

# Pentland floating offshore wind farm

## Volume 2: Offshore EIAR

Chapter 21: Risk of Major Accidents and/or Disasters

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## GLOSSARY OF PROJECT TERMS

Key Terms	Definition
Dounreay Tri Floating Wind Demonstration Project (the 'Dounreay Tri Project')	The 2017 consented project that was previously owned by Dounreay Tri Limited (in administration) and acquired by Highland Wind Limited (HWL) in 2020. The Dounreay Tri Project consent was for two demonstrator floating Wind Turbine Generators (WTGs) with a marine licence that overlaps with the Offshore Development, as defined. The offshore components of the Dounreay Tri Project consent are no longer being implemented.
Highland Wind Limited	The Developer of the Project (defined below) and the Applicant for the associated consents and licences.
Landfall	The point where the Offshore Export Cable(s) from the PFOWF Array Area, as defined, will be brought ashore.
Offshore Export Cable(s)	The cable(s) that transmits electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OECC)	The area within which the Offshore Export Cable(s) will be located.
Offshore Site	The area encompassing the PFOWF Array Area and OECC, as defined.
Onshore Site	The area encompassing the PFOWF Onshore Transmission Infrastructure, as defined.
Pentland Floating Offshore Wind Farm (PFOWF) Array and Offshore Export Cable(s) (the 'Offshore Development')	All offshore components of the Project (WTGs, inter-array and Offshore Export Cable(s), floating substructures, and all other associated offshore infrastructure) required during operation of the Project, for which HWL are seeking consent. The Offshore Development is the focus of this Environmental Impact Assessment Report.
PFOWF Array	All WTGs, inter-array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the PFOWF Array Area, as defined, excluding the Offshore Export Cable(s).
PFOWF Array Area	The area where the WTGs will be located within the Offshore Site, as defined.
PFOWF Onshore Transmission Infrastructure (the 'Onshore Development')	All onshore components of the Project, including horizontal directional drilling, onshore cables (i.e. those above mean low water springs), transition joint bay, cable joint bays, substation, construction compound, and access (and all other associated infrastructure) across all project phases from development to decommissioning, for which HWL are seeking consent from The Highland Council.
PFOWF Project (the 'Project')	The combined Offshore Development and Onshore Development, as defined.

## ACRONYMS AND ABBREVIATIONS

BGS	British Geological Survey
CBRN	Chemical, biological, radiological and nuclear
CDM	Construction (Design and Management)
CEMP	Construction Environmental Management Plan
CMS	Construction Method Statement
COP	Copenhagen Offshore Partners
CRR	Community Risk Register
DSLPL	Development Specification and Layout Plan
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EU	European Union
FLO	Fisheries Liaison Officer
FSA	Formal Safety Assessment
HWL	Highland Wind Limited
HSE	Health and Safety Executive
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organization
ISO	International Organisation for Standardisation
MGN	Marine Guidance Note
MMO	Marine Mammal Observer
MS-LOT	Marine Scotland Licencing Operations Team
NATO	North Atlantic Treaty Organisation
NRR	National Risk Register
OEMP	Operational Environmental Management Plan
OHSAS	Occupational Health and Safety Assessment Serie
OREI	Offshore Renewable Energy Installations
PAM	Passive Acoustic Monitoring
PFOWF	Pentland Floating Offshore Wind Farm
PS	Piling Strategy
SAR	Search and Rescue
SCADA	Supervisory control and data acquisition
THC	The Highland Council
UK	United Kingdom
UN	United Nations
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator

## 21 RISK OF MAJOR ACCIDENTS AND/OR DISASTERS

### 21.1 Introduction

This chapter presents a description of potential Major Accidents and/or Disasters relevant to the PFOWF Array and Offshore Export Cable(s), hereafter referred to as the 'Offshore Development', during construction, operation and maintenance, and decommissioning.

