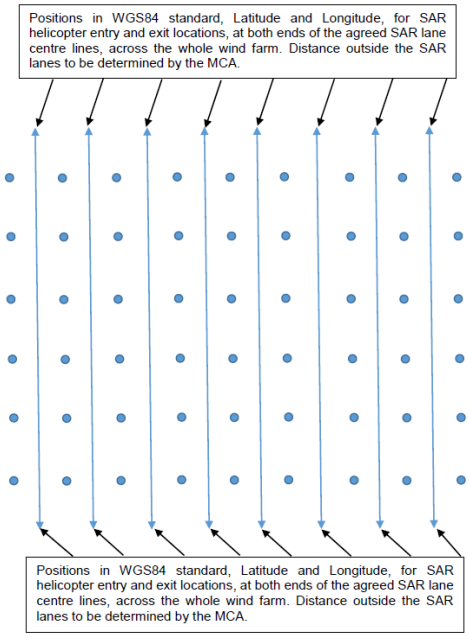
- For WTG two minimum distances must be shown: (i) between turbine towers and (ii) between blade tips, when the blades are transverse to a lane.

- For tide, wave, sea current devices and floating wind turbines, the minimum distance shown should be the narrowest distance expected between devices (depending on their size and shape and their likely movement by wave and tide forces). The 'swinging' radius of each device should also be shown (if this changes at various stages of the tide, this should also be indicated).

- Supply of latitude and longitude of entry/exit positions and accurate drawings showing the SAR access lanes 'through wind farms/ORED agreed with the MCA, including position of access points (on the centre line of the SAR lane, 0.5nm from the boundary), bearings of the lanes and distance of the lane (between access points) and minimum width.

- Accurate positions, in WGS84 datum, of all turbines/devices and other structures in the wind farm/ORED, supplied as both paper chart and electronic format according to the data-standard requirements of the Flight Management Systems (FMS) of the SAR helicopter provider and the electronic chart plotter system of the rescue boat/lifeboat service providers.

- Supply of position and other relevant information to Kingfisher Information Services for their navigational awareness chart service.



5 Lighting and marking

5.1 ORED Lighting – general points

5.1.1 This section is concerned with lighting for SAR and emergency response purposes. Lighting for marine navigational safety is the responsibility of the General Lighthouse Authorities. Developers are strongly recommended to discuss and confirm the detail of navigational safety lighting and marking with the MCA and other relevant authorities before manufacture or installation.

5.1.2 In poor visibility and/or at night, any lighting, is required to be controllable from shore so that it can be switched on or off - at the request of a SAR helicopter, rescue boat or the SAR Mission Co-ordinator. Working lights on OREI must not cause confusion or interfere with the lights from aids to navigation.

Figure 10:Diagram of Requirement for Accurate Positions Outside of the Wind Farm on SAR Access Lanes, Centrelines

- Work lights should be positioned to face inwards or towards the structure.
- Work lights should have a reduced vertical optical profile above the horizontal, by means of either hoods/baffles or through optical design, to mitigate the risk of direct light into the eyes of those working and to reduce light pollution or interference with aids to navigation.
- A light simulation of the area to be illuminated should be completed to demonstrate that light pollution is kept to a minimum and the area is illuminated consistently and to a safe level.

5.1.3 To assist rescue operations from WTG, wind turbine personnel may consider carrying strobe-torches or portable lights that could be placed on the roof of a nacelle to indicate the turbine which the helicopter should proceed to. Additionally, for those WTG with transparent roof hatches or hatches that can be opened, internal lighting might be requested to be switched on to enable the upward-spilling light to identify a specific turbine to SAR helicopters.

5.2 ORED layout numbering

5.2.1 ORED devices and layouts are required to be numbered so that surface craft and aircraft can identify and locate individual devices and can navigate easily around and amongst an array. Installation numbers can also be used by craft in an emergency to report their position by reference to a nearby device number, and position fixing can be enhanced if more than one turbine can be used to fix a position by the taking of bearings. The numbering of layouts also contributes to the situational awareness of SAR craft and to enable them to navigate visually to a device or location in an array to conduct rescue operations. It also assists with safety of navigation of craft passing

close by or through an array. Out of sequence and/or complicated numbering schemes are potentially confusing and will not be accepted. MGN 654 provides complementary information about numbering of turbines.

5.2.2 ORED layout numbering schemes are required to follow a 'spreadsheet' format whereby an array is numbered in a navigationally logical and sequential manner, using a combined alphabetical and numerical order. This must commence with a development name designator-code (normally 2 or 3 letters) and then row/column numbering starting with letter 'A' and then a turbine number. For numbers less than 10, they should be preceded by a leading zero e.g. 01. The numbering and orientation of the scheme must be determined in discussion with the MCA; from a SAR perspective the numbering and orientation should be aligned with the 'SAR Access Lanes' such that progression through the development is indicated by increment/decrement of turbines in a logical fashion.

5.2.3 For developments with complex boundaries and/or layouts, particular attention should be given to the numbering to maintain the logical sequence as much as possible.

5.2.4 Letters 'O' and 'I' should not be used to avoid confusion or misunderstanding with numbers 0 and 1.

5.2.5 Where a developer must have turbine electrical-connection identifiers included on the outside of turbines/devices, the MCA can accept this, but these designator letters/numbers must be placed in brackets beneath the other number and letter combinations. For SAR purposes, the MCA would prefer there be only one reference system used for identification of structures.

5.2.6 Example of a turbine layout tower numbering ID plate/panel acceptable to the MCA:

ABZ (ORED site-designator code letters)

A01 (first turbine in row 'A')

(J8) (Electrical connection identifier letter/number if required by operator)

5.2.7 Wherever possible, developers should avoid early use of numbering systems internally, if it will later cause confusion following any amendments required by the MCA.

5.3 Wind turbine tower and nacelle ID marking

5.3.1 Individual wind turbines are marked for safety of navigation[13] and SAR situational awareness purposes with ID number plates, providing a combined 360° visibility around the tower base or the railings of the transition piece walkways, usually somewhere close to the level of the entrance door area. These ID numbers must be

[13] As per IALA guidelines

clearly readable by an observer stationed 3 metres above sea level at a distance of at least 150 metres from the turbine.

5.3.2 Each ID number plate shall be illuminated by a low intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision. Lighting for this purpose must be hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.

