MARINE GUIDANCE NOTE

Maritime and Coastguard Agency

MGN 372 (M+F)

Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs

Notice to other UK Government Departments, Offshore Renewable Energy Installation Developers, Port Authorities, Ship owners, Masters, Ships' Officers, Fishermen, Rescue Organisations and Recreational Sailors.

Summary

This Marine Guidance Note (MGN) highlights the issues to be taken into account when planning and undertaking voyages in the vicinity of offshore renewable energy installations (OREIs) off the UK coast.

Key Points

- Offshore renewable energy installations present new challenges to safe navigation, but proper voyage planning and access to relevant safety information should ensure that safety is not compromised.
- At present most OREIs are wind farms, though prototype installations using wave or tidal power have been established off the UK coast.
- Information is provided to enable appropriate voyage planning decisions to be made.
- The Guidance Note should be read in conjunction with MCA's other MGN entitled "Offshore Renewable Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues".

1 Introduction:

1.1 The number of offshore renewable energy installations (OREIs) around the UK coast is increasing. At present most are wind farms, though tidal and wave energy installations are being developed and some prototype installations have been established which may be close to shipping routes.

1.2 In June 2008 five offshore wind farms were operational, with a further twenty four in construction or at various stages of planning. These are mainly located in three strategic areas – East Irish Sea, the Greater Wash and the Thames Estuary. There are also sites in other English, Welsh, Scottish and Northern Irish areas. In the future, other strategic wind farm sea areas may be designated.

1.3 Wind farms can be very large, some approaching 100 square nautical miles. The sites may be irregular in shape and adjacent developments can be in close proximity to each other. In addition single wind turbines may be established as isolated units.

1.4 Wave and tidal energy devices are currently sited on an ad hoc basis, where wave or tidal stream conditions are optimum but where interference with other marine activities is, as far as practicable, minimised.

1.5 This Guidance Note will enable masters and skippers to make an informed risk assessment for the intended voyage. This should be taken into account together with the guidance on voyage planning found in other publications, relating to the implementation of SOLAS V Regulation 34 ("Voyage Planning"). Reference should be made to the MCA publication *"Safety of Navigation, Implementation of SOLAS Chapter V, 2002"* (Second Edition with amendments - June 2007) which is also accessible on the MCA website. MCA and IMO Guidance on Voyage Planning are contained in Annexes 24 and 25 of that publication. Further reference to MCA's other MGN entitled: "Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Safety and Emergency Response Issues" is recommended.

1.6 Mariners are reminded of the requirement to navigate safely at all times and this Guidance Note aims to assist mariners in carrying out that obligation. OREIs are a new development and this guidance is of a general nature, based on the information available to date. It should be noted that specific details of individual sites may vary. As additional information becomes available in the light of experience, the guidance may be reviewed and updated. Notes on United Kingdom Hydrographic Office (UKHO) charts and Sailing Directions should be studied. Details will be included in the next edition of NP100, The Mariner's Handbook.

1.7 Any urgent Maritime Safety Information relating to OREIs will be promulgated by Notices to Mariners and Radio Navigation Warnings.

1.8 The ANNEX to this MGN contains illustrations of various OREIs and their markings.

2 Wind Farms:

2.1 **Visibility and appearance:** Wind Farms are readily identifiable both visually and by radar from a considerable distance in good meteorological conditions. The turbines typically comprise: a foundation below sea level, a yellow transition section not less than 15 metres high measured above the Highest Astronomical Tide (HAT), above which is a platform forming the base of the turbine tower, which may be typically 70 - 80 metres in height. At the top of the turbine tower is the nacelle, a box shaped structure housing the generator. The turbine blades are located opposite the nacelle. Each turbine blade can be more than 60m in length. The structures above the yellow transition section are usually painted matt grey. (See illustrations in ANNEX) The total height of a turbine and rotors is currently up to about 150 metres. Theoretically an observer with a height of eye 3 metres would be able see the tips of the blades at 28 nautical miles. The more substantial nacelle would, if 70m high, be visible to the same observer at 20 nautical miles in clear visibility.

