Maritime & Coastguard Agency

MARINE GUIDANCE NOTE

MGN 654 (M+F)

Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.

Notice to Other UK Government Departments, Offshore Renewable Energy Developers, Offshore Transmission Owners, Port Authorities, Ship owners, Masters, Ships' Officers, Fishermen and Recreational Sailors.

This notice replaces Marine Guidance Note 543 and should be read in conjunction with the following MCA documents:

- *Marine Guidance Note 372 "Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners operating in the vicinity of UK OREIs", and*
- *"Methodology for Assessing the Marine Navigational Safety Risks & Emergency Response of Offshore Renewable Energy Installations".*

Note: References contained in this document can be accessed via the MCA website at www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping

Other useful websites include:

- www.gov.uk/beis
- www.thecrownestate.co.uk
- www.crownestatescotland.com
- www.legislation.gov.uk
- www.gov.uk/mmo
- www.gov.scot/marine-and-fisheries/
- https://naturalresourceswales.gov.uk
- www.daera-ni.gov.uk
- https://infrastructure.planninginspectorate.gov.uk
- www.un.org/depts/los
- www.kis-orca.eu
- www.iala-aism.org

Summary

This Marine Guidance Note highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response (search and rescue, salvage and towing, and counter pollution) caused by offshore renewable energy installation developments (wind, wave and tidal). It applies to proposals in United Kingdom internal waters, Territorial Sea and Exclusive Economic Zone.

Key Points

- The recommendations in this guidance note should be used, primarily, by OREI developers seeking consent to undertake marine works and in developing post-consent plans and documentation.
- The MGN intends to follow the consenting process and provide guidance at each stage.
- It provides updates in accordance with current practices; and
- The revision includes a reorganisation of the annexes to incorporate existing bespoke documents into the guidance, as follows:
  - **Annex 1**: Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations.
  - **Annex 2**: MCA's shipping template for assessing wind farm boundary distance from shipping routes.
  - **Annex 3**: NOREL paper on under-keel clearance - Guidance to Developers in Assessing Minimum Water Depth over Tidal Devices.
  - **Annex 4**: Hydrography Guidelines for Offshore Renewable Energy Developers.
  - **Annex 5**: Search and Rescue (SAR) and emergency response matters.
  - **Annex 6**: MGN Checklist.

1. Introduction:

1.1 Offshore Renewable Energy Installations (OREI) include offshore wind farms, tidal energy converters (including tidal range devices), wave energy converters and any associated infrastructure with the potential to affect marine navigation and emergency response, proposed in United Kingdom (UK) internal waters, Territorial Sea and Exclusive Economic Zone (EEZ).

1.2 Recommendations in this guidance note should be taken into consideration by all OREI developers seeking formal consent for marine works. Failure by developers to give due regard to these recommendations may result in objections to their proposals on the grounds of navigational safety or emergency response preparedness. Additional information on the process for consenting OREIs and the regulatory framework is available from the Department for Business, Energy & Industrial Strategy (BEIS), Marine Management Organisation (MMO), Natural Resources Wales (NRW), Marine Scotland and Department of the Environment, Agriculture and Rural Affairs (DAERA) [Northern Ireland] websites.

1.3 The considerations and criteria contained in this Marine Guidance Note (MGN) and its annexes are intended to address the navigational and emergency response impacts of OREIs proposed for UK sites. Their development necessitates the establishment of clear guidance to deal with potential adverse effects. The licensing and consent regimes must take account of local factors, national requirements and international standards which could influence the establishment of an OREI.

1.4 This guidance has been developed in consultation with BEIS, the devolved Government authorities for England, Scotland, Wales and Northern Ireland, mariners in the commercial,

military, fisheries and recreational sectors, relevant associations and port authority representatives, the General Lighthouse Authorities (GLA) and emergency response services.

2. Primary and Secondary Legislation with regard to OREIs and Navigation

2.1 The 2020 Energy White Paper sets out the Government's "ambition to have 40GW of offshore wind by 2030, a fourfold increase on today's installed capacity". The Energy Act 2004 (as amended) establishes a regulatory regime for OREIs beyond the Territorial Sea, in the UK's EEZ, and supplements the regime which already applies in the UK's internal and Territorial Sea. Sections 99 and 100 of the Act deal specifically with navigation and introduces a new section, 36B with the title "Duties in relation to navigation" into section 36 of the Electricity Act 1989 (as amended). Under section 36B of the Electricity Act 1989, sub-section (1), consent cannot be granted for an OREI which is likely to interfere with the use of "recognised sea lanes essential to international navigation". This expression directly refers to Article 60(7) of the United Nations Convention on the Law of the Sea, 1982 (UNCLOS) and the position is repeated in Section 2.6.161 of the National Policy Statement for Renewable Energy Infrastructure (EN-3).

2.2 The Merchant Shipping (Safety of Navigation) Regulations 2020 implements the Safety of Life at Sea (SOLAS) Convention Chapter V (Safety of Navigation). This applies to all vessels on all voyages. In some cases, areas of sea may be considered an essential area for navigation and of strategic importance for vessel operation and in accessing ports and harbours. Whilst not an IMO designated routeing measure, these might be an area of sea that is actively used by all vessel types, including large commercial and internationally trading vessels, supply routes, and ferry routes. Therefore, for the purposes of this document "sea lanes" are considered to be IMO-adopted routeing measures and potentially other sea/shipping routes transited by all vessel types[1].

2.3 Section 36B, sub-section (2) of the Electricity Act 1989 (as amended) provides that the decision to grant consent and any conditions placed on a consent must "have regard to the extent and nature of any obstruction of or danger to navigation which (without amounting to interference with the use of such sea lanes) is likely to be caused by the carrying on of the activities, or is likely to result from their having been carried on."

2.4 Shipping is recognised in the Marine Policy Statement 2011, Chapter 3.4, as "an essential and valuable economic activity in the UK" and that "increased competition for marine resources may affect the sea space available for the safe navigation of ships. Marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety and ensure that their decisions are in compliance with international maritime law". In addition, both the Marine and Coastal Access Act 2009, Part 4, Section 69, sub-section (1)(c) and the Marine (Scotland) Act 2010, Part 4, Section 27, sub-section (1)(a)(iii), provide for marine licence decisions to "have regard to the need to prevent interference with legitimate uses of the sea".

2.5 The MCA (through UK Technical Services Navigation) is a statutory consultee within the planning process for development consent and a primary advisor to the licensing authorities for issuing marine licences. The MCA provides advice and guidance to developers and other Government departments throughout the lifetime of an OREI on matters concerning navigational safety and emergency response.

[1] Table 10 of the Methodology document provides a list of example vessel types involved in navigation activities.

3. How and When the Recommendations Should be Used

3.1 This MGN is intended for the guidance of developers and others. Failure to accept the principles of the guidance may result in delays or objections from stakeholders within the licensing and consenting process. The recommendations should be taken into account by OREI developers and their contracted environmental and risk assessors in the preparation of Scoping Reports (SR), Navigational Risk Assessments (NRA) and resulting EIA Reports, and in any required post-consent documents.

3.2 The recommendations should be used to evaluate all navigational possibilities, which could be reasonably foreseeable, by which the siting, construction, extension, operation and de-commissioning of an OREI could cause or contribute to an obstruction of, or danger to, navigation or emergency response. They should also be used to assess possible changes to traffic patterns and the most favourable options to be adopted, including those of operational site monitoring.

3.3 In terms of navigational priority, these recommendations do not encourage a differentiation to be made between any types of seagoing watercraft, operations, or mariners.

3.4 It is recognised that all OREI projects are at varying stages of planning and development, both pre-consent and post-consent, therefore proposals on meeting the principles of this guidance for undertaking marine works will be assessed on a 'case by case' basis.

3.5 The recommendations contained therein apply to all sites, whether within the jurisdiction of port/harbour limits or in open sea areas. However, port/harbour authorities may require developers to comply with their own specific criteria and/or local regulations and directions. In addition, where proposals within port/harbour limits could affect navigation or emergency planning or response, the port/harbour authority will be under an obligation to review its safety management system following the issue of consent to the developer, in accordance with the Port Marine Safety Code. Evaluating the impact of OREI schemes on existing port/harbour activities should be carried out in consultation with the relevant port/harbour authority and the wider port community. Such reviews should be undertaken by the developer as part of the Environmental Impact Assessment and the outcome addressed in the resulting EIA Report.