In accordance with the Institute of Environmental Management and Assessment (IEMA) (2020) Guidance: Major Accidents and Disasters in EIA: A Primer:

- > a '*Major Accident*' is as an event that threatens immediate or delayed serious environmental effects to human health, welfare and/or the environment and requires the use of resources beyond those of the client or its appointed representatives (i.e. contractors) to manage. For example, effects that cause a fatality, multiple fatalities or permanent injury or widespread or irreversible harm or damage. Major Accidents can be caused by disasters resulting from both man-made and natural hazards.
- > A '*Disaster*' is a man-made/external hazard (such as an act of terrorism) or a natural hazard (such as an earthquake) with the potential to cause an event or situation that meets the definition of a major accident as described above.

There are two main areas of vulnerability for the Offshore Development. These are:

- > Internal project risks: Risks of the Offshore Development's potential to cause a major accident and/or disaster.
- > External project risks: The vulnerability of the Offshore Development to a potential major accident and/or disaster.

These risks have been identified for the Offshore Development and have been assessed within this chapter. The chapter identifies the processes and measures which will be implemented to prevent a potential Major Accident and/or Disaster and to mitigate the significance of effects arising from risks identified. In certain instances, risks identified have been assessed elsewhere within this Offshore Environmental Impact Assessment Report (EIAR), and where this is the case, these assessments are signposted.

Xodus Group Limited have carried out this assessment. Further details of the Project Team's competency including lead authors for each chapter are provided Volume 3: Appendix 1.1: Details of the Project Team of this Offshore EIAR.

### 21.2 Legislation, Policy and Guidance

In addition to those described in Chapter 3: Policy and Legislative Context of this EIAR, the following key relevant legislation, strategy and guidance relating to the assessment of Major Accidents and/or Disasters was used in the preparation of this Chapter:

#### 21.2.1 Legislation

- > EIA Regulations

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, known collectively as 'The EIA Regulations' (as detailed in Chapter 2: Legislation and Policy), requires the EIA to consider:

*'Expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development.'*

The EIA Regulations also detail that an EIAR should include:

*'A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information*

*available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.'*

> Health and Safety at Work etc. Act 1974

The Health and Safety at Work Act is the primary legislative instrument covering workplace health and safety in the UK. The Act establishes various obligations to ensure, so far as is reasonably practicable, that persons are not exposed to risks to their health and safety.

Several regulations made under the Act place general duties on employers to assess risks and to implement controls. The overriding principle is that foreseeable risks to persons shall be reduced so far as is reasonably practicable and that adequate evidence shall be produced to demonstrate that this has been done.

> Construction (Design and Management) (CDM) 2015 Regulations

The CDM Regulations place specific duties on clients, designers, contractors and workers, so that health and safety is considered throughout the life of a construction project from its inception to its subsequent final demolition and removal. They include the requirement to appoint a Principal Designer and Principal Contractor to co-ordinate health and safety aspects during construction.

Under the CDM Regulations, designers must avoid foreseeable risks so far as reasonably practicable by eliminating hazards from the construction, cleaning, maintenance, and proposed use and demolition of a structure; reducing risks from any remaining hazard; and giving collective safety measures priority over individual measures.

> The Management of Health and Safety at Work Regulations 1999

These regulations generally make more explicit what employers are required to do to manage health and safety under the Health and Safety at Work etc. Act 1974.

> Electricity at Work Regulations (1989 No. 635)

The purpose of the Regulations is to require precautions to be taken against the risk of death or personal injury from electricity in work activities.

> EU Regulation 402/2013 on the Common Safety Method on Risk Evaluation and Assessment (CSM-RA) (as amended by Regulation EU 2015/1136)

An EU Regulation that describes the methods required to be used to assess compliance with safety levels and safety requirements.

> The Planning (Hazardous Substances) Regulations 2015

The Planning (Hazardous Substances) Regulations 2015 implement land-use planning requirements under the Seveso III Directive (2012/18/ EU) on the Control of Major Accident Hazards (COMAH). Hazardous substances consent is required for the presence of certain hazardous substances at, or above controlled quantities specified.

> COMAH Regulations 2015

The COMAH Regulations aim to prevent and mitigate the effects of major accidents involving dangerous substances which can cause serious damage/harm to people and/or the environment. COMAH treats risks to the environment as seriously as those to people.