2.2 **Navigational Aids:** Wind farms are marked by aids to navigation as specified by the General Lighthouse Authorities (GLA). The International Association of Lighthouse Authorities (IALA) *Recommendation O-117 on the Marking of Offshore Wind Farms* requires offshore wind turbines to be marked so as to be conspicuous by day and night, with consideration given to prevailing conditions of visibility and vessel traffic. In certain cases cardinal marks may also be permanently placed adjacent to wind farms. During construction standard cardinal marks will be used around the area.

2.2.1 A corner structure, or other significant point on the boundary of the wind farm, is called a Significant Peripheral Structure (SPS). The SPS will be marked with lights visible from all directions in the horizontal plane. These lights should be synchronized to display simultaneously an IALA "special mark" characteristic, flashing yellow, with a range of not less than five (5) nautical miles. Aids to navigation on individual structures are placed below the arc of the rotor blades, typically at the top of the yellow section.

2.2.2 As a minimum, each SPS will show synchronised flashing characteristics. In some cases there may be synchronisation of all SPSs. In the case of a large or extended wind farm, the distance between SPSs should not normally exceed three (3) nautical miles.

2.2.3 Selected intermediate peripheral structures (IPS) on the boundary of a wind farm between SPSs will be marked with flashing yellow lights which are visible from all directions horizontally. The characteristics of these lights areas differ from those displayed on the SPSs, and have a range of not less than two (2) nautical miles. The distance between such IPS or the nearest SPS should not exceed two (2) nautical miles. The characteristics of the lights and marks will be shown on the chart.

2.2.4 Single structures, not part of a group of turbines, are marked, according to the *IALA Recommendation O-114 on the marking of offshore structures*, with a white light flashing Morse code “U”.

2.3 **Other illumination and identification aids:** In addition to the navigational aid lights marking the SPSs and selected IPS of a wind farm, IALA permits:

a) Illuminating of peripheral structures and all structures within the wind farm
b) Racons, which may have the Morse characteristic "U".
c) Radar Reflectors and Radar Target Enhancers; and/or
d) AIS as an Aid to Navigation (as per IALA Recommendation A-126).

Mariners should consult the largest scale chart available for details.

2.4 **Sound signals:** Where required on a wind farm, the typical range of such a sound signal shall not be less than two (2) nautical miles. Details will be given on the chart.

2.5 **Markings:** Individual turbines will be marked with a unique alphanumeric identifier which should be clearly visible at a range of not less than 150 metres. At night, the identifier will be lit discretely, (e.g. with down lighters), enabling it to be seen at the same range. Wind turbines are therefore readily visible in good conditions; however it should be remembered that they may not be so easily seen at night or in reduced visibility from the wind farm interior. Fixed red aviation lights on the tops of the nacelles may be visible to surface craft, and care must be taken not to confuse these with vessels’ sidelights or marine navigational aids, despite the possibility of them appearing to have a flashing characteristic when seen through rotating turbine blades.

2.6 **Charting:** All wind farms off the UK coast will be charted by the UKHO either by a group of black wind turbine chart symbols, or an outer limit with an encircled black wind turbine symbol. The outer limit will be in black dashed line, or a magenta T-shaped dashed line if there are navigational or other restrictions in the area; see Admiralty Chart 5011(INT1) - *Symbols and Abbreviations used in Admiralty Charts*. Whether all submarine cables associated with wind farms will be charted depends upon the scale of the chart. As with all submarine cables mariners should note the hazards associated with anchoring or trawling near them. Heed should also be taken of any chart notes relating to wind farms.