3.6 OREI developers should evaluate the impacts of their projects and comply with the recommendations during all phases of:

(1) planning;
(2) construction;
(3) operation; and,
(4) decommissioning.

4. Planning Stage – Prior to Consent

4.1 Early engagement with MCA and relevant navigational stakeholders e.g. during the scoping stage, is key for early identification of potential areas of concern that may require close attention. Developers are required to produce a NRA in the planning stage as part of their application for development consent. The MCA's *"Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)"* (hereafter known as the 'Methodology document') provides guidance for producing an NRA, including a template. It is based on IMO Formal Safety Assessment

and the latest version is available on the MCA's website. Any substantial changes to the project that impacts on shipping and navigation may require relevant NRA updates.

4.2 Potential navigational or communications impacts or difficulties caused to mariners or emergency response services, using the site area and its environs, should be assessed. Assessments should be made of the consequences of ships deviating from normal routes to avoid proposed sites, including smaller vessels e.g. domestic, coasters, recreational or fishing vessels, entering shipping routes with larger vessels. Special regard should be given to evaluating situations which could lead to safety of navigation being compromised e.g. an increase in 'end-on' or 'crossing' encounters, reduction in sea-room or water depth for manoeuvring, leading to choke points, etc.

4.3 Issues that could contribute to a marine casualty leading to injury, death or loss of property, either at sea or amongst the population ashore, or damage to the marine environment, should be highlighted as well as those affecting emergency response. Consultation with national search and rescue authorities should be initiated as early as possible and consideration given to the types of aircraft, vessels and equipment which might be used in emergencies. This should include the possible use of OREI structures as emergency refuges and any matters that might affect emergency response within or close to the OREI.

4.4 An MGN checklist is available on the MCA website as an aid for developers when completing and submitting their NRA to ensure all guidance has been considered and addressed.

4.5 Developers are responsible for ensuring that formally agreed co-ordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (ETRS89) datum.

4.6 NRA – Traffic Survey[2]

a. An up to date, traffic survey of the proposed development area concerned should be undertaken within 12 months prior to submission of the EIA Report. This should include all the vessel and craft types found in the area and total at least 28 days duration but also take account of seasonal variations and peak times in traffic patterns and fishing operations. AIS data alone will not constitute an appropriate traffic survey; radar, manual observations, other data sources (e.g. for fishing and recreation) and stakeholder consultation will ensure those vessels that are not required to carry and operate AIS are included, and it provides an appropriate representation of the base line marine traffic.

b. However, to cover seasonal variations, peak times or perceived future traffic trends, the survey period may be extended to a maximum of 24 months. For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period. Should there be a break in the continuation surveys, a new full traffic survey may be required and the time period starts from the completion of the initial 28 day survey period.

[2] See Methodology document Annex B.

c. In the event of location specific issues being identified by the existing traffic survey and/or through consultation, additional surveys beyond the minimum outlined above may be required in order to support assessment of such issues.

d. These variations should be justified in consultation with the relevant GLA, UK Chamber of Shipping, representative recreational (e.g. RYA) and fishing vessel organisations and, where appropriate, port/harbour and navigation authorities. While recognising that site-specific factors need to be taken into consideration any such survey should include but may not be limited to an assessment of the cumulative and individual effects of the following:

i. Proposed OREI site relative to areas used by any type of marine craft.

ii. Numbers, types and sizes of vessels presently using such areas.

iii. Non-transit uses of the areas, e.g. fishing, day cruising by leisure craft, commercial passenger vessels undertaking visits to the OREI, racing, aggregate dredging, personal watercraft etc.

iv. Whether these areas contain shipping routes used by coastal, deep-draught or international scheduled vessels on passage.

v. Alignment and proximity of the site relative to adjacent shipping routes.

vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.

vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.

viii. Whether the site lies within the limits of jurisdiction of a port and/or navigation authority.

ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.

x. Proximity of the site to offshore firing/bombing ranges or ordnance dumping grounds and areas used for any marine military purposes either presently or in the past.

xi. Proximity of the site to existing or proposed submarine cables and pipelines, offshore oil / gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites. This should include projects in the planning process, in addition to those consented.

xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.

xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil.

xiv. Proximity of the site to any types of aids to navigation and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon.

xv. Researched opinion using appropriate computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of ‘choke points’ in areas

of high traffic density and nearby planned or consented OREI sites not yet constructed.

xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.

xvii. Proximity of the site to areas used for recreation which depend on specific features of the area

e. Developers are advised to discuss their traffic survey proposals prior to making any commitments in carrying out the survey – see Section 3 of the Methodology document for further information on scope and depth of assessment.

d. A review of the Navigational Risk Assessment should be carried out post-consent and prior to construction commencing to validate the EIA Report. This may include additional traffic survey data or if there are any changes to plans that could impact navigation e.g. construction methodology.

4.7 NRA – Predicted Effect of OREI on traffic and Interactive Boundaries

a. In late 2004 the Greater Wash wind farm developers group sought guidance from the Maritime and Coastguard Agency on the inter-relationship of wind farms to shipping routes so that they could take early recognition of the factors involved when planning a turbine layout within their allocated water space. The template in Annex 2 is the result.

b. The template combines the simulated radar reception results of the North Hoyle electromagnetic trials with published ship domain theory to better interpret the inter-relationship of marine wind farms and shipping routes. The resultant template also informs the assessments made as part of the consenting process.

c. There may be opportunities for the interactive boundaries to be flexible where, again, for example, vessels may be able to distance themselves from turbines to provide more comfort without significant penalty, or where turbines could be distanced from shipping nodal points. Domains have been derived from a statistical study of ship domains based on radar simulator performance, and traffic surveys in the North Sea, but it is recognised that larger, high speed, hazardous cargo and passenger carrying vessels may have larger domains.

d. Traffic surveys would also establish any route traffic bias where mariners may naturally turn to starboard to facilitate passing encounters in accordance with the IMO International Regulations for Preventing Collisions at Sea, 1972 (COLREG). Additionally, marine traffic surveys would identify vessel type or category which may consequently require larger domains to ensure that the following factors can be taken into consideration in determining corridor widths:

i. Compliance with the best practices of seamanship and principles to be observed in keeping a navigational watch including the composition of the watch,

ii. The manoeuvrability of vessels with special reference to stopping distance and turning ability in the prevailing conditions,

iii. Provisions that may be required with mechanical failure of vessels involved and level of support services,

iv. The state of visibility, wind, sea and tidal stream, and the proximity of navigational hazards,

v. The traffic density including concentrations of fishing vessels or any other vessels,

vi. The draught in relation to the available depth of water and the existence of submarine cables and obstructions,

vii. The effect on radar detection of the sea state, weather and other OREI sources of interference.

e. In the approaches to ports and harbours this is particularly relevant. This additional information would influence where boundaries need to be established.

f. When larger developments provide corridors between sites to allow safe passage of shipping a detailed assessment will be required to establish the minimum width of the corridor. The assessment of the required sea room (corridor width) will be undertaken on a case-by-case basis and should take into account not only the requirements of the traffic survey but also the general location, sea area involved and nearby structures and installations. It will not always be possible to make a course that is planned, and experience shows that in heavy sea conditions it is much harder to stop or turn the vessel around. Deviations from track by as much as 20°, or more, are common and must be considered. This deviation is used as the baseline for calculating corridor widths contained in the windfarm shipping route template.

Clearly, marine traffic survey information is required to inform such boundaries. Where turbines appear along both sides of a shipping corridor, the width requirement will be proportional to corridor length, based on a 20-degree course deviation.

g. The following factors should be applied when considering the width of a shipping corridor through an array, between two turbine arrays or between an array and shore and how far turbines should be from an established shipping route. The assessment of the required sea room must take into account the general location and sea area involved. The bridge awareness, availability of engines for immediate manoeuvre and readiness to use anchors will all vary when the vessel is on a general sea passage, as opposed to in areas of recognised constrained operation, for example port approaches and rivers.

i. Size, manoeuvring characteristics and volume of the vessels expected to transit the proposed lanes.