> Seveso III Directive

Main EU legislation dealing specifically with the control of onshore major accident hazards involving dangerous substances.

### 21.2.2 Strategy

- > North of Scotland - Community Risk Register 2021, Regional Resilience Partnership

This Community Risk Register (CRR) highlights risks that have the highest likelihood and potential to have significant impact, causing disruption to the North of Scotland region and its communities.

- > National Risk Register – 2020 edition, HM Government

The National Risk Register (NRR) provides information on the most significant risks that could occur in the next two years and which could have a wide range of impacts on the UK.

### 21.2.3 Guidance

The following guidance has been used to inform the assessment of Major Accidents and/or Disasters for the Offshore Development:

- > IEMA (2020) Guidance: Major Accidents and Disasters in EIA: A Primer

The structure of the assessment of Major Accidents and/or Disasters aligns with the Guidance. This is a standalone chapter, which cross-references to other EIA topics where necessary, and the assessment focuses on risks which are seen to be of low likelihood but are of potentially high consequence if realised.

- > International Maritime Organization (IMO) (2018): Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO Rule-Making Process

The FSA is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment, and property. FSA can be used as a tool to help in the evaluation of new regulations for maritime safety and protection of the marine environment. The FSA approach to risk assessment is applicable to the Offshore Development and has been used to derive the approach to the risk assessment presented within this chapter.

- > Health and Safety Executive (HSE) (2001): Reducing Risks, Protecting People HSE's Decision-Making Process

This document describes HSE's decision-making process. It makes transparent the protocols and procedures HSE follow to ensure that the process of decision-making, including risk assessment and risk management, is perceived as valid. This document has been used to derive the approach to the risk assessment presented within this chapter.

- > The G + Global Offshore Wind Health and Safety Organisation: Good Practice Guidelines Database

The G+ has published six good practice guidance documents to date. The guidance is intended to be used by all to improve global health and safety standards within offshore wind farms. The guidance documents have been considered whilst undertaking this assessment.

## 21.3 Scoping and Consultation

Scoping and consultation has been ongoing throughout the EIA process and has played an important part in ensuring the scopes of the baseline characterisation and impact assessment are appropriate with respect to the Offshore Development and the requirements of the regulators and their advisors.

Relevant comments from the EIA Scoping Opinion and the Scoping Opinion Addendum specific to Major Accidents and/or Disasters provided by Marine Scotland Licensing Operations Team (MS-LOT) on behalf of Scottish Ministers are summarised in Table 21.1 below, which provides a high level response on how these comments have been addressed within the Offshore EIAR.

Table 21.1 Summary of consultation responses specific to Major Accidents and/ or Disasters