2.7 **Effects of Wind Farms and Wind Turbines on routeing options**

In planning a voyage mariners must assess all hazards and associated risks. The proximity of wind farms and turbines should be included in this assessment. This section provides information on the effects of wind farms and their turbines, which should be taken into account:

2.7.1 **Spacing:** Turbines within a wind farm are generally spaced 500 metres or more apart depending on the size of the turbine. In order to make best use of the wind resource, turbine spacing is proportional to the rotor size and the down-wind wake effect created. In general terms, the larger the rotor the greater the spacing. Small craft may be able to navigate safely within the wind farm boundaries, while larger craft will need to keep clear.

2.7.2 **Depth of water:** The majority of wind turbines now operating or planned are located in relatively shallow water, e.g. on shoals or sand banks. The limited depth of water therefore provides a natural constraint between larger vessels and turbines. However it is expected that new generations of wind farm will be constructed in deeper water, where navigable channels in the vicinity may restrict vessels to a particular route passing close to a wind farm boundary.

2.7.3 **Seabed changes:** Wind farm structures could, over time, affect the depth of water in their vicinity. In dynamic seabed areas with strong tidal streams, changes in the scouring of the seabed may occur. This may result in depth information being unreliable. Once a wind farm has existed for a few years there will be a better appreciation of any tidal scour or changes of depth. Wind farm developers are required to make an assessment of any potential changes in sedimentation that may occur as a consequence of their plans. Development may be permitted where the assessed effect is considered tolerable. In practice though the actual effect could differ, so mariners should bear this in mind and allow sufficient under-keel clearance with a suitable margin of safety. Some wind turbines have scour protection in the form of boulders and/ or concrete mattresses placed around their base.

2.7.4 **Tidal streams:** Wind farm structures may obstruct tidal streams locally, creating eddies nearby. Mariners should be aware of the likelihood of such eddies which are only likely to be significant very close to the structures.

2.7.5 **Small craft:** Vessels involved in turbine maintenance and safety duties may be encountered within or around a wind farm. Fishing vessels may also be operating in the area. Mariners should be alert to the likely presence of such vessels and be aware that the structures may occasionally obscure them. This is particularly relevant at night. Large vessels may also become obscured, for example if they are on the opposite side of a wind farm. A good lookout should be therefore be maintained at all times by all available means, as required by the International Regulations for Preventing Collisions at Sea (COLREGS).

2.7.6 **Shore marks:** In coastal areas shore marks may also become obscured by wind farm structures. Mariners should be particularly alert to this. In particular, the characteristics of lights at night may need careful verification if turbines temporarily mask them. The ship's position should be checked by other means when a wind farm obscures coastal marks.

2.7.7 **Transformer stations:** In or adjacent to larger wind farms offshore electrical transformer-stations may be present. These are of similar appearance to small offshore production platforms. Submarine cables link turbines to this sub-station from where the generated power is exported to the shore. Whether all submarine cables are charted depends upon the scale of the chart; in some cases only the export cable may be shown. All craft operating within a wind farm should therefore avoid anchoring except in emergencies as the anchor could easily become fouled.

2.8 Effects on Communications and Navigation systems

In 2004 the MCA and Qinetiq conducted trials at the North Hoyle wind farm to determine any impact of wind turbines on marine communications and navigations systems. The results from the full report, available on the MCA web site, are summarised below.

2.8.1 The trials indicated that there is minimal impact on VHF radio, Global Positioning Systems (GPS) receivers, cellular telephones and AIS. UHF and other microwave systems suffered from the normal masking effect when turbines were in the line of the transmissions.

2.8.2 The turbines produced strong radar echoes giving early warning of their presence. At close range, however, the trials showed that they may produce multiple reflected and side lobe echoes that can mask real targets. These develop at about 1.5 nautical miles, with progressive deterioration in the radar display as the range closes. Where a shipping lane passes within this range considerable interference may be expected along a line of turbines .Target size of the turbine echo increases close to the turbine with a consequent degradation of target definition and bearing discrimination. These effects were encountered on both 3cm and 10 cm radars.