(1) Standard turning circles for vessels are worked on six times the ship's length. This is a particularly good assumption when vessels on ocean or deep-sea passage will not have the same manoeuvrability as when engines and systems are prepared for port approach.

(2) Requirements for stopping in an emergency must be considered, for example following a steering gear failure a crash stop, the quickest way to stop a vessel's movement, for a large tanker may still be up to 3km.

(3) The Netherlands made an assessment of sea room requirements using data supported by the PIANC assessment for channel design and the PIANC *Interaction Between Offshore Wind Farms and Maritime Navigation* (2018) report. In general, they strive for an obstacle free, or buffer, zone of 2nm between wind farms and shipping routes.

(4) The possibility of ships overtaking cannot be excluded and should be taken into consideration. Consequently, the assumption should be that four ships should safely be able to pass each other.

(5) Between overtaking and meeting vessels, a distance of two ship's lengths is normally maintained as a minimum passing distance. This is based on the experience gained from ships' masters and deep-sea pilots operating in the North Sea and has been verified by simulation trials carried out in the Netherlands (based on 400m length vessels).

ii. Provisions for possible mechanical failure of transiting vessels, bearing in mind the availability of support services.

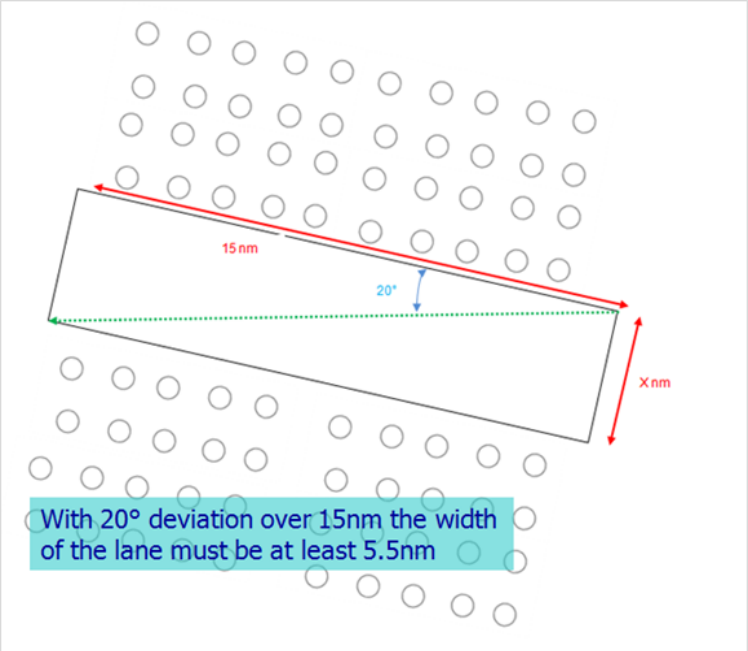
(1) Engine failure whilst using a transit lane might necessitate emergency or unplanned anchoring, restricting available sea room for other vessels.

(2) Dependant on depth of water the swinging circle of very large vessels, when anchored, must be calculated to assess the sea room required.

iii. Constraints of weather, sea and tidal conditions that may be expected in the location.

(1) Unlike inshore and estuary areas, when on passage in exposed sea areas, for example offshore in the North Sea, it will not always be possible to make good a planned course. Experience also shows that in heavy sea conditions it is much harder to turn the vessel around and may not be possible to achieve a dead stop and deviations from track are common. Therefore 20° or more, are common (as determined from the traffic assessment of the NRA) and must be considered in developing corridors through OREIs.

(2) For example:



(3) In tidal areas, the navigable width of a channel or route, for example, between an OREI and the shore, may be significantly reduced at low water.

iv. Other traffic, for example concentrations of fishing vessels, that will affect available sea-room to manoeuvre.

(1) Concentrations of fishing vessels, or leisure traffic, will create requirements for manoeuvre and course alteration by other through traffic and also restrict sea room in the shipping lane. The risk of further vessel to vessel conflict will be consequently increased.

(2) Displacing a group of traffic into space utilised by other users where available sea room is already confined, must be considered. For example, where leisure traffic is forced to use the same sea space as much larger and faster commercial vessels.

v. Existence of submarine cables and obstructions. The existence of submarine cables or other seabed obstructions may affect the ability of a vessel to anchor safely away from other traffic and this may be another consideration when assessing sea room requirements.

vi. Radar interference. Dependant on the proximity to wind turbine towers, and the location of radar scanners aboard the vessel, some vessels may experience degradation of the radar display by false echoes. It may be possible that this will reduce the ability of the bridge team to identify other vessels, including crossing vessels at the extremities of the lanes, which may require avoiding action. It is common to find that the radar instrumentation is then often adjusted to reduce the unwanted interference which can have the effect of reducing actual target acquisition.

h. IMO Routeing Measures. In some circumstances it may be requested, or necessary, to introduce, extend, expand or remove an IMO routeing measure as a result of an OREI. In this instance a proposal must be submitted in discussion with the MCA for consideration by the UK Safety of Navigation (UKSON) committee and subsequent recommendation to and approval by the IMO.

4.8 NRA - OREI Structures

a. It should be determined whether any features of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling, could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response. Such dangers would include air clearances of wind turbine blades above the sea surface, changes to charted depth due to tidal turbines, the burial depth of cabling, lateral movement of floating wind or tidal turbines etc.

b. Recommended minimum safe (air) clearances between sea level conditions at mean high water springs (MHWS) and rotor blades on fixed foundation wind turbines, or auxiliary platforms, stipulate that they should be suitable for the vessels types identified in the traffic survey but not less than 22 metres, unless developers are able to offer evidence that risks to any vessel type with air drafts greater than the requested minimum air drafts being provided are minimised. Depths, clearances and similar features of other OREI types which might affect marine safety should be determined on a case-by-case basis, for example, floating foundation wind turbines must allow for the degrees of motion (pitch, roll, yaw, heave, surge and sway), as appropriate.

c. There is no standard clearance figure that can be used to establish the safe clearance over underwater turbine devices. Rather, developers will need to demonstrate an evidence based, case-by-case approach which will include dynamic draught modelling in relation to

charted water depth to ascertain the safe clearance over a device. The following approach should be adopted:

i. To establish a minimum clearance depth over devices, the developer needs to identify from the traffic survey and data sources the deepest draught of observed traffic. This will then require modelling to assess impacts of all external dynamic influences giving a calculated figure for dynamic draught. A 30% factor of safety for under keel clearance (UKC) should then be applied to the dynamic draught, giving an overall calculated safe clearance depth to be used in calculations.

ii. The Charted Depth reduced by safe clearance depth gives a maximum height above seabed available from which turbine design height including any design clearance requirements can be established.

iii. The MCA's "Under Keel Clearance Policy" paper (see Annex 3) should be closely followed throughout the Environmental Impact Assessment.

d. It should also be determined whether:

i. The structures could block or hinder the view of other vessels under way on any route.

ii. The structures could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc.

In both cases, the impact must form part of the risk assessment.

4.9 NRA – Tides, Tidal Streams and Weather

It should be determined whether:

a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.

b. The set and rate of the tidal stream, at any state of the tide, has a significant effect the handling of vessels in the area of the OREI site.

c. The maximum rate tidal stream runs parallel to the major axis of the proposed OREI site layout, and if so, its effect on vessel handling and manoeuvring.

d. The set is across the major axis of the OREI layout at any time, and, if so, at what rate.

e. In general, whether engine and/or steering failure, or other circumstance could cause vessels to be set into danger by the tidal stream. This should include unpowered vessels and small low speed craft.

f. The structures themselves could cause changes in the set and rate of the tidal stream.

g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the OREI area or adjacent to the area.

h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to all vessels that might pass through or in close proximity to it.

i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.

j. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.