5.3.3 The following parameters should be considered when selecting a suitable light:

a) uniformity factor – better than 1:4 suggested

b) mean luminance - 5 cd/m2 ≤ Lmean ≤ 10 cd/m2

c) Colour temperature – 2500 K – 3500 K

5.3.4 Individual ID numbers are also to be painted on the nacelle roof, or other OREI (e.g. substation) so that SAR helicopters and/or other low flying aircraft (SAR, counter pollution, fisheries patrol or military) can locate and/or reference an OREI visually. These ID numbers should be recognisable from an aircraft flying 500 feet (152 metres) above the highest part of the structure, which for wind farms would be the blades at their vertical point. Advice from the CAA (October 2013), following discussion with the MCA, is that such numbers should be as large as practicable but not less than 1.5 metres in height and of proportionate width. This implies that ID numbers should be more than 1.5 metres in height where there is space to achieve this. It is expected that developers will make ID numbers as large as can be sensibly fitted on a nacelle roof.

5.3.5 ID numbers should be placed on the roof in a logical manner so that the OREI can be easily distinguished however there is no requirement for them to be lit.

5.3.6 Designs of nacelle roofs often limit the space for ID marking, however, this is not a justifiable reason for reducing the size of the numbers. The MCA and CAA should be consulted if this is a perceived issue but ultimately, this marking requirement should be fully implemented in the design requirement of the turbine.

5.4 Other OREI marking

5.4.1 Tide and wave devices, which are on the surface at any time of their operation, shall also be marked with ID numbers on the most appropriate vertical and horizontal surfaces.

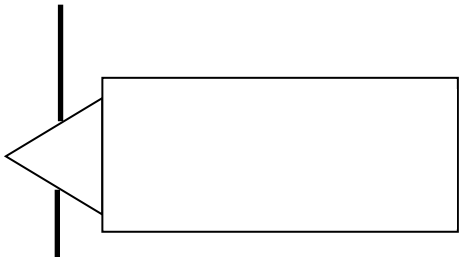


Figure 11: Example of ID Numbers on wind turbine nacelle roof, acceptable to MCA

5.5 Wind turbine blade hover reference marking

5.5.1 WTG blades need to be marked to provide a SAR helicopter pilot with a hover reference point when hovering over a nacelle during a rescue. This is necessary because SAR helicopters are large aircraft and the pilot (sitting on the right of the aircraft) may not be able to use objects or markings on the nacelle for reference because these are too far behind the pilot's location to be easily seen. The WTG

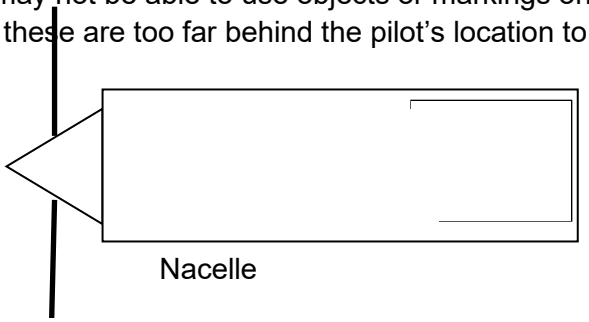


Figure 12: Suggested alternative orientation and size of air-viewable ID numbers on WTG nacelle roof.

blades are in the pilot's normal vision-arc and so are the best place for such markings.

5.5.2 Three marks are required on each blade - one each at the 10, 20 and 30 meter interval (starting from the hub end of the blade) and placed near the trailing edge of the blades so that, when they are feathered, and the blades are parked in the 'bunny ears' ('Y' position) or offset 'Y' (one or two blades angled forward into the wind), the marks lie upwards in view of the helicopter pilot.

5.5.3 The marks should be painted in a contrasting shade to the blades overall colour - red (RAL 3020) is considered to be most suitable. The diameter of the marks (dots are preferred) should be at least 600 Millimetres but may need to be larger according to the overall size and shape of the turbine and blades.

5.5.4 The blade tip should also be marked in a contrasting shade to the turbines overall colour - red (RAL 3020) is considered to be most suitable (the amount of tip paint is dependent on the size of blade, but approximately 2% of the blade length should be sufficient). See image below. Where blade tips cannot be painted because of e.g. lightning protection material on the tip and/or leading edge, the developer is to offer alternative solutions for consideration by the MCA. A red band as near to the tip as possible, measuring 2% of the blade length, is considered an acceptable alternative by the MCA.

5.5.5 The blade marking proposal should be confirmed with the MCA OELO before placing them on blades.

5.5.6 All markings on blades and nacelles must be maintained in operational condition throughout the life of the wind farm. This means that all markings and numbers must be legible and clearly visible.

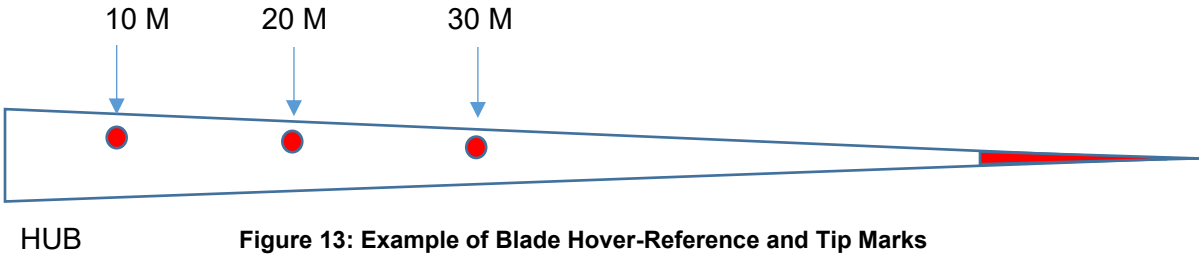


Figure 13: Example of Blade Hover-Reference and Tip Marks

5.6 ORED aviation lighting

5.6.1 Aviation hazard lighting for ORED must be provided so that safe SAR aircraft operations can be conducted at night or in poor visibility.

5.6.2 The Civil Aviation Authority (CAA) and the MCA are in regular dialogue as to how much and what kind of lighting is required in wind farms (dependent on their size, location, shape and risk factors) and so no design decisions should be finalised for aviation lighting until developers have consulted with the CAA and MCA.