2.8.3 Similar effects were found during the BWEA-funded trials undertaken off the Kentish Flats wind farm in 2006. Radar antennae which are sited unfavourably with respect to items of the ship's structure can enhance these effects. Careful adjustment of radar controls can suppress some of these spurious radar returns but mariners are warned that there is a consequent risk of losing targets with a small radar cross section, which may include buoys or small craft, particularly yachts or GRP constructed craft, therefore due care should be taken in making such adjustments.

2.8.4 If these interfering echoes develop, the requirements of the COLREGS Rule 6 *Safe speed* are particularly applicable and must be observed with due regard to the prevailing circumstance. In restricted visibility Rule 19 *Conduct of vessels in restricted visibility* applies and compliance with Rule 6 becomes especially relevant. In such conditions mariners are required, under Rule 5 *Lookout* to take into account information from other sources which may include sound signals and VHF information, for example from a VTS, or AIS. Mariners should bear in mind though that not all vessels are equipped with AIS.

2.8.5 Where adequate safe water exists it may be prudent in planning the voyage of larger vessels to set tracks at least 2nm clear of turbine fields.

2.9 Rotor effects

2.9.1 Offshore wind turbines located around the UK are required to have the lowest point of the rotor sweep at least 22 metres above Mean High Water Springs. This clearance should be ample for the majority of small craft. Those with a greater air draught should be aware of this height, and take appropriate care. It would, in any case, be imprudent for larger vessels to be this close to a turbine, other than in an emergency.

2.9.2 In harvesting energy turbines “de-power” the wind. Research indicates that a 10% reduction in wind velocity in the lee of a wind turbine may be expected. This wind-shadow effect is predicted to exist within the vertical air column up to heights of 15 metres. The impact of the wind-shadow reduces with distance in the lee of a turbine. The inter-turbine spacing affects the impact of rotor wash or wake. The width of the rotor wake is about 150 metres, which is broadly similar to the rotor diameter. As the rotor wake interacts with the sea surface further shadow effects are predicted. The wind, having changed its flow through the rotors, will be expected to recover downwind of the turbine. Consequently, wind-sheer may occur as the wind back fills.

2.9.3 In simple terms, the effect of a turbine rotor harvesting the wind can be pictured as a horizontal cone, centred on the rotor hub with the approximate diameter of the rotor. The cone extends down-wind, attenuating to a point at a distance proportional to the wind velocity. This down-wind effect will also be dependent upon the azimuth of the rotor. The impact on a vessel will be proportional to its windage area and, for a sailing vessel, the mast height.

2.9.4 Mariners, particularly yachtsmen, need to be aware of these effects. By day the normal visual clues should be noted and changes in leeway or the balance of tidal stream to wind power anticipated. Extra care should be taken at night, when visual clues are not so easily detected.

3 Offshore Wave and Tidal Energy Installations:

Unlike Wind Farms, systems using wave or tidal energy may not be clearly visible to the mariner.

3.1 Wave energy convertors (WECs) capture kinetic energy carried by waves Wave energy convertors are likely to be located at or near the surface from an attachment or mooring point on the seabed. WECs may be visible or semi-submerged. The following definitions are used:

3.1.1 Attenuator: An attenuator is a floating device which works in parallel to the wave direction and effectively rides the waves. Movements along its length can be selectively constrained to produce energy One example consists of large linked floating cylinders which are connected by a hydraulic system. Potential energy is stored via hydraulic rams, which operate as the hinged units move in the waves. The generated pressure is used to drive turbine generators inside the cylinders.

3.1.2 Point absorber: A point absorber is a floating structure which absorbs energy in all directions through its movements at/near the water surface

3.1.3 Oscillating Wave Surge Converter: An arm oscillates as a pendulum mounted on a pivoted joint in response to the movement of water in the waves.