Consultee	Comment/ Issue Raised	Offshore Development Approach and Section ID
<b>Scoping Opinion</b>		
MS-LOT, on behalf of Scottish Ministers	<p><i>Major Accidents and Disasters</i></p> <p><i>5.21.2 The Developer considers major accidents and disasters associated with the construction and operation of the Onshore Proposed Development. The Scottish Ministers agree that the assessment in relation to major accidents and disasters in relation to the Onshore Proposed Development can be scoped out of the EIA Report. However, the Scottish Ministers request that the Developer considers major accidents and disasters associated with the Offshore Proposed Development. Further details regarding this are provided in section 3.4 of this Scoping Opinion.</i></p>	<p>This chapter has been prepared to ensure adequate consideration of Major Accidents and Disasters is given in relation to the Offshore Development.</p>
	<p><i>3.4 Risks of Major Accidents and/or Disasters</i></p> <p><i>3.4.1 The EIA Report must include a description and assessment of the likely significant effects deriving from the vulnerability of the Proposed Development to major accidents and disasters. The Applicant should make use of appropriate guidance, including the recent Institute of Environmental Management and Assessment (“IEMA”) ‘Major Accidents and Disasters in EIA: A Primer’, to better understand the likelihood of an occurrence and the Proposed Development’s susceptibility to potential major accidents and hazards. The description and assessment should consider the vulnerability of the Proposed Development to a potential accident or disaster and also the Proposed Development’s potential to cause an accident or disaster.</i></p>	<p>This chapter has been prepared in accordance with the IEMA Major Accidents and Disasters in EIA: A Primer’ Guidance. This chapter also includes an assessment of the Offshore Development’s potential to cause a Major Accident and/or Disaster as well as the Offshore Development’s vulnerability to external Major Accidents and/or Disasters.</p>
<b>Scoping Opinion Addendum</b>		
MS-LOT, on behalf of Scottish Ministers	<p><i>Risks of Major Accidents and/or Disasters</i></p> <p><i>The EIA Report must include a description and assessment of the likely significant effects deriving from the vulnerability of the Proposed Development to major accidents and disasters. The Developer has indicated in the Scoping Report that major accidents and disasters are to be considered in relation to the onshore development. The Scottish Ministers wish to highlight that this must also be considered in relation to the offshore Proposed Development. The Developer should make use of appropriate guidance, including the recent Institute of Environmental Management and Assessment (“IEMA”) ‘Major Accidents and Disasters in EIA: A Primer’, to better understand the likelihood of an occurrence and the Proposed Development’s susceptibility to potential major accidents and hazards. The description and assessment should consider the vulnerability of the Proposed Development to a potential accident or disaster and also the Proposed Development’s potential to cause an accident or disaster.</i></p>	<p>This chapter has been prepared to ensure adequate consideration of Major Accidents and/or Disasters is given in relation to the Offshore Development. This chapter has been prepared in accordance with the IEMA Major Accidents and Disasters in EIA: A Primer’ Guidance. This chapter also includes an assessment of the Offshore Developments potential to cause a Major Accident and/or Disaster as well as the Offshore Development’s vulnerability to external Major Accidents and/or Disasters.</p>

Consultee	Comment/ Issue Raised	Offshore Development Approach and Section ID
MS-LOT, on behalf of Scottish Ministers	<p><i>Risks of Major Accidents and/or Disasters</i></p> <p><i>The Scottish Ministers advise that existing sources of risk assessment or other relevant studies should be used to establish the baseline rather than collecting survey data and note the IEMA Primer provides further advice on this. This should include the review of the identified hazards from your baseline assessment, the level of risk attributed to the identified hazards and the relevant receptors to be considered.</i></p>	As detailed in Section 21.4.4 of this chapter, relevant publicly available sources have been used to establish the baseline of hazards for the Offshore Development. This has been supplemented with reference to the project specific Construction Design Management (CDM) risk register. An assessment of these hazards has been undertaken and those of relevance have been attributed a risk level and receptor, as presented in Section 21.9.
	<p><i>Risks of Major Accidents and/or Disasters</i></p> <p><i>The assessment must detail how significance has been defined and detail the inclusions and exclusions within the assessment. Any mitigation measures that will be employed to prevent, reduce or control significant effects should be included in the EIA Report.</i></p>	Details of inclusions and exclusions to the risk assessment are provided in Section 21.4.6. Details of embedded mitigations and management plans are provided in Section 21.7 of this chapter. No additional embedded mitigation or management plans are required to mitigate the risks assessed.

## 21.4 Baseline Characterisation

In line with the EIA Directive and advice from Scottish Ministers, the baseline characterisation herein is informed by existing sources of information, in order to identify the hazards of relevance to the Offshore Development and inform the risk assessment, rather than collecting survey data (as is typically the case for other EIA receptor topics).

In line with the IEMA Guidance, standalone risk assessments for Major Accidents and Disasters have not been undertaken as existing public sources of data are available to inform the baseline. The sources used are detailed below in Section 21.4.3.

### 21.4.1 Hazard Scope

For the purpose of this baseline, hazards are defined as something with the potential to cause harm, that could result in a major accident and/or disaster occurring. A risk is the likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur.

The hazards identified during the baseline characterisation are assessed in terms of their potential to interact with the Offshore Development by means of reviewing the source-pathway-receptor model, as detailed in Chapter 6: EIA Methodology.