4.10 NRA – Access to and Navigation Within, or Close to, an OREI

It should be determined to what extent navigation would be feasible within or near to the OREI site itself by assessing whether:

a. Navigation within and /or near the site would be safe:

i. for all vessels, or
ii. for specified vessel types, operations and/or sizes.
iii. in all directions or areas, or
iv. in specified directions or areas.
v. in specified tidal, weather or other conditions.

b. Navigation in and/or near the site should be prohibited or restricted:

i. for specified vessels types, operations and/or sizes,
ii. in respect of specific activities,
iii. in all areas or directions, or
iv. in specified areas or directions, or
v. in specified tidal or weather conditions, or simply
vi. recommended to be avoided.

c. Where it is not feasible for vessels to access or navigate through the site, it could cause navigational safety, emergency response or routeing problems for vessels operating in the area, e.g. by causing a vessel or vessels to follow a less than optimum route or preventing vessels from responding to calls for assistance from persons in distress (as per SOLAS obligations).

d. Guidance on the calculation of safe distances of wind farm boundaries from shipping routes can be found in Annex 2 “MCA Template for assessing distances between wind farm boundaries and shipping routes”. Advice on the safe distances of other OREI developments from shipping routes may be obtained from MCA’s Navigation Safety Branch.

4.11 NRA - Search & Rescue, Maritime Assistance Service, Counter Pollution and Salvage Incident Response

a. The MCA, through HM Coastguard, is required to provide a Search and Rescue (SAR) and emergency response service within the sea area occupied by all offshore renewable energy installations in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.

b. A preliminary assessment on the potential impacts to SAR and emergency response with the introduction of the OREI must be carried out and included as a chapter in the NRA. Further information can be found in Chapter 3 of the Methodology document. Information on post-consent requirements can be found in section 6.8 of this MGN.

4.12 NRA - Hydrography

a. In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are required of the development at the pre-consent stage:

   i. The site of the generating assets area shall be undertaken as part of the licence and/or consent application.
   ii. All proposed cable route(s).

b. The development may result in an alteration to maritime traffic patterns as vessels seek alternative passage around the installed generating assets area. Where this is the case, it may be considered necessary that a hydrographic survey of these alternate passages and their immediate environs extending to 500m be undertaken. MCA can provide guidance here if required.

d. All hydrographic surveys listed above should fulfil the requirements of the MCA's 'Hydrography Guidelines for Offshore Developers' in Annex 4.

e. Further hydrographic surveys are required during the post-consent and decommissioning stages (see sections 6.8 and 7 below).

4.13 NRA - Communications, Radar and Positioning Systems

To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:

a. The structures could produce radio frequency interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation and timing (PNT) or communications including Global Maritime Distress Safety System (GMDSS) and Automatic Identification Systems (AIS), whether ship borne, ashore or fitted to any of the proposed structures. Consideration should be given to three scenarios:

   i. Vessels operating at a safe navigational distance (see Annex 2),
   ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g. support vessels, survey vessels, SAR assets.
   iii. Vessels by the nature of their work necessarily operating within the OREI.

   Note: *GMDSS frequencies may not be subject to harmful interference, but for other frequencies, cases (ii) and (iii) may rely on agreed special measures where necessary.*

b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects, amongst others:

   i. Vessel to/from shore;
   ii. Vessel to vessel
   iii. VTS radar to/from vessel;
   iv. Anomalous radar beacon (Racon) reception by vessel; and,
   v. Search and Rescue and maritime surveillance aircraft to/from vessels and/or OREI structures

c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.

d. The site might produce acoustic noise which could mask prescribed sound signals.

e. The generators and the seabed cabling within the site and onshore might produce electromagnetic fields affecting compasses and other navigation systems.

4.14 NRA – Assessment of Risk[3]

a. The above NRA data and evidence gathering will feed into understanding the base case densities and types of traffic and estimating the level of baseline risks without the OREI in place and inherent risks associated with the introduction of the OREI. The Methodology document requires a hazard log to be developed listing the hazards caused or changed by the OREI and the predicted baseline and inherent risks associated with each hazard. The hazard log must also include residual risks to show the tolerability level of risk after risk mitigation measures have been implemented to reduce them to As Low as Reasonably Practicable (ALARP)[4].

4.15 NRA - Risk Mitigation[5]

a. 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 Navigation Safety Branch and will be listed in the developer's EIA Report. These will be consistent with international standards contained in, for example, the Safety of Life at Sea Convention, 1974 (SOLAS) - Chapter V, IMO Resolutions A.572 (14) and Resolution A.671 (16) and could include any or all of the following:

   i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information (MSI) dissemination methods.

   ii. Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC).

   iii. Safety zones of appropriate configuration, extent and application to specified vessels.

   iv. Designation of the site as an area to be avoided (ATBA).

   v. Provision of Aids to Navigation as determined by the General Lighthouse Authority.

   vi. Implementation of routeing measures within or near to the development.

   vii. Monitoring by radar, AIS, closed circuit television (CCTV) or other agreed means.

   viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones or ATBA.

   ix. Creation of an Emergency Response Cooperation Plan with the MCA's Search and Rescue Branch for the construction phase onwards.

---

[3] See Methodology document Annex C and D.

[4] Descriptions of ALARP can be found in:
a) Health and Safety Executive (2001) 'Reducing Risks, Protecting People'
b) IMO (2018) MSC-MEPC.2/Circ.12/Rev.2 dated 9 April 2018, 'Revised Guidelines for Formal Safety Assessment (FSA) in the IMO Rule-Making Process'

[5] See Methodology document Annex E and G.

x. Use of guard vessels where appropriate.

xi. Update NRAs every two years e.g. at testing sites.

xii. Device-specific or array-specific NRAs.

xiii. Design of OREI structures to minimise risk to contacting vessels or craft.

xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.

b. The mention of the IMO/UNCLOS safety zones limited to 500 metres does not imply a direct parallel to be applied to OREIs. Section 95 of the Energy Act 2004 provides for the decision to grant safety zones around renewable energy installations. The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 (SI 2007 No. 1948) provides the regulatory framework for establishing safety zones to OREIs in the UK. It allows for 500m safety zones around wind turbines during construction, extension, major maintenance or decommissioning and 50m safety zones during operation. If developers wish to submit an application to either BEIS or the appropriate marine licensing authority where applicable, it must be accompanied with safety case and supporting evidence showing justification for the safety zone(s) and how it will be managed. The decision whether the safety zone(s) is granted will be made following a consultation with relevant stakeholders. For further guidance, please see DECC's document titled "Applying for Safety Zones Around Offshore Renewable Energy Installations".

5. Development Consent

5.1 The MCA will expect all appropriate aspects of this MGN and the Methodology document to be considered and adequately addressed through the MGN Checklist and submitted as part of the consent application. Any aspects missing or inadequately addressed to the satisfaction of MCA may result in delays or objection to an application.

5.2 In order to make an application, developers should aim to get agreement from all relevant navigation stakeholders for ensuring risks are assessed as ALARP and that risk mitigation measures are agreed.

6. Post-consent – construction and operation phases

6.1 In the UK all vessels have freedom to transit through OREIs, subject to any applied safety zones, and their own risk assessments, which should take account of factors such as vessel size, manoeuvrability, environmental factors and competency of the Master and crew. MGN 372 (or subsequent update) provides further guidance on navigation in and around OREIs.

6.2 Layout Design

a. MCA has statutory obligations to provide Search and Rescue (SAR) services in and around OREIs in UK waters, using both SAR helicopters and emergency response vessels. The MCA also has responsibilities to ensure the safety of navigation is maintained and to address the risks to mariners who may wish to transit an offshore renewable development or find themselves in the vicinity of a development in an emerging situation or in adverse weather conditions.

b. Turbine layouts of every offshore renewable energy project with floating and/or surface piercing devices and structures must be designed to allow safe transit through OREIs by SAR helicopters operating at low altitude in bad weather, and those vessels (including rescue craft) that decide to, or must, transit through them. Multiple lines of orientation provide alternative options for passage planning and for vessels and aircraft to counter the environmental effects on manoeuvring i.e. sea state, tides, currents, weather, and visibility. OREI structures (turbines, substations, platforms, and any other structure within the OREI site) that are aligned in straight rows and columns are considered the safest layout arrangement by UK navigation stakeholders and the MCA contracted SAR helicopter pilots. Developers should therefore carry out a further site-specific assessment, which builds on previous assessments, to identify the proposed locations of individual structures.