3.1.4 Oscillating water column: An oscillating water column is a partially submerged, hollow structure. Waves cause the water column to rise and fall allowing trapped air to flow to and from the atmosphere via a turbine the rotation of the turbine is used to generate electricity.

3.1.5 Overtopping device: This type of device relies on physical capture of water from waves which is held in a reservoir above sea level, before being returned to the sea through conventional low-head turbines which generates power. An overtopping device may use collectors to concentrate the wave energy.

3.1.6 Submerged pressure differential: These devices are typically located near shore and attached to the seabed. The motion of the waves causes the sea level to rise and fall above the device, this pressure differential being used to generate electricity.

Other devices may have unique and very different designs to the more well-established types of technology.

3.2 **Tidal energy convertors** (TECs) capture potential energy from the movement of large bodies of water as the tides ebb and flow. TEC devices may be surface or sub surface structures incorporating a generator fixed or moored to the sea bed , which captures the potential energy present in the moving body of water associated with a tidal stream. Power take-off is normally via cables to an electrical terminal.

3.2.1 Horizontal axis turbine: This type of device extracts energy from moving water in much the same way as wind turbines extract energy from moving air using a vertical rotor plane.

3.2.2 Horizontal axis turbine (enclosed blade tips): The funnel-like collecting device, usually with Venturi effect to accelerate water column, sits submerged in the tidal current. The flow of water can drive a turbine directly or the induced pressure differential in the system can drive an air-turbine.

3.2.3 Vertical axis turbine: This device extracts energy from moving in a similar fashion to that above, however the turbine is mounted on a vertical axis, i.e. Using a horizontal rotor plane

3.2.4 Oscillating Hydrofoil. A hydrofoil attached to an oscillating arm and the motion is caused by the tidal current flowing either side of a wing, which results in lift.

3.3 **Methods for fixing WECs and TECs to the seabed** From the mariner's perspective it is important to realise that there are various methods by which devices can be fixed to the seabed, which will affect their visibility above the surface.

3.3.1 Seabed Mounted / Gravity Base Devices: physically sit on the seabed by virtue of the weight of the combined device/foundation. In some cases there may be additional fixing to the seabed.

3.3.2 Pile Mounted: This principle is analogous to that used to mount most large wind turbines, whereby the device is attached to a pile penetrating the ocean floor.

3.3.3 Floating Flexible Mooring: The device is tethered via a cable/chain to the seabed, allowing considerable freedom of movement. This allows a device to swing as the tidal current direction changes with the tide.

3.3.4 Floating Rigid Mooring: The device is secured into position using a fixed mooring system, allowing minimal movement.

3.3.5 Hydrofoil Inducing Down force The device uses a number of hydrofoils mounted on a frame to induce a positioning down force from the tidal current flow.

3.4 **Transformer Station or Hub** – A special structure containing power conversion equipment either within or outside the wave / tidal; energy array to which individual generators are connected via a power cable. A submarine cable transfers the power ashore from the hub. A hub may be a separate fixed or floating platform.

Note: *Animated illustrations of current and proposed wave and tidal devices can be seen on www.emec.org.uk*

3.5 **Visibility and Marking of Wave and Tidal Energy Installations:**
Visibility will depend on the device type. Some installations are totally submerged while others may only protrude slightly above the sea surface. Marking will be based on IALA *Recommendation 0-131 on the marking of offshore wave and tidal energy devices*, which states that:
"Wave and Tidal energy extraction devices should be marked as a single unit or as a block or field as follows:

a. When structures are fixed to the seabed and extend above the surface, they should be marked in accordance with the IALA recommendations contained in the marking of offshore wind farms – O-117.

b. Areas containing surface or sub-surface energy extraction devices (wave and/or tidal) should be marked by appropriate navigation buoys in accordance with the IALA Buoyage System, fitted with the corresponding topmarks and lights. In addition, active or passive radar reflectors, retro reflecting material, racons and/or AIS transponders should be fitted as the level of traffic and degree of risk requires.