In line with the IEMA Guidance, hazards which meet the following criteria have not been taken forward to the risk assessment (as presented in Section 21.9) if:

- > The Offshore Development is not vulnerable to the hazard, or will not cause the hazard;
- > The hazard is unlikely to result in effects that cause a fatality, multiple fatalities, permanent injury, widespread or irreversible harm or damage i.e. would not result in a major accident and/or disaster;
- > There is either no credible pathway or receptor in terms of EIA Regulations;
- > The accident involves a workplace hazard, which can only impact the workers undertaking the task such as falls from height or misuse of tools. This is considered to be an occupational health and safety incident which is managed through compliance with the Management of Health and Safety at Work Regulations and not the intended purpose of EIA (as detailed in Section 21.4.1.1 below); or
- > The hazard has been risk assessed within another chapter of this EIAR.

#### 21.4.1.1 Workplace hazards

As detailed above, workplace hazards are exempt from the scope of this assessment as these hazards are managed through relevant HSE legislation as detailed in Section 21.2. Nonetheless, the following Safety Management Systems will be implemented to ensure these hazards are managed robustly. The Safety Management Systems for the Offshore Development include the following:

- > **HSE Resource:** Ensuring the project has access to safety expertise when required;
- > **Competence:** Ensuring all direct parties involved in the project have the training, knowledge and experience to deliver their works safely;
- > **Supply Chain Selection:** Ensuring the potential supply chain is assessed and can meet the project HSE expectations;
- > **Safety by Design:** Ensuring the correct design principals are applied to allow hazards to be eliminated where possible and mitigated to a level considered As Low As Reasonably Practicable (ALARP) where elimination is not possible;
- > **Works Planning:** Ensuring works are planned in a way that considers the workers' safety throughout;
- > **Safe Systems of Work:** Ensuring the workers have the required information to carried out their works safely, these include Risk Assessments, Method Statements, Permits to Work and Emergency Response Procedures;
- > **Monitoring and Supervision:** Where required, carrying out checks to ensure works are being delivered as planned; and
- > **Incident Investigation and lessons learned:** Ensuring measures are in place to carry out effective investigation into incidents in order to prevent reoccurrence.

#### 21.4.2 Study Area

The principal study area for the assessment of Major Accidents and/or Disasters is the Offshore Site (the area in which the Offshore Development is to be located within the Pentland Firth).

North Scotland, including the Highland Council (THC) local authority area, is considered to identify potential hazards at a local (Caithness) and regional (Scotland) level which may be of relevance to the Offshore Development.

Consideration has also been given to the UK as a whole to identify any national hazards which may be of relevance to the Offshore Development.

These key areas are shown on Figure 21.1.