c. In compliance with safety of navigation and search and rescue requirements in the UK, developers of every offshore renewable energy project with floating and/or surface piercing devices should undertake a thorough appraisal of the safety benefits afforded by two consistent lines of orientation and, based on this, either implement such layouts or, where appropriate, consider alternatives. The MCA will not consider any layout proposals with just one line of orientation, without supporting documentation which fully justifies the proposed layout to the satisfaction of MCA. A layout with zero lines of orientation will not be acceptable to the MCA.

d. The layout assessment 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 assessment should consider the potential impacts the proposed locations may have on navigation and SAR activities. Where a project proposed one line of orientation, this should be discussed with MCA and a safety justification must be prepared to support this reduction and submitted to the MCA for consideration.

e. The safety justification should build on work conducted as part of the Navigation Risk Assessment and the mitigations identified as part of that process. It should include a risk comparison between one and two (or more) lines of orientation, the reasons why two lines is not proposed and present sufficient information to enable the MCA to adequately understand how the risks to navigation and SAR associated with the proposed layout have been reduced to ALARP.

f. Liaison with the MCA is encouraged as early as possible following the outcome of the site-specific layout assessment, and to discuss any potential improvements which can be made to the proposed layout, where considered necessary. Where a project proposes just one line of orientation, this discussion should include any potential secondary lines, and additional risk mitigation measures that may be required as a result.

g. Micrositing should be carried out in such a way which has the least impact on the overall layout within agreed distances. Any requirement to locate structures beyond agreed distances should be discussed with MCA on a case-by-case basis.

h. Where multiple OREI sites have adjacent boundaries less than 1nm apart, including extensions to existing sites, due consideration must be given to the requirement for lines of orientation that allow a continuous passage for vessels and/or SAR helicopters through both sites, whilst still maintaining plans for at least two lines of orientation as appropriate to the site-specific nature of that site. Adjacent sites, as used in this section, will be assessed on a case-by-case basis.

i. Each layout design will be assessed on a case-by-case basis and once agreed formal acceptance will be provided collectively by both MCA's Technical Services Navigation and HM Coastguard.

6.3 Marine Navigational Marking

It should be determined:

a. How the overall site would be marked by day and by night throughout construction, operation and decommissioning phases, taking into account that there may be an ongoing requirement for marking on completion of decommissioning, depending on individual circumstances. Aids to Navigation (AtoN) will be determined (and sanctioned) by the relevant General Lighthouse Authority (GLA) (Trinity House, Northern Lighthouse Board or Commissioners of Irish Lights).

b. How individual structures and fittings on the perimeter of and within the site, both above and below the sea surface, would be marked by day and by night.

c. If the specific OREI structure would be inherently radar conspicuous from all seaward directions (and for SAR and maritime surveillance aviation purposes) or would require special radar reflectors or target enhancers.

d. If the site would be marked by additional electronic means e.g. Racons.

e. If the site would be marked by an Automatic Identification System (AIS) transceiver, and if so, the data it would transmit.

f. If the site would be fitted with audible hazard warning in accordance with IALA recommendations.

g. If the structure(s) would be fitted with aviation lighting, and, if so, how these would be screened from mariners or guarded against potential confusion with other surface navigational marks and lights (see Annex 5).

h. The proposed site and/or its individual generators must comply in general with markings for such structures, as required by the relevant GLA in consideration of IALA guidelines and recommendations. There is an expectation that working lights and the ID lighting will not interfere with Aids to Navigation or create confusion for the Mariner navigating in or near the OREI.

i. The Aids to Navigation specified by the GLAs are being maintained such that the 'availability criteria', as laid down and applied by the GLAs, is met at all times. Separate detailed guidance is available from the GLAs on this matter.

j. The procedures that need to be put in place to respond to casualties to the aids to navigation specified by the GLAs, within the timescales laid down and specified by the GLAs.

6.4 Identification Marking

a. Individual ID markings should conform to a "spreadsheet" format, e.g. lettered on the horizontal axis, and numbered on the vertical axis. The ID marking should be sequential, aligned with 'SAR lanes' (line of orientation for search and rescue purposes) and begin with the OREI name designator code, then the row/column numbering starting with the letter 'A' and then the turbine number. To avoid confusion, the letters 'O' and 'I' should not be used to avoid confusion with the numbers 0 and 1. The detail of this will depend on the shape,

geographical orientation and potential future expansion of each OREI development. The ID marking must be discussed with the MCA who will advise on any specific requirements for each development, taking into account any difference between internal and periphery turbine alignment.

b. The ID marking of substations should be considered in line with the above and there should be a clear differentiation between the substation and the turbine.

c. ID numbers must be clearly readable by an observer stationed three metres above sea level at a distance of at least 150 metres from the turbine. 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.

6.5 Mooring Arrangements

a. Floating devices, including those suspended in the water column, must have suitable mooring arrangements for the environmental conditions to ensure the device(s) remains on station and does not become a navigation hazard through failure of its moorings. The Health and Safety Executive (HSE) and MCA have developed a combined guidance document that should be followed: *Regulatory expectations on moorings for floating wind and marine devices.* This is available from the MCA website and provides information on:

i. Safety Management Systems
ii. Design
iii. Hardware
iv. Installation
v. Operation
vi. Monitoring
vii. Third Party Verification

b. MCA will expect evidence of compliance with the *Regulatory expectations on moorings for floating wind and marine devices* demonstrated through the report and third-party verification.

6.6 Traffic Monitoring

a. There is a requirement for OREI operators to monitor and review the impact their activities have on the safety of navigation during the construction and operation phases.

b. The main purpose of vessel traffic monitoring is to be able to ensure the Navigation Risk Assessment (NRA) for the project is accurate for the construction and operation phase; that the predictions made in the NRA with regards to the traffic patterns are accurate, and to ensure the mitigation measures are effective and remain fit for purpose.

c. This should be carried out using AIS data and where practical, feedback should also be sought from commercial Masters, fishing vessel skippers, work boat crews and recreational sailors/users who regularly operate in and around different OREI sites to get realistic information on their experiences in different conditions.

d. The MCA would expect the opportunity to discuss any changes identified as part of this monitoring, since the submission of the NRA.

6.7 Cable Burial and Protection

a. It should be determined at what depth below the seafloor export cables are buried to ensure there are no changes to charted depths. If burial is not possible, for example due to underwater features and/or seabed ground conditions export cables should be suitably protected (e.g. by rocks or other such suitable mattress placements) to mitigate the risks to vessels. Any consented cable protection works must ensure existing and future safe navigation is not compromised. Consequently, the MCA would be willing to accept up to 5% reduction in surrounding charted depths referenced to Chart Datum, unless developers are able to demonstrate that any identified risks to any vessel type are satisfactorily mitigated.

b. Under no circumstances should depth reductions compromise safe navigation. Therefore, consideration should be given to areas of critical depths in relation to under keel clearance where any reduction in depth will increase risk to safe navigation, such as in IMO routeing measures, mobile seabed, approaches to ports etc, and developers must discuss the tolerability of any changes to depths with MCA.

6.8 Hydrography

a. In order to confirm the seabed has been returned as close to its original profile and to identify underwater hazards, namely exposed cables and any protection measures, detailed and accurate hydrographic surveys are required of the cable route(s) in the post-construction phase. This should be carried out in accordance with the guidelines in Annex 4.

6.9 Search and Rescue Requirements

a. As part of the post consent requirements, developers must address the requirements and guidance of the *Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue (SAR) and Emergency Response* – Annex 5.

b. Based on lessons learned from OREI developments, the MCA has provided a SAR checklist for developers to record decisions made regarding the information contained in this document. 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.

c. This SAR checklist is available to download from the MCA website and developers are expected to complete it as part of meeting their marine licence condition requirements. This is in addition to the MGN checklist required separately as part of the development consent process.

d. An agreed Hub Emergency Response Cooperation Plan (ERCoP) must be in place prior to construction commencing and a template, which includes guidance for completion, is available to download from the MCA website. The ERCoP must be updated or replaced with a new version for the operational phase of the OREI.

e. The offshore renewable energy industry is advancing and evolving, and requirements and guidance may therefore have to change in light of experience and lessons learned from emergencies and SAR incidents.

7. Decommissioning

7.1 The requirements for decommissioning offshore renewable energy installations are derived from the Energy Act 2004, Sections 105 to 114 and further guidance can be found in the BEIS publication *Decommissioning of offshore renewable energy installations under the Energy Act 2004* published in March 2019 and Marine Scotland's publication *Offshore Renewable Energy: decommissioning guidance* published in November 2019.