c. The boundaries of the wave and tidal energy extraction field should be marked by lit Navigational Lighted Buoys, so as to be visible to the mariner from all relevant directions in the horizontal plane, by day and by night. Taking the results of a risk assessment into account, lights should have a nominal range of at least 5 (five) nautical miles. The northerly, easterly, southerly and westerly boundaries should normally be marked with the appropriate IALA Cardinal mark. However, depending on the shape and size of the field, there may be a need to deploy intermediate lateral or special marks.

d. In the case of a large or extended energy extraction field, the distance between navigation buoys that mark the boundary should not normally exceed 3 (three) nautical miles.

e. Taking into account environmental considerations, individual wave and tidal energy devices within a field which extend above the surface should be painted yellow above the waterline. Depending on the boundary marking, individual devices within the field need not be marked. However, if marked, they should have flashing yellow lights so as to be visible to the mariner from all relevant directions in the horizontal plane. The flash character of such lights should be sufficiently different from those displayed on the boundary lights with a range of not less than 2 nautical miles.

f. Consideration should be given to the provision of AIS as an Aid to Navigation (IALA Recommendation A-126) on selected peripheral wave and/or tidal energy devices.

g. A single wave and/or tidal energy extraction structure, standing alone, that extends above the surface should be painted black, with red horizontal bands, and should be marked as an Isolated Danger as described in the IALA Maritime Buoyage System.

h. If a single wave and/or tidal energy device which is not visible above the surface but is considered to be a hazard to surface navigation, it should be marked by an IALA special mark yellow buoy with flashing yellow light with a range of not less than 5 nautical miles, in accordance with the IALA Buoyage System. It should also be noted that many tidal concepts have fast-moving sub-surface elements such as whirling blades.

i. The Aids to Navigation described herein should comply with IALA Recommendations and have an appropriate availability, normally not less than 99.0% (IALA Category 2).

j. The relevant Hydrographic Office should be informed of the establishment of an energy extraction device or field, to permit appropriate charting of same.

k. Notices to Mariners should be issued to publicise the establishment of a wave and/or tidal energy device or field. The Notice to Mariners should include the marking, location and extent of such devices/fields.

Contingency Plans

Operators of wave and/or tidal energy extraction devices or fields should develop contingency plans and emergency response plans which address the possibility of individual devices breaking loose and becoming floating hazards. Automatic location and tracking devices should be considered. Developers and/or operators should have a reliable maintenance and casualty response regime in place to ensure the required availability targets are met. This will include having the necessary A to N spares on hand, with provision made at the design stage, where necessary, to ensure safe access.

However it should be noted that surface buoys used to mark wave or tidal energy devices may not be visible, at all states of the tide due to the nature of the tidal stream.

4 Safety Zones or Exclusion Zones

4.1 At the time of publishing this Guidance Note there are a few temporary exclusion zones in place around some UK offshore wind farms currently under construction. However, it is likely that safety zones will be introduced at other wind farm sites in the near future, and will be monitored and policed.

4.2 Temporary Safety Zones may be established (upon successful application to the Department for Business Enterprise and Regulatory Reform (BERR) and the MCA) during the construction, major maintenance and decommissioning of OREIs. Such Safety Zones will be promulgated by Notices to Mariners and Radio Navigation Warning broadcasts. Safety Zones will be monitored by support craft which may include fishing vessels employed by developers as Guard Vessels. Mariners should give such zones a wide berth. Skippers of fishing vessels operating in the area should make themselves aware of any information promulgated by the local OREI Fishing Liaison Officer.

