



IALA GUIDELINE

G1185

ENHANCING THE SAFETY AND EFFICIENCY OF NAVIGATION AROUND OFFSHORE RENEWABLE ENERGY INSTALLATIONS (OREI)

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1. INTRODUCTION

1.1. BACKGROUND

There is evidence of rapid growth in the establishment of Offshore Renewable Energy Installations (OREI) globally. Increasingly various maritime sectors including shipping, fishing, recreational, and environmental are competing, or coexisting, for use of the same sea space increasing risk to the maritime user. Therefore there is need for a comprehensive guideline on issues affecting safe and efficient navigation in the vicinity of OREI.

1.2. PURPOSE

The purpose of this document is to offer guidance, based on current best practice and knowledge, when considering navigational safety issues in and around OREI.

This document is intended to assist maritime authorities, OREI developers and other stakeholders when planning the establishment of OREI.

1.3. SCOPE

This guidance includes potential risk mitigation measures to enhance the safety and efficiency of navigation. These include ships' routeing measures, incident response planning, and other information.

This guidance is not intended to interpret other organisations documentation, rather it references relevant documents for stakeholders to consider. It should be read in conjunction with IALA *Guideline G1121 Navigational Safety Within Marine Spatial Planning*

The definition of Offshore Renewable Energy Installation(s) OREI is a fixed or tethered infrastructure, either singularly or grouped and the associated cables, for the purpose of exploiting a renewable energy resource. OREI include, but are not limited to, wind turbine power generators, offshore substations (or equivalent), tide and wave power generating devices, floating solar power generation devices, tidal lagoon power generating devices.

2. RISK MANAGEMENT

Risk management is the identification, evaluation and prioritization of risks (defined in the International Standard on Risk Management ISO 31000¹ as the effect of uncertainty on objectives), followed by the coordinated and economical application of resources to minimize, monitor, and control the probability or impact of adverse events.

ISO 31000 provides a generic description of the risk management process. It is based on best practices, extensive consultation and expert input, and links risk assessment with organizational processes. It is used in many industries, including various maritime sectors.

Risk management in the context of OREI should be a joint responsibility between National Competent Authorities and the Developers and Operators.

¹ ISO 31000 is a family of international standards relating to risk management codified by the International Organization for Standardization. The standard is intended to provide a consistent vocabulary and methodology for assessing and managing risk, resolving the historic ambiguities and differences in the ways risk are described.



2.1. RISK ASSESSMENT

The Formal Safety Assessment (FSA) methodology adopted by the International Maritime Organization (IMO) is a structured and systematic process, recommended for assessment and control of maritime risks. Recognized elements include risk analysis and cost-benefit assessment.

The International Maritime Organization first adopted FSA in 2002, through MSC/Circ.1023/MEPC/Circ.392, recommending the use of FSA for the maritime sector. The current version of the procedure is described in MSC-MEPC.e/Circ.12/Rev2.

IALA has a Risk Management Toolbox that contains qualitative and quantitative models. These proven models are suitable for use with OREI. IALA Guideline G1121 should be referred to during marine spatial planning for OREI, and for more information and guidance on risk management including the use of simulation, refer to IALA Guideline G1018.

2.2. MITIGATION MEASURES

Risk mitigation measures for scenarios in, and around, OREI could include, but are not limited to:

- Aids to Navigation
- Ship routing measures and vessel traffic services
- Emergency response and contingency plans
- A formal marine spatial plan

These, and some other measures are addressed in this document.

3. NAVIGATIONAL SAFETY

3.1. SHIPS ROUTEING

3.1.1. GENERAL

The IMO publication *Ships' Routeing*, contains IMO Res. A572(14) and instructions on how to establish IMO-adopted ships' routeing system. The publication is primarily intended for administrations responsible for planning and implementing routeing systems for use by international shipping.

The purpose of ships' routeing is to improve the safety of navigation in converging areas and in areas where the density of traffic is great or where freedom of movement of shipping is inhibited by restricted sea-room, the existence of obstructions to navigation, limited depths or unfavourable meteorological conditions².

Ships' routeing systems include traffic separation schemes (TSS), two-way routes, recommended tracks, areas to be avoided, precautionary areas and inshore traffic zones. The objective/s of any ships' routeing system will depend on the particular risk which it is meant to mitigate.

It may be necessary to implement internationally adopted ships' routeing systems through national legislation.

Navigation in or around windfarms maybe prohibited for some or all types of vessels.