7.2 To minimise risks to mariners and SAR Operations there is an expectation that all infrastructure above the seabed and the sea surface will be removed. In the time between when the installation ceases to be operational and its removal, appropriate mitigation measures as per section 4.15 must be applied.

7.3 An agreed and updated ERCoP must be in place prior to the removal of any offshore infrastructure.

7.3 In order to confirm the seabed has been returned as close to its original profile once all, or some, of the infrastructure has been removed as required, a hydrographic survey is required of the cable route(s) and the installed generating assets area in accordance with the guidelines in Annex 4.

8. New and Emerging Technologies

8.1 It is recognised that the OREI industry is constantly evolving and its associated technology and procedures are developing. This means that there is an increasing demand on the UK's territorial seas and the EEZ and the MCA wishes to ensure that the increased use of those resources is managed in such a way that any risks that might impact on safety and pollution of the marine environment is kept to as low as is reasonably practicable.

8.2 The MCA continues to work with other regulators, navigation stakeholders and developers in achieving this goal. Regular meetings are held under the auspices of the Nautical and Offshore Renewable Liaison Group (NOREL) at which technical and consenting issues are discussed, and if necessary, referred to the Technical Working Group. Agreed recommendations and guidance is periodically agreed by NOREL and the MCA reserves the right to vary or modify the recommendations in this document based on experience or in accordance with internationally recognised standards in the interest of safety of life at sea and protection of the marine environment.

More Information

UK Technical Services Navigation
Maritime and Coastguard Agency
Bay 2/20
Spring Place
105 Commercial Road
Southampton
SO15 1EG

Tel: +44 (0) 20 3817 2554
e-mail: navigationsafety@mcga.gov.uk

General Inquiries: infoline@mcga.gov.uk

MCA Website Address: https://www.gov.uk/mca

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Annex 1

Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)

The MCA's "Methodology" document provides the recommended risk assessment methodology to use when preparing a Navigation Risk Assessment (NRA) for an OREI as part of the Shipping & Navigation chapter of a development consent application. It is based on the International Maritime Organization's Formal Safety Assessment guidelines and its principles can be applied to all OREIs of all sizes.

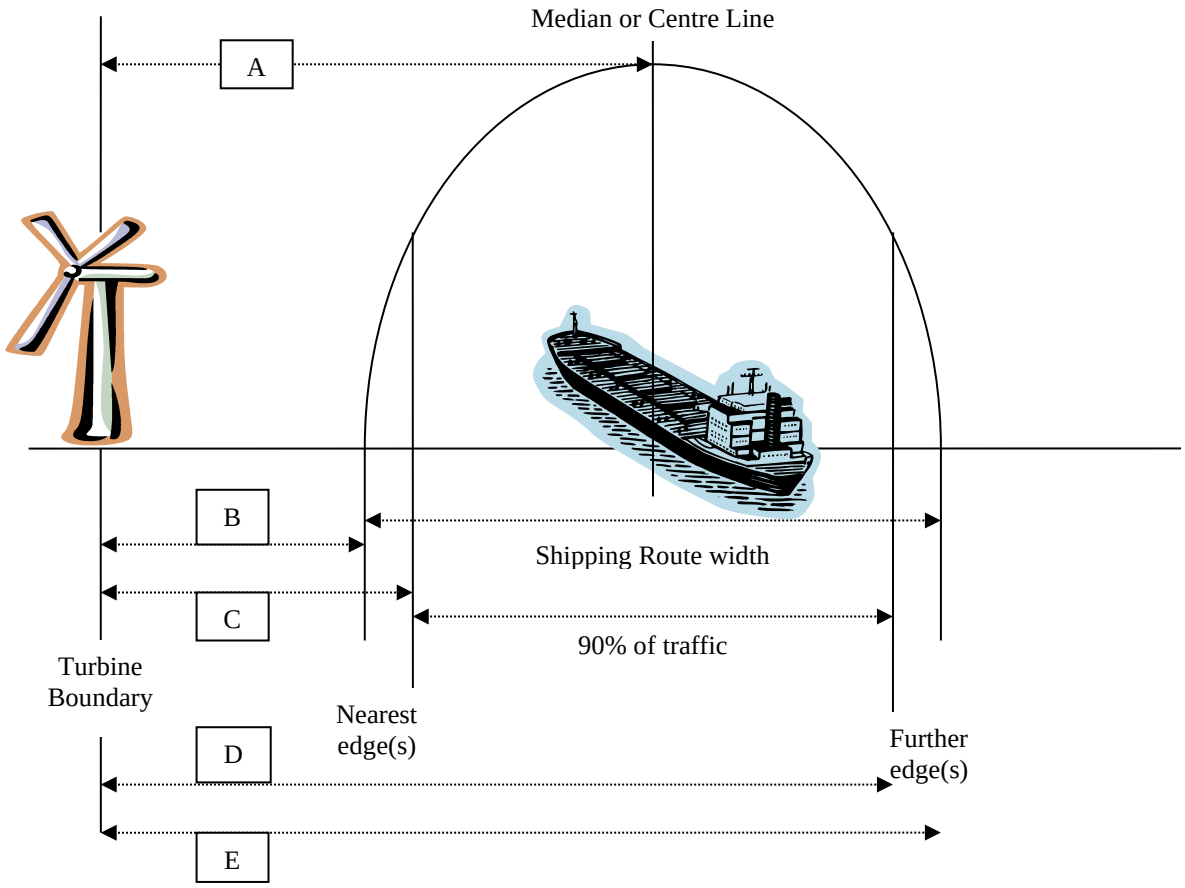
The document provides recommendations on the structure and contents of a NRA, including the identification of hazards and risk controls and a declaration that the risks associated with the OREI are As Low As Reasonably Practicable (ALARP) and tolerable.

The document is available to download from the MCA website.

Annex 2

INTERACTIVE BOUNDARIES

The below templates can be used for assessing distances between wind farm boundaries and shipping routes – see paragraph 4.7[6]



Precisely where an interactive boundary should lie requires similarly flexible definition and agreement. See diagram above where:

A = Turbine boundary to the shipping route median or centre line
B = Turbine boundary to nearest shipping route edge or IMO routeing measure boundary
C = Turbine boundary to nearest shipping 90% traffic level*
D = Turbine boundary to further shipping 90% traffic level*
E = Turbine boundary to further shipping route edge

(* = or another % to be determined)

[6] The Nautical Institute and World Ocean Council guidance document titled *The Shipping Industry and Marine Spatial Planning* may be useful to read in conjunction with this Annex: https://www.nautinst.org/uploads/assets/uploaded/299f934f-ee69-492e-8ada51abf26e8b19.pdf

WIND FARM SHIPPING ROUTE TEMPLATE

The wind farm "Shipping route" guidance template below is to be used as guidance and approval of distances between wind farm boundaries and shipping routes is on a case by case basis with MCA and relevant navigation stakeholders. It is important to recognise that the template is not a prescriptive tool but needs intelligent application and advice will be provided on a case-by-case basis.

Distance of turbine boundary from shipping route (90% of traffic, as per Distance C)[7]	Factors for consideration	Risk	Tolerability
<0.5nm (<926m)	X-Band radar interference Vessels may generate multiple echoes on shore-based radars	**VERY HIGH**	**INTOLERABLE**
0.5nm to <1nm 926m to <1852m	Mariners' Ship Domain (vessel size and manoeuvrability)	**HIGH**	**TOLERABLE IF ALARP** **Additional risk assessment and proposed mitigation measures required** * Descriptions of ALARP can be found in: a) Health and Safety Executive (2001) 'Reducing Risks, Protecting People' b) IMO (2018) MSC-MEPC.2/Circ.12/Rev.2 dated 9 April 2018, 'Revised Guidelines for Formal Safety Assessment (FSA) in the IMO Rule-Making Process'
1nm to <2nm 1852m to <3704m	Minimum distance to parallel an IMO routeing measure, as per Distance B. S-Band radar interference ARPA affected (or other automatic target tracking means)	**MEDIUM**	
2nm to 3.5nm (3704m – 6482m)	Preferred distance to parallel boundary of an IMO routeing measure, as per Distance B[8] Compliance with COLREG becomes less challenging	**LOW**	
>3.5nm (>6482m)	Minimum separation distance between turbines on opposite sides of a route	**LOW**	**BROADLY ACCEPTABLE**
>5nm (>9260m)	Adjacent wind farm introduces cumulative effect Minimum distance from TSS entry/exit	**VERY LOW**	**BROADLY ACCEPTABLE**

[7] Distance from an IMO Routeing Measure is measured from the routeing boundary i.e. Distance B.