4.3 Permanent Safety Zones are not expected to be established around entire wind farm arrays, as compelling risk-assessed arguments would be required for their establishment. However, applications for the establishment of safety zones around single installations or several installations making up an array will be considered on a case by case basis by BERR and the MCA, taking site specific conditions into account. An electronic version of the BERR guidance note on applying for Safety Zones around OREI can be found on the BERR website at www.berr.gov.uk

4.4 The nominal safety zone around an operational wind turbine is expected to have a 50 metre radius however the UKHO may not be able to show a limit of this size on charts or ENCs due to scale of coverage. Additionally, it may be necessary to limit access for specific activities (such as trawling) where the infrastructure requires restriction of such activity. In such cases the requirements will be promulgated separately. The UKHO will publish information for specific sites on charts and in their publications when the extent of this change is known.

4.5 With respect to other types of OREI, the establishment of safety zones may be more proscriptive, since wave and tidal devices may not be fixed in position, may extend horizontally for considerable distances on or below the sea surface, and may have potentially dangerous moving parts. Their low profiles may make them difficult to detect visually or by radar. Operational developments will include research and trial units whose positions may vary at short notice.

4.6 Access

Mariners should be aware that there is no right of access to any type of OREI. They are private property and appropriate warning signs are displayed. In any event access requires skill and is limited by sea state, and should only be undertaken in controlled circumstances by trained personnel.

4.7 Emergencies

4.7.1 In emergencies such as engine or steering failures close to or within OREI, mariners should immediately inform HM Coastguard and be prepared to use anchors if necessary, being aware of submarine cables and other seabed obstructions.

4.7.2 Mariners may, in extreme emergency, seek refuge on wind turbine towers. Access is via vertical ladders which may be encrusted with marine growth in the inter-tidal zone. Boarding turbines is hazardous and difficult, but the towers can provide refuge if the circumstances require. Very limited shelter from the elements can be obtained pending rescue, as internal access to the turbine tower will not be possible

4.7.3 If taking refuge on a turbine tower mariners are warned that the rotors will continue to turn until others become aware of their plight. In such circumstances mariners should alert HM Coastguard by the best means available, remembering that the turbine tower may obscure line of sight communications, so they may need to adjust their position on the platform.

4.7.4 Once alerted, HM Coastguard can contact the wind farm operations control room which can remotely shut down individual turbines. Wind farms have an active Safety Management System requiring them to park rotor blades in a suitable configuration to permit helicopter operations, although there may be occasions when the prevailing conditions preclude helicopter rescue from turbines. In such conditions distressed mariners may have to wait for evacuation by sea, when sea conditions permit.

4.7.5 Mariners in extreme emergency are unlikely to be able to use wave or tidal turbines as places of refuge.

4.7.6 When responding to a distress call or alert from within a wind farm or other OREI mariners should make a careful assessment of the risks associated with entering the area, taking into consideration the guidance outlined above. Large vessels may be unsuitable for requisitioning but all mariners should initially respond as required by international law and immediately relay the details to the nearest Coastguard Station.

4.8 Options

4.8.1 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) In the case of a wind farm, navigate, with caution, through the wind farm array.

4.8.2 The choice will be influenced by a number of factors including the vessel's characteristics (type, tonnage, draught, manoeuvrability etc), 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 In some sea areas, additional information may be promulgated by Vessel Traffic Services.

5 Way ahead

This guidance may be updated in the future as more experience of offshore wind farms and other OREIs has been gained. Problems of an urgent nature relating to all OREI types should be reported immediately to HM Coastguard. Mariners may wish to report effects or other problems they experience to the Navigation Safety Branch of the MCA.

6 Conclusion

Although offshore renewable energy installations present new challenges to safe navigation around the UK coast, proper voyage planning, taking into account all relevant information, should ensure a safe passage and the safety of life and the vessel should not be compromised.