5.6.3 The aviation hazard lighting requirements for wind turbines fall outside of those contained in the Air Navigation Order (ANO). However, the CAA accepts the operational need for different lighting for offshore wind turbines. Developers are therefore requested to write to the CAA to request a derogation from the ANO. The CAA has outlined its position on offshore windfarm lighting in CAP 764 (published February 2016). This document includes MCA requirements for lighting of offshore windfarms. It is important that the developer communicates early-on with the MCA regarding lighting for offshore OREIs.

5.6.4 The lighting of offshore wind farms with aviation hazard lights is necessary for:

a) Flight safety of aircraft passing by or over wind farms (hazard avoidance);

b) Flight safety of Search and Rescue aircraft (helicopters and/or fixed wing) operating over, around or within a wind farm, often at low altitude, to conduct SAR operations to save life; and

c) Flight safety of low flying military aircraft using conventional techniques or night vision devices.

5.6.5 In (b) above, the lighting is necessary to ensure that aircraft operating at night and/or in poor visibility, close to OREIs, can identify (1) the shape and layout of a field and (2) locate and monitor each OREI (as an individual hazard).

5.6.6 The CAA has discussed lighting requirements in detail with the MCA and the General Lighthouse Authorities (GLA) of the United Kingdom and, in particular, that which is necessary to assist SAR operations. It was agreed with the MCA that lights are required on OREI as follows[14]:

a) Whenever boundary turbines are equal to or greater than 900 metres apart, all boundary turbines shall be lit (at night and in poor visibility) with a single, 2,000 candela, red aviation hazard light, flashing Morse 'W' in unison with all other turbines so lit. The 2,000 candela light should be automatically adjustable in intensity to not less than 200 candela whenever the visibility is greater than 5 km. This requirement is also necessary where the SAR coordinating authority and/or the SAR helicopter or aircraft requests a reduction in light intensity. Then the light needs to have fixed illumination (no flashing required). Where boundary turbines are less than 900 metres apart, the number and location of those lit shall be in accordance with discussion with the MCA and the CAA.

b) All other OREI of a wind farm (OREI within the boundaries and those OREI on the boundary that are not lit because they are less than 900 metres apart) shall be fitted with a single, 200 candela, red[15] aviation hazard light, with fixed illumination (no flashing required). During routine operations i.e. no SAR operations are underway in or around the windfarm, these lights shall be switched off. The lights may be required to be switched on at the request of the SAR coordination authority and/or a SAR helicopter or aircraft.

c) The SAR lights mentioned in b) above, should be visible by a SAR helicopter operating below nacelle level as well as from all directions above. The SAR lights should be at least 30 candela from 20° below nacelle level up to nacelle level and 200 candela from nacelle level up to 90° above nacelle level.

d) All aviation hazard lights shall be visible through 360°. Where this is not achievable using a single light due to the design of the OREI, an additional light or lights may be required to ensure 360° visibility is maintained.

e) All OREI aviation hazard lights throughout a field shall be individually controllable (from the windfarm operators control centre or through a remote operations and control system) so that they can be switched on or off as required when requested by the SAR coordinating authority[16] and/or SAR aircraft commander.

[14] Any questions on technical specification should be directed to the MCA's OELO in the first instance. Further information may be updated in due course following discussions with the CAA.

[15] As per CAP 437, the colour of the light(s) should be red, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.3.1(a), whose chromaticity is within the following boundaries.

- Purple boundary y = 0.980 – x
- Yellow boundary y = 0.335

[16] The SAR coordinating authority is the SAR Mission Coordinator (SMC) at the relevant HM Coastguard Rescue Coordination Centre (RCC) conducting rescue co-ordination.

f) All OREI hazard lights throughout a field shall be compatible with Night Vision Imaging Systems (NVIS)

I. For the light defined in a) the MCA require it to emit IR light in Morse code W, according to the specifications of the Ministry of Defence (MOD). This IR light shall remain flashing Morse code W when the hazard light is dimmed according to a). Upon request, this IR light should be switched off in case of distraction to the SAR crew.

II. For the light defined in b), the light shall emit at least 4mW/sr over the light output angles as defined in c) and d). The infrared wavelength shall be between 800nm to 900nm. Once deployed, in case 4 mW/sr is deemed not to be sufficient in the field, it should be possible to increase the output power by a factor of 2.

g) All lighting components should be tested by an independent test house. The photometrical, infrared intensity and colour measurements performed in the optical department of this test house should be accredited according to the version of EN ISO/IEC 17025 current at the time of the testing. The angular sampling intervals should be: every 10° in azimuth; every 1° in elevation.

5.6.7 Like maritime navigation lighting, aviation lighting is an aid to safe flight at low altitude and the avoidance of hazardous obstacles. The turbine field aviation hazard lighting (internal and external) must relate to the physical layout of ORED, regardless of duty holder and/or date of construction such that if OREI are built adjacent to or as extensions of existing wind farms, the disposition of lights will have to be modified accordingly to provide a contiguous and unconfusing pattern to aircraft. If the wind farms have different duty holders, then a common lighting pattern and control methodology will be required. Flight safety is as important as vessel safety. Early conversations should be initiated with the MCA, GLA and the CAA to understand the requirements and to develop appropriate solutions.

5.6.8 SAR helicopters requesting lighting to be switched on or off shall normally do so through the relevant RCC or directly with the duty holder by radio, if this option exists.

5.6.9 Aviation lighting must be properly maintained throughout the life of the wind farm and response to lighting failures must be in accordance with CAA requirements.

5.6.10 It is not currently considered necessary for surface-located wave and tide devices to have any aviation lighting fitted.

5.7 Rescue boat lighting

5.7.1 Rescue boats/lifeboats will not normally require lighting other than that which is installed to meet the requirements of navigational safety and for the identification of individual OREIs e.g. ID-number lights on all wind turbine towers. If there are

deck/working lights on the turbine or device, these may be required to be switched on, or off, during rescue or search operations.

5.7.2 The MCA, and rescue boat/lifeboat operators may request additional lighting requirements if a particular ORED proves to need such lighting to enable the safer operation of rescue boats/lifeboats. Any such additional lighting would not routinely be illuminated but only used during a SAR situation and on request of the rescue unit(s) or the SAR Mission Coordinator.

5.8 Floating device tracking

5.8.1 Where possible, it is expected that floating energy installations are fitted with tracking devices so they can be monitored, particularly if they break free from their moorings.