[8] The Netherlands assessed sea room requirements using data supported by the PIANC assessment for channel design and the PIANC Interaction Between Offshore Wind Farms and Maritime Navigation (2018) report. In general, they strive for an obstacle free, or buffer, zone of 2nm between wind farms and shipping routes.

Annex 3

Under Keel Clearance Policy Paper, NOREL, May 2014

Guidance To Developers in Assessing Minimum Water Depth over Tidal Devices[9]

Purpose
The purpose of this paper is to provide guidance to developers in determining an appropriate margin of safety for vessels transiting over tidal devices and their associated structures.

This Paper is intended to assist discussions between developers and MCA and represents guidance only. Developers are free to deviate from the approach where they consider it necessary, can present a sound argument for doing so and/or offer mitigation measures.

Additionally, it is intended that this paper assists developers in identifying suitable locations for underwater devices when considered in the context of available water depth, vessels and craft that transit the area. However, it is not intended that this paper removes the need for developers to consult with the relevant regulator and advisors.

This UKC guidance addresses the worst case scenario, each specific development will have its own unique characteristics and will therefore be assessed on a case by case basis.

Background
Traditionally, the (minimum) under keel clearance was calculated as one of the factors required to provide safe passage for a vessel. Once known, this would allow the most viable route to be planned taking into account a vessel's size, draught and nature of cargo. Many vessel transits occur in the confined waters of ports and harbours where a minimum clearance can be defined and controlled. Many ports use whichever is the greater of a defined figure or 10% of a vessel's draught as the minimum under keel clearance.

Transits of areas of limited water depth in relation to a ship's draught and available width of navigable water are undertaken with caution, at reduced speed, with engines ready for immediate manoeuvre, watertight doors closed, bridge manning increased and in port areas, tug assistance for larger vessels. These precautions are taken because, despite the application of a minimum under keel clearance, the likelihood of grounding on immediately adjacent shallows is increased.

When calculating compliance with this requirement, the Master considers the effects of squat, heeling and other dynamic forces on the vessel. Tidal predictions will also be taken into account and transits planned to take advantage of tidal height.

Outside ports and other confined waters, the minimum under keel clearance used is at the discretion of the Master and quite often forms part of Ship Owner/Operator, Charterer or Insurer's policies/requirements.

Ensuring safe transit
In open waters, a larger minimum under keel clearance allowance will be used to account for the vessel's dynamic movement in a seaway and other external factors leading to subsequent changes in draught. Generally transits will be planned for any state of tide.

[9] This guidance can also be applied to wave energy devices.

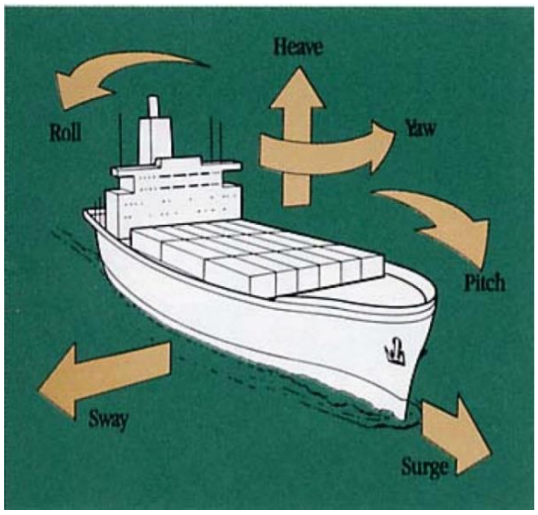


Figure 1: Vessel movements in a seaway

Available depth of water is affected by height of tide. There is a significant difference in some locations between Neap and Spring tide heights and range. Tidal heights can be affected by meteorological conditions which can on occasions mean that the actual tide height is less than the predicted height of tide.

The sea state has a significant impact with swell and sea waves causing reduced depths in the trough of a wave. Pitching and rolling along with vertical heave increases the draught of a vessel, as does the heeling of a vessel by the wind, sea and sharp rudder movements.

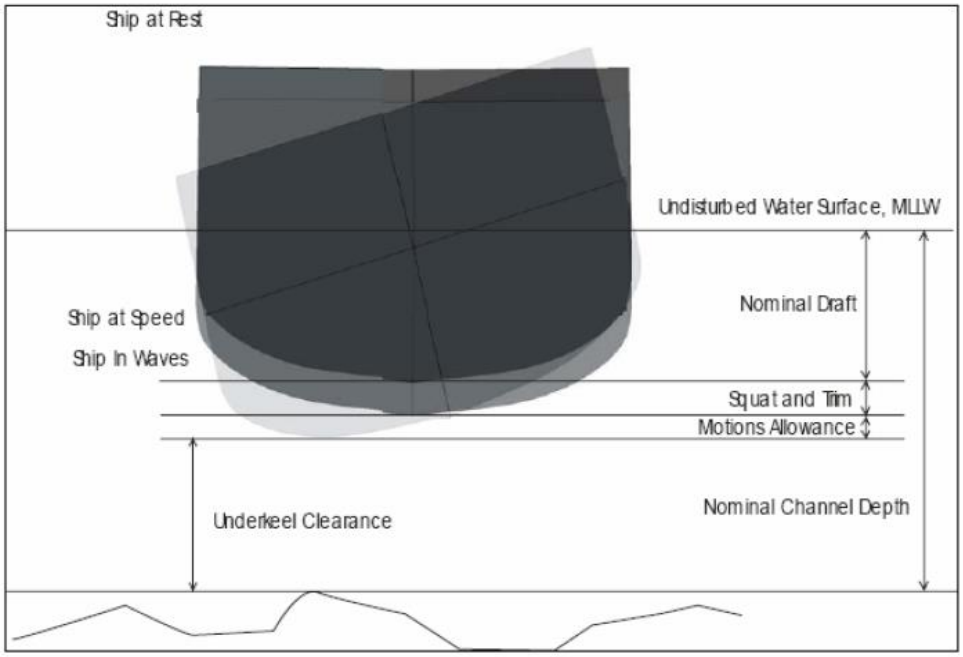


Figure 2: Effects of vessel dynamic movements on under keel clearance

Vessels create significant pressure variations around them as they pass through the body of water. These pressure variations are causal factors in vessel squat, bank effect, and interaction between vessels. The impact on these pressure variations on wave, tidal and similar devices is unknown and therefore advice from individual manufacturers should be sought.

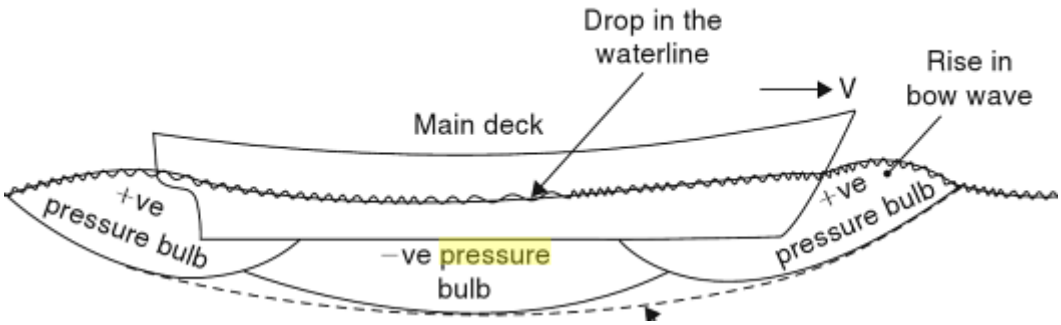


Figure 3: Vessel pressure variations (reproduced from Derret "Ship Stability for Masters and Mates")

Guidance for determining safe depth of water over wave, tidal and similar devices

Where there is no safe and reasonable deviation for marine traffic using the area, under keel clearance (UKC) over tidal turbines or other man made under water obstructions must allow for the safe transit of vessels at all states of tide.