More Information

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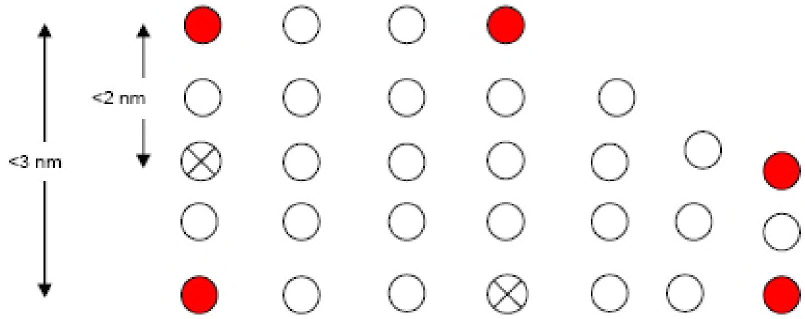
ANNEX

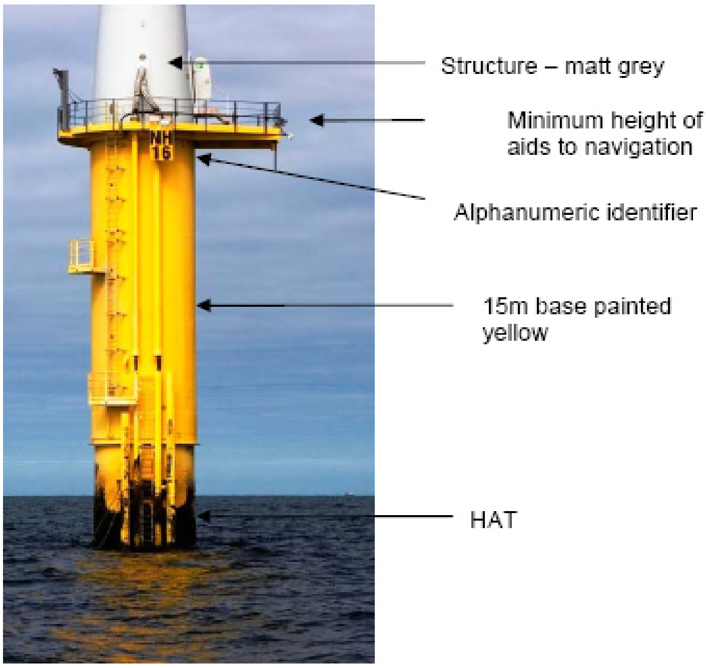
Marking and appearance of OREIs

1. Example of wind farm marking

SPS – lights visible from all directions in a horizontal plane. Lights synchronised to display an IALA "special mark" characteristic, flashing yellow, with a range of not less than five (5) nautical miles.

Intermediate structures – on the periphery of the farm other than SPSs – marked with flashing yellow lights visible in all directions in a horizontal plane with a characteristic different from the SPSs and a range of not less than two (2) nautical miles



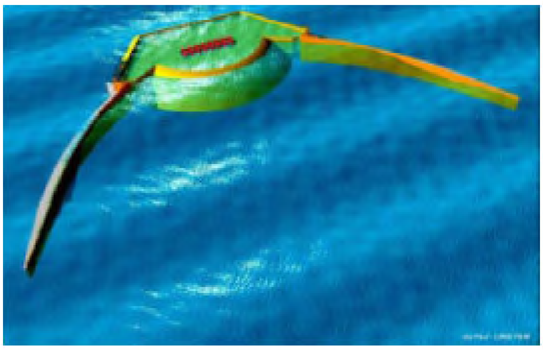


(Photos Courtesy Npower Renewables)

2. Examples of Wave and Tidal Installations

Pelamis Ocean Power Delivery (wave turbine installation) – Recommended colour above the waterline is yellow. *(Photos Courtesy Pelamis Wave Power)*

"Seaflow" project – tidal turbine installation. Coloured red and black as isolated danger. *(Photos courtesy Marine Current Turbines Ltd.)*



"Wave Dragon" – wave turbine installation- recommended colour above the water is yellow. *(Photos courtesy Wave Dragon Ltd).*