5.8.2 The duty holder should have a plan in place for the notification, tracking, locating and recovery of such devices, should they break free and HM Coastguard updated at timely intervals until such time as the installation is safely recovered. The duty holder should also be able to broadcast frequent sécurité messages on VHF radio to alert vessels to the hazard to navigation.

6 Technical

The increase in the number of offshore developments creates technical challenges and opportunities which must be considered by the developer and MCA to ensure as many of the additional risks can be mitigated, and that communications and surveillance coverage are maximised[17]. Early discussions regarding this will provide a more efficient process. The MCA requirements, as outlined in this section, will be recorded within the SAR checklist on a case-by-case basis, however, detailed technical information relation to each element can be found within the document “MCA technical requirements for windfarms”. This document is available to developers on request from the MCA.

6.1 In-field VHF radio communications and communications with HM Coastguard

6.1.1 The coordination of SAR operations is significantly enhanced whenever the SAR Mission Co-ordinator, the vessel(s)/person(s) in distress and responding rescue units and/or other vessels/craft, are able to communicate directly with each other[18]. Marine band (FM) VHF radio is the most common form of radio communications in use and is likely to be fitted to and used by all types of craft, SAR aircraft, vessels and personnel involved in an emergency situation.

[17] IALA guideline 1111 provides information for the preparation of operational and technical performance requirements for VTS systems.

[18] Communications difficulties between on-scene assets and HM Coastguard were identified during Exercise Sancho in 2022 and were raised by participants as being a complicating factor in the successful coordination of the scenario. Recommendation 12 raised the need for industry to consider these communications issues.

6.1.2 Given that SAR units (air and surface) may often be operating in dangerous sea and weather conditions, and that SAR helicopters may often be operating outside of Air Traffic Service communications coverage, marine band VHF radio is a means by which SAR units can make immediate emergency calls, if they get into difficulty, and know that someone is able to hear them.

6.1.3 A SAR helicopter will only enter, or operate in the close vicinity of, an ORED if they have direct communications with the windfarm operator.

6.1.4 Wherever a windfarm or ORED is wholly or partially outside of effective, shore-based VHF radio coverage or where the windfarm poses significant risk, developers are required to discuss with the MCA the need for provision of in-field, marine band VHF radio communications aerial(s) (VHF voice with Digital Selective Calling (DSC[19])) that can cover the entire wind farm site and its surrounding area. Such VHF radio communications should be connected to both the wind farm control centre and an additional radio available to HM Coastguard's communications network. Detail of how this can be achieved is available in an MCA technical document and should be discussed early with the MCA. Costs for the provision and maintenance of this service will rest with the developer.

6.1.5 It must be noted that the minimum requirement is for an ORED (as outlined in 6.1.4) to be fitted with marine band VHF DSC radio. Other communications systems and radio frequency bands are not suitable because they cannot be used or heard by the coastguard and vessels or aircraft responding to an emergency situation. In the event of an emergency situation, the SMC at the coordinating RCC, will need to be able to communicate with all units involved throughout the emergency (and perhaps at the same time). Marine band VHF enables this to be achieved.

6.1.6 It may also be necessary for the operators of existing windfarms/ORED and, in some cases, future ORED, to ensure that work and support boats/craft/vessels, have effective and consistent radio communications with HM Coastguard's shore-based radio aerial network. Therefore, all new OREDs, and some existing ones, may be requested to conduct a communications trial to confirm that the work and support craft can reliably communicate with the coastguard whenever those craft are operating offshore and around or amongst the ORED.

6.1.7 In addition, all new OREDs will be required to conduct a communications trial in their development area, prior to any construction work beginning. The MCA will assess the results of these trials as part of initial discussions with the developer, contributing to decisions on requirements for VHF aerials. A subsequent test following the completion of the construction phase would also enable a comparison to be made, to ascertain whether the OREIs cause any degradation to the reception. Further detail is included in 6.2.

[19] Digital Selective Calling allows users to transmit Distress and Urgency Alerts and, for Coastguard use, the transmission of Distress and Urgency Relay alerts to all ships (in effect, all other DSC radio stations in range). The transmission of DSC alerts is a vital part of the process of distress alerting and SAR coordination within the GMDSS.

6.1.8 Whenever there are reports of or doubts about the reliability of radio communications to and from the work and support craft working in or around an ORED, the MCA may require that a communications test be carried out to verify any weaknesses in communications. If weaknesses are identified, the operator will be required to work with the MCA and to put in place measures to resolve the problem.

6.2 Radio survey requirements

6.2.1 All new windfarm developments are required to carry out a radio reception survey to ascertain what level of mitigation may be required and to allow for a comparison once construction has completed.

6.2.2 As a result, developers are required to carry out a survey based on the criteria below, which the MCA suggests is completed during surveys already being carried out (e.g. traffic, UXO). The radio survey results should be made available to the MCA for discussion along with other SAR and emergency response considerations.

6.2.3 The survey should be completed on a vessel with an aerial height comparable to that which will be used during normal operations (i.e. the height of aerials used by windfarm support vessels). The survey should test the communications relevant to the area to which the vessel is operating (e.g. VHF or MF). In addition, a post construction survey must be able to demonstrate that there is adequate VHF coverage to the Coastguard operational network within the development area, and if there is not, additional radio mitigations may be required.

6.2.4 Before each survey, the relevant RCC should be contacted by telephone to provide notification of the intended survey and to confirm it is an appropriate time to do so.

6.2.5 Each radio survey should record the following, ensuring a reasonable coverage around the boundary, and at several points throughout the area, preferably with no two points more than 5 km apart:

a) Vessel details: type, name, callsign, size, radios on board, height of aerials

b) Environmental (record for each position tested, or if no marked change, reference to a previous position): sea state, wind speed and direction, QNH (pressure at sea level), general weather (rain/snow/sun/haze), night/day

c) For each position: Lat/Long (DD°MM.MM), time test undertaken, radios used (make, model, type (VHF/Medium Frequency (MF))), shore contact (Coastguard/Marine Coordinator (if one available)), position and name of receiving aerial, range and bearing to receiving aerial (or at least to a point on land), channels/frequencies used, signal strength and readability (1-5 for each) at the vessel + signal strength and readability of receiving aerial, notes.

d) A test between survey vessel and another vessel nearby would be useful, in which case, details of the receiving vessel would also be required.

e) Once the windfarm moves into Operations and Maintenance, a further survey should be conducted. In all cases out with normal VHF range to shore, where the coastguard has access to an offshore radio, VHF tests should be carried out.