² IMO Res A.572(14) *General Provisions on Ships' Routeing*



3.1.2. SHIPS' ROUTEING

As per SOLAS Chapter V/10, Ships' Routeing systems are recommended for use by, and may be made mandatory for, all ships, certain categories of ships or ships carrying certain cargoes, when adopted and implemented in accordance with the guidelines and criteria developed by the Organization.

SOLAS Chapter V/10 also states Contracting Governments shall refer proposals for the adoption of ships' routeing systems to IMO, which will disseminate relevant information on any adopted ships' routeing systems.

IMO MSC/Circ. 1060 (*Guidance note on the preparation of proposals on ships' routeing systems and ship reporting systems for submission to the sub-committee on safety of navigation*) and MSC/Circ.1060 Add.1 are two IMO circulars that can help develop Member States develop submissions on ships' routeing. Such submissions need to be made to IMO's Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) for assessment and approval as per MSC.1-Circ.1608.

3.1.3. SHIP REPORTING SYSTEMS

Ship Reporting Systems (SRS) are designed to provide coastal States with information on the presence of either all or specified categories of ships, within specific waters. SRS aim to enhance navigational safety and environmental protection and better respond in any developing situation.

SRS can also be a risk mitigator when establishing offshore renewable energy infrastructure.

As per SOLAS Ch V/11, IMO is recognized as the only international body for developing guidelines, criteria and regulations on an international level for ship reporting systems.

3.1.4. VESSEL TRAFFIC SERVICES

As per SOLAS Ch V/12 contracting governments planning and implementing VTS shall, wherever possible, follow IMO guideline (IMO Res A.1158 (32)). The use of VTS may only be made mandatory in sea areas within the territorial seas of a coastal state.

VTS should have the capability to interact with vessel traffic and respond to developing situations within a VTS area to improve the safety of navigation. Therefore, VTS could be considered a risk mitigation measure for OREI.

3.1.5. SAFETY AND CAUTIONARY ZONES

Safety Zones

Under the United Nations Convention on the Law of the Sea 1982, coastal states have exclusive rights over artificial islands and structures in their exclusive economic zones (EEZ). These constructions can provide economic benefits. However, they must not hinder safe navigation or harm the environment. The coastal state has full jurisdiction over these structures, including customs, fiscal, health, safety, and immigration regulations.

Coastal states can establish safety zones around these installations to ensure navigational safety. Ships must have due regard for these zones and international navigation practices. It's important to note that these structures do not create territorial seas, EEZs, or affect their boundaries.

Within these safety zones navigation can be prohibited for all or certain types of vessel.

Cautionary Areas / Extended Safety Zone

Cautionary Areas / Extended Safety Zones designated by national authorities can be an integral part of the developments safety management systems.

An example of these areas extending around a windfarm and the associated cable corridor in Portugal is shown below.



Figure 1 Example of Charted Safety Zone from Portugal

Rules can be made for navigating within and in the proximity of such areas.

Areas To Be Avoided

An Area To Be Avoided is a routing measure comprising an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or certain classes of ship.

National Competent Authorities could consider establishing Areas to Be Avoided in or around OREI based on the results of any risk assessment conducted as a potential risk mitigator. Restrictions can be applied to navigating within such areas.