This transit must be safe; this means that it must protect the vessel, its crew and cargo along with the wave, tidal turbine or other under water structures associated with them.

Two key factors need to be considered in determining UKC:

(i) The height of the device including its vertical safety margin. Two aspects to be considered; the position of the sea bed in relation to chart datum (CD) and the minimum vertical safety margin (M required above the device to ensure vessel transits do not damage and/or are detrimental to the device (e.g. the effects of interaction between a vessel and the device).

(ii) The draught of vessels transiting above the device. In Figure 4 the draught (Dd) is the maximum dynamic draught of the vessel and includes suitable allowances for the factors discussed under the heading 'Ensuring safe transit'.

When considered collectively, these two factors should ensure that there is no increase in likelihood of a vessel grounding (or in this case, striking an underwater device).

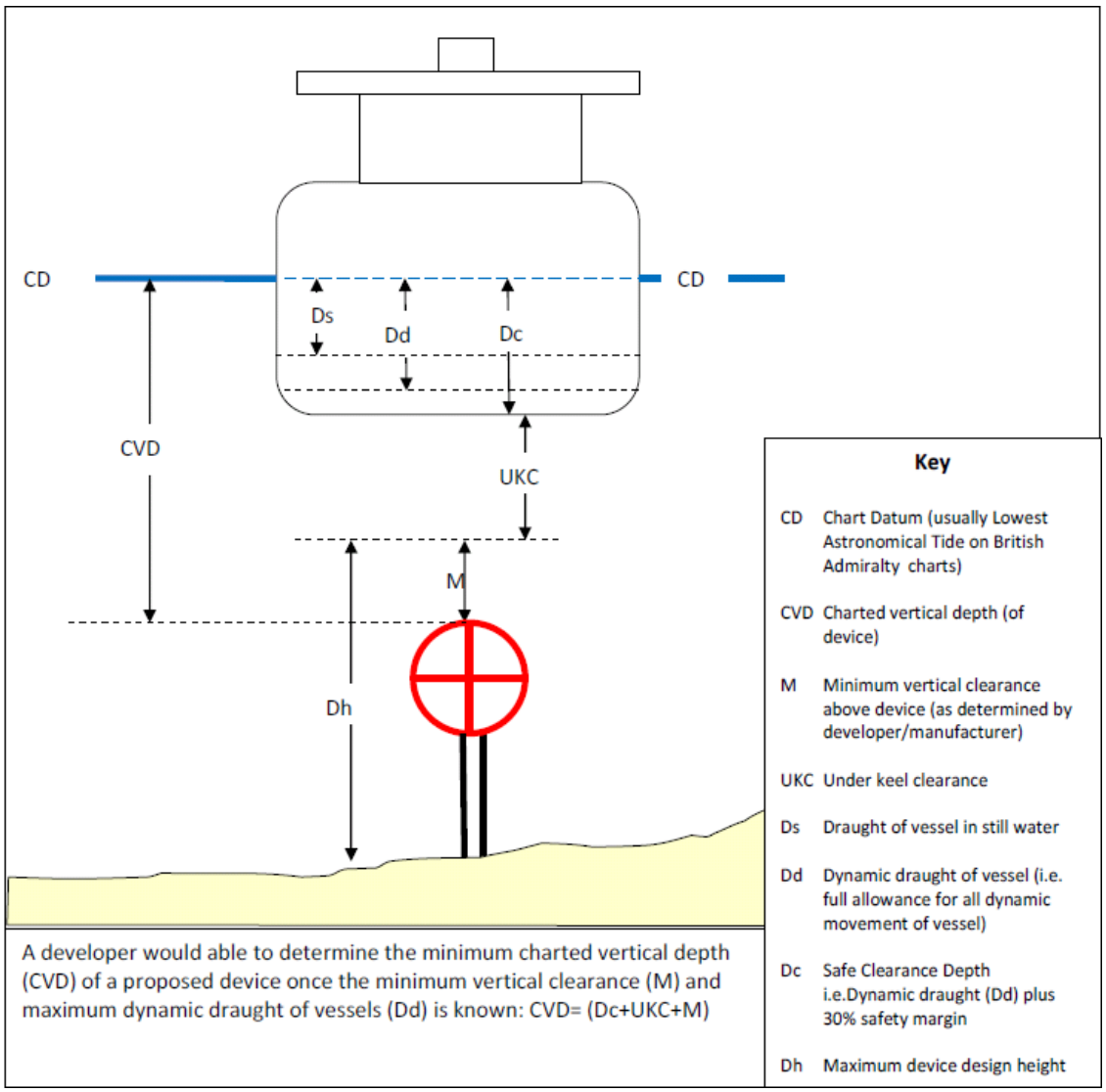


Figure 4: Illustrative view of a vessel passing over an underwater wave, tidal or similar device with the key heights and measurements

Each location will be unique and must be considered for the characteristics of sea, weather and swell. Traffic using the area must be thoroughly understood and the generic characteristic of vessels whether small, medium or large and their behaviour in expected sea states should be documented.

Based on this analysis, the maximum worst case dynamic draft can be calculated along with the least depth of available water.

OREI operators have no control over the transit time of vessels and therefore will not know what the tide state is during transit. To take account of this, their calculations should be based from chart datum and consider the worst case scenario transit at Low water (which for calculation purposes can be considered as the charted depth).

Assessment Criteria

In assessing minimum clearance depth over devices, using Figure 4 as the source data, the developer needs to establish a figure for Charted Vertical Depth (CVD) i.e. the minimum depth of water over the device, the following process should be adopted.

Establish, from traffic survey the deepest draft of observed traffic (Ds), this will require modelling to assess impacts of all external dynamic influences giving a calculated figure for dynamic draught (Dd).

A 30% factor of safety for UKC should then be applied to the dynamic draught, giving an overall safe clearance depth (Dc) to be used in calculation,

Charted Depth reduced by safe clearance depth (Dc) gives a maximum height above seabed available from which turbine design height (Dh) including any design clearance requirements (M) can be established.

This simple formula will give a minimum depth over the device against a calculated worst case scenario.

Conclusion

Taking account of the issues identified within this paper, it is clear that there is no standard figure that can be used to establish the safe clearance over underwater devices. Rather, developers will need to demonstrate an evidence based, 'case by case' approach which will include dynamic draught modelling to ascertain the safe water depth taking into consideration the guidance contained in this document.

Annex 4

Hydrography Guidelines for Offshore Developers

All hydrographic surveys should provide full seafloor coverage that meets the requirements of IHO S44ed5 Order 1a. Particular attention should be given to horizontal and vertical sounding accuracy, together with target detection requirements and, we would request that all data and reports are passed on to the UKHO for the update of the UK's nautical charts and publications.

The full details can be found in The Hydrography Guidelines for Offshore Developers and the Post Construction Hydrography Guidelines for Offshore Developers available from the MCA website.

Annex 5

Search & Rescue, Maritime Assistance Service, Counter Pollution and Salvage Incident Response

OREI developers must fulfil the requirements of the MCA's guidance document "*Offshore Renewable Energy Installations: Requirements, Advice and Guidance for Search and Rescue and Emergency Response"* which includes design, equipment and operational requirements.

A completed SAR checklist and a Hub Emergency Response Co-operation Plan (ERCoP) are required to be in place for the construction, operation and decommissioning phases of any OREI. The SAR checklist is a record of discussions regarding the requirements, recommendations and considerations outlined in the above document and should be agreed by the developer and MCA on a case-by-case basis. The content of the SAR checklist will apply throughout the life of the OREI and will be used by the MCA to ensure actions agreed pre-construction and are correctly implemented.

Templates of the SAR checklist and Hub ERCoP are available from the MCA website.

Annex 6

MGN Checklist

A checklist document has been produced as an aid for developers to confirm the guidance in this MGN has been addressed within a Navigation Risk Assessment and/or Environmental Impact Assessment as required for development consent decisions.

Full details and the template can be found on the MCA website. It should be noted a completed checklist is required to accompany the Navigation Risk Assessment and/or shipping and navigation chapter in an EIA Report.