6.2.6 A further survey will be required once construction has been completed, to compare the results against the pre-construction survey. Any areas of poor coverage will require further discussion with the MCA and could result in additional mitigations being required e.g. additional radios or repeater stations.

6.2.7 In addition to the formal survey, it is acknowledged by the MCA as good practice to carry out periodic radio tests with HM Coastguard, from within the windfarm, to confirm satisfactory radio coverage.

6.3 Automatic Identification System

6.3.1 AIS is fitted, with a few exceptions, to all vessels over 300 Gross Tonnage, fishing vessels of 15 metres or more, and voluntarily to other types of vessels e.g. pleasure craft, smaller fishing boats. AIS receivers, fitted to OREIs, enable duty holders to monitor AIS equipped vessel activity around and within the ORED.

6.3.2 AIS may also assist in locating vessels in distress and identifying and tracking those that could be of assistance in the event of a SAR incident or other emergency in or around an ORED. It can also provide early warning of any vessels that may be on a collision course with an OREI.

6.3.3 In addition, the installation of AIS receivers by a duty holder is of considerable benefit to HM Coastguard because it enables the continuous tracking of responding vessels and SAR units, and the monitoring and management of SAR operations e.g. search area coverage.

6.3.4 Wherever a wind farm/ORED is wholly or partially outside of shore based AIS coverage, developers are required to discuss the need to fit AIS receivers with the MCA and to providing such AIS data feeds to HM Coastguard.

6.3.5 Any AIS fitted to OREDs must not routinely broadcast the position of the ORED structures by transmission of Virtual Aids to Navigation (VAToN), unless otherwise agreed with the appropriate general lighthouse authority.

6.4 CCTV

6.4.1 Duty holders may decide to fit CCTV to their ORED for safety and/or security reasons. CCTV has significant benefits in providing ORED control rooms with visual indications of weather and sea state and can contribute to decision making for deployment of maintenance personnel and support vessels. Such systems may also be of operational benefit to HM Coastguard and so duty holders should consider offering data feeds. Such information might be provided by webcam access through a website link (which could be username and password protected).

6.5 In-field weather information

6.5.1 Accurate information about weather conditions at an ORED is extremely important for the planning and execution of SAR missions. SAR resource crew will base their response decisions on accurate weather data, and the coordinating SAR Mission Co-ordinator will need to determine if a SAR resource, particularly a helicopter, is able to conduct a rescue. If the actual weather is out of limits for a SAR response, then the SMC will have to plan for and provide an alternative response solution. Immediate and accurate weather data, from the site, enables such decisions to be made rapidly and reduces delay. Windfarms are therefore required by the MCA to provide the following, real time weather information, in accordance with CAP 437, from the wind farm site[20]:

- Wind Speed & Direction
- Atmospheric Pressure
- Air Temperature
- Dew Point
- Present Weather & Visibility
- Cloud Height
- Wave Height (CAP1145)

6.5.2 Such information could be provided from equipment which meets UK helideck weather observation standards, in accordance with CAA and ICAO requirements, or from other systems and equipment that provide the same information and to the same standard as required by CAP 437. The information shall be from a location that is, as far as practicable, fully exposed to wind and sky from any direction and not subject to any anomalous effects from nearby equipment or structure which might cause inaccurate readings or results.

6.5.3 The weather information must be provided in a readily accessible way to HM Coastguard's network and the UK SAR helicopter service, preferably through a website (with username and password protected access).

6.5.4 In addition, the MCA may require for the windfarm to provide a direct weather feed into HM Coastguard systems.

6.6 Radar surveillance

6.6.1 The population of OREIs is increasing and the size and scale of developments (and their adjacency and cumulative effects) is significantly different from that in the past. There are a large number of non-AIS boat movements in UK and European waters and this activity effects the navigational decisions and manoeuvring of larger vessels. It also creates different SAR and navigational safety challenges e.g. small craft can normally safely pass through wind farms (thus increasing their presence within them and, possibly, the chance of SAR occurring), and are not easily located or tracked

[20] This requirement is irrespective of whether or not an OREI operates helicopters.

because they are not mandated to use AIS. In the latter case, the inability of the SAR service to locate and monitor a target, which requires SAR response, may cause prolonged SAR operations due to the need to conduct a large-scale search for a distressed craft that is, for whatever reason, unable to report its position. Active surveillance systems may lessen this risk because 'targets' can be directly investigated by SAR units, which lessens the area which needs to be systematically and laboriously searched and, consequently, diminishes SAR units' exposure to risk when operating amongst the OREIs.

6.6.2 Also, the concentration and channelling of shipping traffic caused by the presence of wind farms in the UK sea space will inevitably mean that there will be, in some areas, more vessel interactions and traffic compression and this may increase the need for continuous, effective surveillance for safety of navigation, emergency response and SAR purposes.

6.6.3 Section 4.15 of MGN 654, states that 'Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the MCA's Technical Services Navigation Branch and will be listed in the developer's EIA Report'. This may include a requirement on a developer to provide radar surveillance of a windfarm.

6.6.4 The MCA and/or developers may therefore consider that an ORED risk profile, and/or navigational safety and/or SAR response would be improved by provision of marine radar surveillance of the area within and around the wind farm by enabling:

a) Location, monitoring, tracking and prediction of the movement of any craft or vessels that are not transmitting AIS signals;

b) timely location of a non-AIS craft or vessels that is, for example, on a collision course with the OREI and/or to alert HM Coastguard to an emerging threat of collision/interaction to allow an early response;

c) monitoring the passage of such vessels through the ORED (so far as the radar is physically able to monitor a vessel passing through an ORED);

d) surveillance around the ORED to identify craft or vessels acting suspiciously (which are unlikely to be transmitting on AIS) and to monitor the activity, predict movement and track and report to relevant authorities and support any intervention activities;

e) early warning and tracking of any craft or vessel that is or appears to be attempting to board or go alongside OREIs;

f) SAR-surveillance to enable the location and tracking of a distressed craft or vessel that is not transmitting, or unable to transmit, AIS signals and/or that cannot report or update its position by other means;

g) SAR-Surveillance to attempt to locate overdue or missing craft that have been predicted, on information available, to possibly be within the radar coverage of the ORED;

h) Locating SAR targets within or close to a wind farm to enable SAR units to be sent directly to them to reduce the risk to and the need for SAR units to conduct searches amongst or close to turbines to locate such targets;

i) monitoring of the progress and safety of SAR helicopters operating at low altitude in and around ORED;

j) monitoring of the progress and safety of surface SAR units during a SAR operation;

k) monitoring of vessel traffic-density around and through any ORED to contribute to ongoing risk assessments and any relevant measures required to improve maritime safety around or within renewable energy sites;

l) Locating and tracking of drifting objects e.g. containers, which may cause a maritime safety risk to boats working within the ORED.