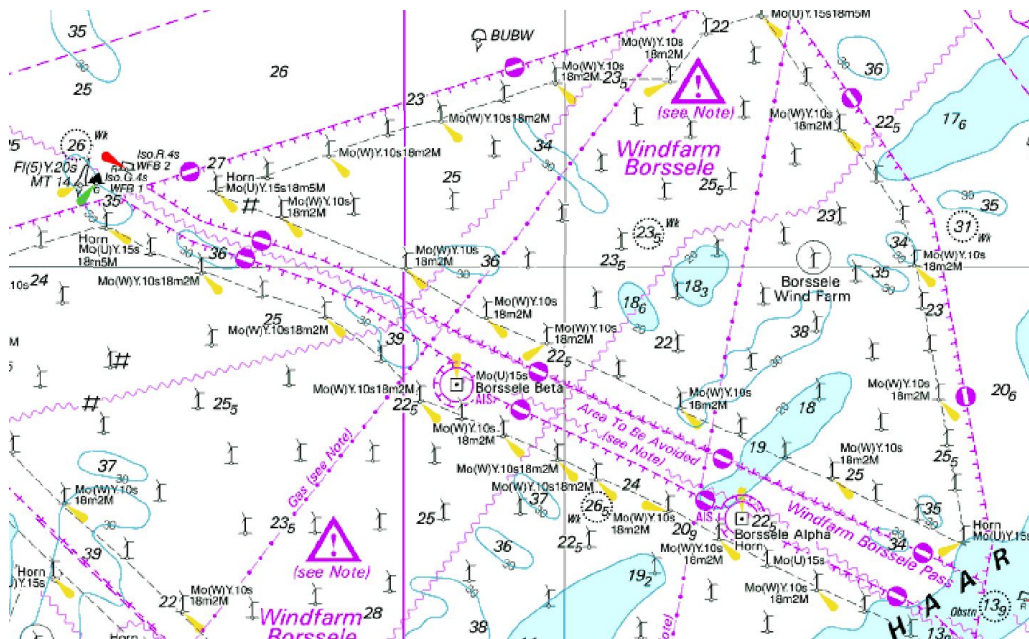


Figure 2 Example of Area to Be Avoided at Netherlands OREI shown on UKHO Chart

3.1.6. SAFETY DISTANCES

Mariners must be advised to exercise caution and allow a safe distance when navigating in close proximity to and within OREI.



IMO Doc GPSR Paragraph 3 - 14 gives member states formal guidance on recommended safe distances from offshore infrastructure. This documentation can be cross referenced to NCSR3/Inf.9

PIANC report no: 161 recommends safe distances to be maintained between traffic lanes, channel entrances, and OREI depending on the identified type of traffic and level of risk acceptable to the National Competent Authority.

A formal risk assessment will assist in determining these distances. Factors to be considered include the location of the OREI, weather conditions including potential ice coverage, current and projected growth and patterns of maritime traffic.

3.2. LIGHTING AND MARKING

There is guidance available for the lighting and marking of OREI for safe marine navigation. The lighting and marking of OREI should be in accordance with the latest edition of IALA Guideline *G1162 The Marking Of Offshore Man-Made Structures*.

Developers should consult this guideline and with the National Competent Authorities.

AtoN lighting can be obscured to vessels operating in the area. The AtoN must not be confused with other lighting including working lights and other background lighting.

3.2.1. ADJACENT DEVELOPMENTS AND EXTENSIONS

OREI which are extended, or adjacent developments are constructed close to each other, could be perceived by an external observer as one OREI impacting the safety of navigation. National Competent Authorities and developers should ensure mitigation measures are taken to reduce the perceived impact.

National Authorities should cooperate with each other when OREI are constructed at, or near, international borders.

3.3. NAUTICAL CHARTS AND PUBLICATIONS

All OREI should be charted by the national hydrographic authority appropriately for the different phases of the development during construction, operation and decommissioning. Whether all individual structures and submarine cables associated with the OREI appear on a chart depends on the scale of the chart.

Significant depth reductions may be encountered where cables cross or have additional protection laid on them where burial depths have not been achieved. This should be apparent to the mariner from accurate charting and taken into consideration when passage planning over cables.

Developers and mariners should be aware that individual devices, sub stations, cables to and from devices, and other infrastructure may not be visible on ENC if the operator has not displayed the corresponding layer.

Competent Authorities could consider identifying and establishing navigable channels, or recommended routes, around or through OREI areas.

3.4. OBSCURATION OF OTHER VESSELS

Vessels, including remote or autonomous units, involved in turbine maintenance and safety duties may be encountered within or around a wind farm. 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 when other vessels navigating through, or past installations may become obscured or confused with background lighting from turbines of other devices.

3.5. IMPACT ON COMMUNICATIONS

VHF maritime communication may be impacted by physical deployment of OREI and could be impacted by the associated VHF communication infrastructure deployed at these installations to support other systems. These radiocommunication capabilities could include command and control systems, emergency warning and information systems, security communications or general radiocommunications (land mobile).

Operators of OREI should ensure radiocommunication site planning is undertaken to minimize interference being caused to, or from, maritime radio communication systems.

3.6. IMPACT ON RADAR

3.6.1. IMPACT ON SHIPBORNE RADAR

Shipborne radar displays can be significantly impacted. At close range turbines may degrade radar performance that may mask real targets. The structures may also produce blind spots and shadow areas on the radar display.

Radar usage and settings for navigation during winter periods in ice differ from periods of clear waters. Potential radar interference by wind farms will be different for ice and open water navigation. In winter navigation, the use of radar requires receiving a reflection from the ice to find a navigable route, while during the open water season, radar is used to detect objects around the vessel.