6.6.5 If developers are intending to fit radar, or the MCA sets a specific requirement for radar to be fitted, developers are requested to discuss the provision of the radar information to HM Coastguard and processes and procedures for management of the radar monitoring activity.

6.6.6 If developers decide to fit radar, they would not be expected to provide any form of formal radar service e.g. VTS. Any use of radar would only be to provide active surveillance of vessel activity within, around and approaching the ORED.

6.6.7 Where radar is fitted, and a feed is supplied, HM Coastguard will not provide any form of radar service to an ORED or to traffic operating around or passing through, except where a service has been agreed as necessary e.g. to cover a Traffic Separation Scheme (TSS) or routing measure. It will normally only make use of radar imagery to provide surveillance information in support of search and rescue and emergency response operations when required.

6.6.8 Radar for surveillance of an ORED and its approaches must be able to detect a target of at least the size of a small inshore fishing boat/yacht (Radar Cross Section of c.3M²). IALA Guideline 1111 provides relevant information and guidance on this subject.

6.7 SAR helicopters radar and electro optical systems

6.7.1 For SAR helicopter operations, radar is a key tool for aiding flight safety when navigating amongst or around WTGs (obstacle detection) and is a rescue-object location tool - especially at night, in bad weather and poor visibility. It is therefore fundamental to the safe operation of SAR helicopters within and around wind farms that WTGs and other structures are detectable to airborne radars (at a safe range)

and that the aircraft crew, using radar, can discriminate between individual turbines. Evaluation work may need to be conducted by developers to determine if there are any particular difficulties that may be encountered by SAR helicopters using radar close to or within a wind farm. Such evaluations will allow the creation of relevant procedures for the use of radar in and around a particular wind farm and/or will capture useful information about use of radar for SAR purposes in this environment. Outcomes from such trials and evaluations may lead to a post-construction requirement to mitigate any serious interference or other radar degradation – if that is technically possible. The MCA will advise, during the consultation process on layouts, if they consider that testing and trials may be necessary.

6.7.2 If an ORED is considered by the MCA to be problematic for use of SAR camera/imaging systems, the MCA may request the developer to undertake evaluation work to assess effects on electro-optical (Infra-red, night vision imaging systems and low light TV cameras, etc.). Mitigation requirements may then need to be placed on an OREI if such systems are found to be degraded when used amongst those OREIs. MCA will advise during the consultation process on layouts and turbine types.

6.8 Rescue boat / lifeboat radar and electro optical systems

6.8.1 Radar is an important safety of navigation and rescue-object location tool during rescue boat/lifeboat operations at night and/or in poor visibility. It is therefore important that OREIs are detectable to marine navigation radars in accordance with MCA requirements contained in relevant MGNs and that, subject to inherent target range and bearing discrimination performance of the marine radars, individual OREIs can be differentiated from others i.e. each OREI's radar image should not merge with a nearby device when a surface rescue craft is close e.g. within 1 Nautical Mile. If radar clutter, propagation and/or degradation is found to be unacceptable, developers may be required to provide mitigations and/or other solutions, if these are physically possible.

6.8.2 Some rescue boats/lifeboats may use electro-optical devices e.g. night vision imaging systems, to aid location of SAR objects or to navigate safely in the dark. Mitigations may need to be required from developers if such systems are found to be degraded when used amongst an ORED.

6.9 Radar reflectors – wave, tide and sea current devices

6.9.1 Surface, and surface piercing wave and tide devices must also be marked with radar reflectors so that each device can be located on radar by aircraft and surface craft operating over, around or within an array. These reflectors may also assist radar location of any devices if they should break-away from an array. The radar reflector and supporting structure may also provide better visual acquisition properties for devices when viewed by eye, particularly from surface craft. Current evidence indicates that wind turbines do not normally require additional radar-signal enhancement. However, there may be unusual circumstances where the MCA, or

other organisations, require the fitting of devices to increase the conspicuousness of a radar image from a turbine or turbines.

6.9.2 All OREDs must be marked and lit in accordance with the relevant General Lighthouse Authority requirements.

6.10 Aircraft flight simulator data

6.10.1 UK SAR helicopters have associated flight simulators where aircrew can practice flight manoeuvres and emergency procedures, etc. Such simulations can also provide variable weather, visibility, sea states and vessel targets and search and rescue objects which conform to the weather and sea conditions being simulated. The provision, by duty holders, of accurate, flight-simulator compatible, visual imagery of a proposed or existing wind farm, would be highly beneficial in enabling SAR helicopter aircrews to assess proposed layouts, become familiar with particular windfarms and practise or develop techniques and procedures for operating within and around wind turbines.

6.11 Future technology

6.11.1 As referenced in 1.6, the industry is developing and trialling new technology and systems which in many cases may reduce risk offshore and could also be available to assist with search and rescue.

6.11.2 It is not possible, or desirable, to be prescriptive about what technology may provide, or mitigate, however duty holders who are considering utilising future technology should liaise with the offshore energy lead to ensure that any benefits can be maximised.

6.11.3 Specific examples cannot be referenced until they have been fully tested and implemented, though if and when this occurs, it is anticipated that there may be positive impacts on various sections of this document, particularly 3.8.

6.12 Maritime Security

6.12.1 While somewhat out of scope of this document, there is an increasing importance of maritime surveillance around the UK and in this context, OREDs are both a hinderance and opportunity in equal measure.

6.12.2 OREDs can reduce the effectiveness of shore-based surveillance equipment and may be a target for nefarious and/or direct action. However, they may also provide the basis, as noted above, for additional offshore surveillance.