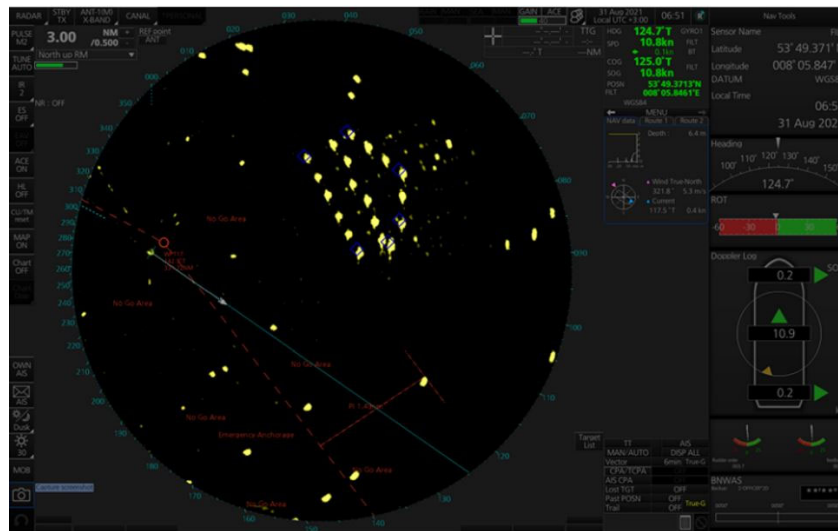


Figure 3 Finnish Infrastructure in Clear Seas

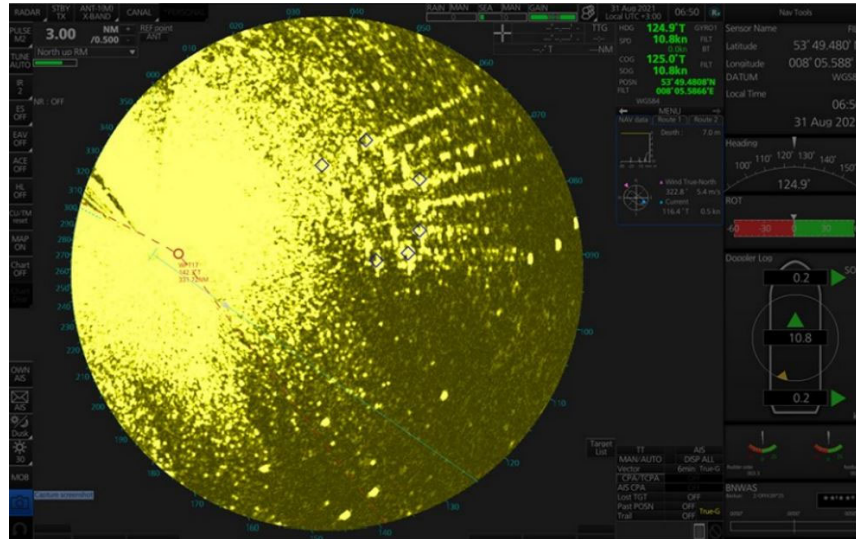


Figure 4 Same Finnish Infrastructure During Ice

3.6.2. IMPACT ON VTS RADAR

A wind turbine or farm may create a blind spot or false reflected signals for the VTS radar that interfere with radar surveillance and make it more difficult to detect and locate vessels, especially if there are several blind spots and they are located close to each other.

3.7. WEATHER

Existing and predicted weather patterns and their affect on maritime traffic should be considered within the risk assessment process. This could include wind patterns, wave formation, and reductions in visibility due to fog.

3.8. ICE AND SUB POLAR REGIONS

Navigation during ice-free period differs significantly from navigation in ice. During harsh ice conditions space for maritime traffic cannot be limited to the straightforward routes used during ice-free periods.

Winter navigation routes are dependant on the ice situation at the given moment. Using the optimal route in ice conditions is a key factor in maintaining the smooth, low-emission operation of navigation to the ports of the area during the winter season. OREI placed in the vicinity of shipping channels and areas of maritime activity increase the need for assistance during winter navigation. To ensure the safety of navigation it is not possible to leave vessels waiting for assistance in moving ice near OREI. For instance; as the masses of ice move, the ice may push the vessel towards a wind farm which may cause the vessel to collide with a wind turbine.

Cameras and radar equipment suitable for monitoring the movement of ice in or around OREI could improve the monitoring of the overall ice situation in order to assign icebreaking assistance.

3.9. INTERACTION WITH AVIATION

Offshore renewable energy sites also display navigational warning lights prescribed by the national aviation authority. These lights are normally red and have various characteristics depending on the national requirement, they are also higher powered and visible from longer ranges than marine AtoN so the mariner will see these first and should take care not to confuse these with smaller vessel navigation lights.

4. INCIDENT RESPONSE

4.1. SEARCH AND RESCUE (SAR)

This section is based broadly on policy documents published online by the Maritime & Coastguard Agency UK (MCA). These documents include Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR & Emergency Response and Marine Guidance Notice (MGN) 654. For further information on SAR within or in the vicinity of OREI, Administrations could refer to these documents.

A SAR response can be degraded due to the presence of OREI. Therefore, Administrations have a significant interest in their layout and operation. It is vital OREI are sited, constructed, equipped, and operated so as to minimise their impact on any SAR or emergency response and salvage operation. OREI developers should be required to provide evidence of suitable risk mitigation measures in this regard.

Based on international experience and empirical evidence, principal measures strongly recommended for effective SAR in and around any OREI include:

- Linear layout of individual turbines, with preferably 2 lines of orientation
- SAR Lanes
- Clear and unique identification marking visible to surface vessels and SAR aircraft
- Control and rapid shutdown of individual and groups of OREI devices (wind turbines in particular)

The layouts of OREI with fixed, floating and/or surface piercing devices and structures must be designed to allow safe transit of surface vessels, including rescue craft and SAR helicopters through OREI.

Multiple lines of orientation are preferred as they provide alternative options for planning SAR operations for vessels and aircraft to counter the effects of the environment (e.g. sea state, tide, and visibility) on manoeuvring.

Where a project proposes only one line of orientation, this should be discussed by developers with National Competent Authorities and a safety justification should be prepared and submitted to support.

4.1.1. REFUGE AREAS

Where OREI are proposed be to very large National Competent Authorities may request refuge areas being included in the layout.

4.2. SHIP LOSS OF PROPULSION

Sufficient margin between OREI and shipping lanes should be maintained to mitigate the risk of vessels losing power/propulsion and drifting into the developed area. The National Competent Authority should advise the developers on the required safe distance, or potential other mitigation like Emergency Response Vessels, on a case by case basis for the development.

4.3. COLLISIONS, ALLISIONS AND GROUNDINGS

The establishment of OREI will increase the risk of collision, allision and possibly grounding in the area.

National Competent Authorities and Developers should have, and regularly review, plans for reacting to accidents including collisions, allisions and groundings.

5. MARINE SPATIAL PLANNING



As per the Intergovernmental Oceanographic Commission (IOC) of UNESCO (2009), Maritime Spatial Planning is defined as a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives specified through a political process.

The main purpose of Marine Spatial Planning is to achieve a balance between navigational safety, environmental protection, economic effects and communication (information management) (R-1010 The Involvement of Maritime Authorities in Marine Spatial Planning (MSP)).

Specific navigational concerns should be considered when assessing the impact on existing marine traffic routeing and navigational safety caused by offshore developments (IALA Guideline G1121 Navigational Safety within Marine Spatial Planning).

A formal, national and multi-lateral Marine Spatial Planning process is important, as it can bring together multiple stakeholders, such as governments, shipping, OREI, aquaculture, fishing, conservation and recreational users, to make informed, coordinated decisions on how to use marine resources sustainably and reduce conflict between users.

5.1. FREEDOM OF NAVIGATION AND INNOCENT PASSAGE

Part V of UNCLOS is about the Exclusive Economic Zone (EEZ) and amongst others addressing issues about rights, jurisdiction and duties of the coastal states. This actively interacts with Marine Spatial Planning and therefore OREI. This is more specifically addressed in art 60.

UNCLOS contains sections addressing the principles, rights and requirements of freedom of navigation and innocent passage.

IALA members recognise the need to identify what is a “recognised sea lane” and interpretation differs globally.

“recognised sea lanes” could include, but not be limited to, shipping routes linking recognised IMO routeing measures, historical routes along nations coastal water and between nations primarily used by commercial shipping.

6. OTHER CONSIDERATIONS

6.1. MARITIME AUTONOMOUS SURFACE SHIPS (MASS)

National Competent Authorities and OREI developers need to be aware of the increasing use of differing types of MASS. Mitigation measures for the safe operation of MASS in or around OREI should be implemented as agreed between all stakeholders.

7. ACRONYMS AND ABBREVIATIONS

AtoN	Aid(s) to Navigation
EEZ	Exclusive Economic Zone
ENC	Electronic Navigational Chart
FSA	Formal Safety Assessment
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission
ISO	International Standards Organisation



MASS	Maritime Autonomous Surface Ships
OREI	Offshore Renewable Energy Infrastructure
PIANC	World Association for Waterborne Transport Infrastructure
SAR	Search and Rescue
SOLAS	International Convention for the Safety of Life at Sea 1974
TSS	Traffic Separation Scheme
UNCLOS	United Nations Convention on the Law of the Sea
VHF	Very High Frequency
VTS	Vessel Traffic Services