6.12.3 The MCA recognises the importance of enhancing the UK capability in monitoring maritime activity, therefore, the technology outlined in this section may be requested on grounds of maritime security in addition to the benefits to SAR and navigation safety.

7 Counter pollution and salvage, Unexploded Ordnance (UXO) and wreck materials

7.1 Counter pollution and salvage

7.1.1 Counter Pollution and Salvage (CP&S) operations within and around wind farms and OREDs are likely to be restricted by the physical obstacles that the installations and devices pose to airborne and/or seaborne response craft. Some response operations may not be possible within OREDs.

7.1.2 The duty holder will be required to compile a Marine Pollution Contingency Plan (MPCP) as part of their license conditions, which should be an operational document designed to facilitate the response to a pollution incident. As such, it should be constructed in a manner which enables all users, including external stakeholders, to promptly gather the key information required to identify and implement the most effective response strategy. Guidance on the completion of an MPCP can be found within the OREEF Guideline for the Development of a Marine Pollution Contingency Plan (MPCP) for Offshore Renewables, available at www.oeer.uk.

7.1.3 All pollution incidents to sea from OREIs must be notified to HM Coastguard without delay. Notification to HM Coastguard is to be undertaken as follows:

- Via offshoreenergy.notifications@mcga.gov.uk and the relevant zone address - if the spill is less than 1 metric tonne and is not ongoing

- Via telephone in the first instance, then backed up by email to offshoreenergy.notifications@mcga.gov.uk and the relevant zone address – if the spill is ongoing, is over 1 metric tonne in quantity, is within a sensitive area (e.g. as assessed within the MPCP) or otherwise be of a significant nature (e.g. debris from a turbine fire).

- Spills from vessels will be reported as per the shipboard oil pollution emergency plan (SOPEP).

7.1.4 The duty holder should ensure relevant staff have adequate awareness of environmental response and consider additional training where required. For example, some level of basic familiarity training for offshore personnel to include briefings on not putting waste overboard, who they need to report spills to and what expectations there may be on a response.

7.1.5 More focussed training on elements such as the national contingency plan, fate and behaviour of oil, spill response at varying locations (e.g. at sea, shoreline) and health and safety considerations, may be useful for those more likely to be more directly involved.

7.1.6 The ORED should have tier 1 resources available offshore to respond to small spills, which may include sorbents, which would be over and above that which is carried on vessels as part of their SOPEP.

7.1.7 The ERCoP should include relevant high-level information and contact information relating to an environmental response and reference the MPCP.

7.2 Unexploded Ordnance (UXO)

7.2.1 During construction or other seabed operations it is possible that unexploded ordnance or materials from uncharted wrecks could be located on or near to OREDs, exposed, disturbed or inadvertently lifted from the seabed.

7.2.2 ORED developers should have commercial contractors in place to respond to such occurrences in which case detailed procedures should be developed and circulated to all relevant parties. It would be the responsibility of the developer, through their contractor, for the removal of any UXO.

7.2.3 If commercial contractors are not immediately available, the following procedures should be followed:

- The object should not be moved (or removed if it is lodged in dredging buckets, pipes or conveyor systems, etc). The situation should be immediately reported to HM Coastguard who may alert the relevant military ordnance disposal organisation. All personnel should be evacuated as far as practicable away from the UXO. If there is no perceived threat to life, the ORED developer would be expected to arrange a commercial contractor to respond.

- Where a perceived threat to life exists, a military Explosive Ordnance Disposal (EOD) team may be deployed, and they will take the lead in advising the relevant response to the UXO. If necessary, telephone advice can be given directly from the EOD team either by mobile phone or by radio to telephone link-call through HM Coastguard.

- Further information and advice to mariners on the handling of UXO can be found in UK MGN 323 (M+F)

7.2.4 In all cases, HM Coastguard must be informed of every ordnance discovery as international reports (OSPAR) are required to be completed.

7.3 Wreck materials

7.3.1 Uncharted wrecks, (aircraft or vessels) or materials from wrecks may be located, disturbed or inadvertently lifted from the seabed during subsea operations. All such finds MUST be reported by law to the UK Receiver of Wreck.

7.3.2 Information on reporting wreck or wreck materials can be found at: https://www.gov.uk/government/groups/receiver-of-wreck

7.3.3 The procedures and related information must be included in the ERCoP.

8 Tidal lagoons

8.1.1 Tidal energy lagoons present some SAR response challenges. These primarily affect rescue boat operations within the lagoon / holding pond area and land-based SAR response by Coastguard Rescue Teams and/or other land emergency services. Unless there are tall structures present on the lagoon walls, buildings, etc. then SAR helicopter operations should not, normally, be much affected. The following general emergency response mitigation measures are necessary for tidal lagoons or other tidal energy structures:

a) If the lagoon wall has a road, then turning bays will be required for vehicles to turn around without hazard and passing places along the lagoon wall road.

b) Access across any locks for vehicles.

c) Safety line anchoring/strong points at lock edges to enable rope-rescue of persons from the water if necessary;

d) helicopter landing places/winching areas to allow SAR helicopters to winch people from the ground and smaller Emergency Medical Service helicopters to land to load casualties;

e) No tall lamp or light structures that would affect helicopter operations;

f) Steps down to the water's edge in some locations: wide enough for a stretcher to be carried by people walking alongside a stretcher (approx. 3 metres wide);

g) Working spaces/platforms to allow access from above to the tidal lagoons turbine inlet and outlet areas;

h) Anchor points along the lagoon walls to enable safety lines to be attached (this could be street furniture that is strong enough to achieve this function) to allow safe rope access to persons in the water;

i) Access bollards and gates to allow emergency services to gain access 24 hours;

j) Public safety equipment and signage along the lagoon structure;

k) Location-reference signs to allow the public to report their precise location to the emergency services. This may also be needed during the construction phase to allow workers to do this;

l) Ability to close the barrage to public access in stormy weather conditions and warning lights if required;

m) Storm shelters (with location number information) in case people become cut off by bad weather/rough seas so they can wait for rescue;

n) Emergency phones at some locations along the wall;

o) Slipway access to the lagoon area for launching of trailer-borne rescue boats must be available 24 hours without restriction and allow rescue boats to be launched at any state of the lagoon tide;

p) Holding area for rendezvous of emergency services vehicles – at the entry area of the lagoons.

Appendices

Appendix A – Abbreviations

ACCSEAS	Accessibility for Shipping, Efficiency Advantages and Sustainability
ACO	Aircraft Coordinator
AIS	Automatic Identification System
ANO	Air Navigation Order
CAA	Civil Aviation Authority
CAP	Civil Aviation Authority Publication
CP&S	Counter Pollution and Salvage
CTV	Crew Transfer Vessel
DfT	Department for Transport
DSC	Digital Selective Calling
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ELT	Emergency Locator Transmitters
EOD	Explosives Ordnance Disposal
EPIRB	Emergency Position Indicating Radio Beacon
ERCoP	Emergency Response Cooperation Plan
ERP	Emergency Response Plan
EU	European Union
FM	Frequency Modulated
FMS	Flight Management System
GLA	General Lighthouse Authority
GMDSS	Global Maritime Distress and Safety System
HEX ID	Hexadecimal Identification
HMCG	HM Coastguard
HSE	Health and Safety Executive
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IAMSAR	International Aeronautical and Maritime Search and Rescue
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Conditions
IMO	International Maritime Organization
IR	Infra-Red
JRCC	Joint Rescue Coordination Centre
MAS	Maritime Assistance Services
MCA	Maritime & Coastguard Agency
MGN	Marine Guidance Note
MMSI	Maritime Mobile Service Identity
MOB	Man Overboard
MOD	Ministry of Defense
MPCP	Marine Pollution Contingency Plan
MRCC	Maritime Rescue Coordination Centre
MRSC	Maritime Rescue Sub Centre
NM	Nautical Mile
NVIS	Night Vision Imaging System
OELO	HM Coastguard's Offshore Energy Liaison Officer
OFTO	Offshore Transmission Owner
ORED	Offshore Renewable Energy Development
OREI	Offshore Renewable Energy Installation

OSARM	Offshore Search and Rescue Management
OSC	On scene Coordinator
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo Paris Conventions)
PLB	Personal Locator Beacon
POD	Probability of Detection
QNH	Pressure at sea level
SAR	Search and Rescue
SMC	Search and Rescue Mission Coordinator
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SOV	Service Operations Vessel
SRU	Search and Rescue Unit
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TSS	Traffic Separation Scheme
UK SRR	UK Search and Rescue Region
UKCS	UK Continental Shelf
UXO	Unexploded Ordnance
VAToN	Virtual Aid to Navigation
VHF	Very High Frequency
VTS	Vessel Traffic Services
WGS 84	World Geodetic Society 84
WTG	Wind Turbine Generator

Appendix B – Document Links

CAP 437	https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=523
ERCoP template	https://www.gov.uk/government/publications/offshore-renewable-energy-installations-orei
HSE/MCA Regulatory Expectations for Emergency Response	https://www.hse.gov.uk/offshore/infosheets.htm (Regulatory expectations for emergency response arrangements for the offshore renewable energy industry (PDF))
MCA beacon registry	Maritime safety: weather and navigation: 406 MHz beacons - GOV.UK
MGN 323	https://www.gov.uk/government/publications/mgn-323-explosives-picked-up-at-sea
MGN 372 Amendment 1	https://www.gov.uk/government/publications/mgn-372-amendment-1-mf-guidance-to-mariners-operating-in-vicinity-of-uk-oreis
MGN 654	https://www.gov.uk/government/publications/mgn-654-mf-offshore-renewable-energy-installations-orei-safety-response
Receiver of Wreck	https://www.gov.uk/government/groups/receiver-of-wreck
Under Keel Clearance – Policy Paper	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/373456/Under_Keel_Clearance_paper_May_14_-_FINAL.pdf

Appendix C – SAR checklist

Introduction

The SAR checklist records decisions made regarding the information contained within this document and is in addition to the MGN checklist required separately as part of the application process.

The MCA will not include reference to the SAR checklist within future consent conditions.

However, it should be noted that the condition text shall include reference to taking *"account and, so far as is applicable to that stage of the project, adequately addressed all MCA recommendations as appropriate to the authorised project contained within MGN654 and its annexes", or equivalent*.

The MCA would also expect the completion of the checklist to be listed in the Statement of Common Ground.

Implementation

During pre-consent (or pre-construction if already consented) consultations with developers, the MCA will request a SAR checklist is completed. The SAR checklist is a record of discussions regarding the content of this document and shall be agreed by the developer and MCA on a case-by-case basis.

The content of the SAR checklist is intended to be a live document and will apply throughout the lifecycle of the development. It will be used by the MCA to ensure actions agreed pre-consent and pre-construction, are correctly implemented. The actions will not all be completed when the checklist is agreed.

The list is not exhaustive and the MCA, or developer, may wish to add additional content, or remove unnecessary entries, as required, till the checklist is agreed, other than the dependencies highlighted in 1.6. The developer may choose to enhance the capabilities over and above that which is agreed in the checklist.

If elements are not known at the time of submitting this document (e.g. will apply during operations and maintenance) then the element should remain in the checklist with a note explaining that it will be investigated at the appropriate stage.

The acceptance of a layout may be subject to additional mitigation requests from the MCA. In these circumstances, the additional mitigations shall be agreed and added to the checklist.

The checklist must be agreed as part of the layout acceptance.

Ongoing process

The agreed checklist should be held by the MCA and developer for future reference. The developer should endeavour to update this as actions are completed, or to log progress.

The MCA may periodically ask for an update on the current state of certain elements, particularly as a project moves into the operations phase and it is considered good practice for the developer to provide annual updates on the checklist.

The checklist would be made available to any personnel or teams who would require information on agreed actions and should be used to inform any new personnel.

Notes on completing the checklist

The checklist can be utilised in alternative formats, as long as the version presented to the MCA clearly shows each required element and the actions agreed.

The requirement of each element will be determined on a case-by-case basis on discussion with the relevant developer.

Additional MCA requirements may outline specific topics to discuss with the developer and/or detail specific requirements relevant to that development.

Commitment/requirement will detail what is required from the developer reference that topic and any specific agreements made.

The agreed column shows when the outcome of that topic has been agreed i.e. it could the agreement is not to provide that element. Any topics which are not agreed should be marked accordingly.

Once all topics have been agreed and a date added to the top of the table, the progress notes should be updated by the developer as actions are completed.

Document link

The SAR checklist template has been removed as a link but the document can be found online at https://www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping.

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