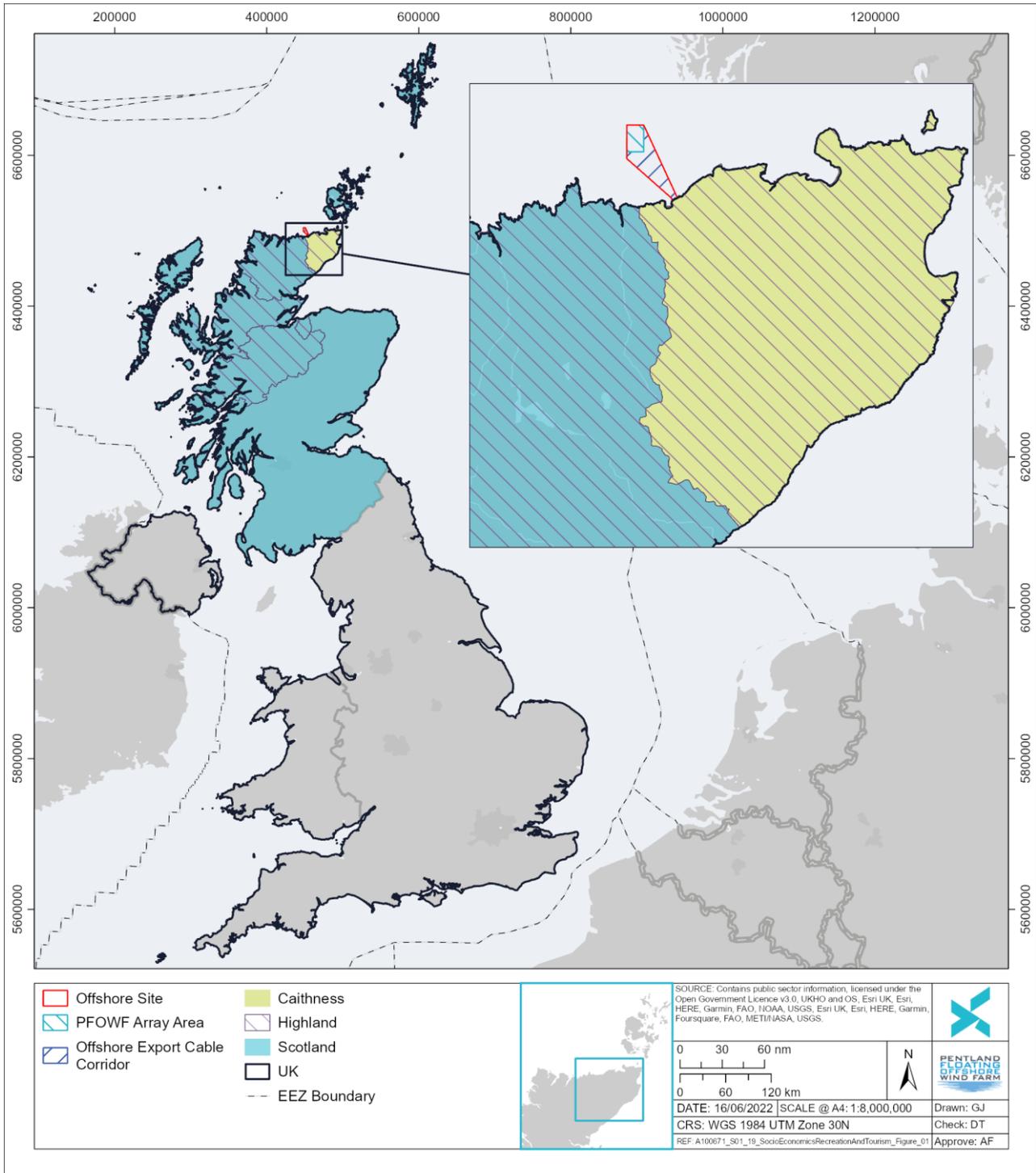


Figure 21.1 Major Accidents and Disasters Study Areas

### 21.4.3 Sources of Information

A review of the literature and data relevant to this assessment relating to Risk of Major Accidents and/or Disasters has been undertaken. The primary data sources used in the preparation of this chapter are listed below in Table 21.2.

Table 21.2 Summary of key sources of information pertaining to Risk of Major Accidents and/or Disasters

Title	Source	Year	Author
North of Scotland - Community Risk Register	<a href="https://www.highland.gov.uk/downloads/file/24009/community_risk_register_by_north_of_scotland_rrp">https://www.highland.gov.uk/downloads/file/24009/community_risk_register_by_north_of_scotland_rrp</a>	2021	Regional Resilience Partnership
National Risk Register	<a href="https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952959/6.6920_CO_CCS_s_National_Risk_Register_2020_11-1-21-FINAL.pdf">https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952959/6.6920_CO_CCS_s_National_Risk_Register_2020_11-1-21-FINAL.pdf</a>	2020	HM Government
Offshore Development CDM Risk Register	n/a	2022	HWL
Global Offshore Wind Health and Safety Organisation: Good Practice Guidelines	<a href="https://www.gplusoffshorewind.com/workprogramme/workstreams/guidelines">https://www.gplusoffshorewind.com/workprogramme/workstreams/guidelines</a>	2022	The G+
Global Offshore Wind Health and Safety Organisation: Learning From Incidents	<a href="https://www.gplusoffshorewind.com/workprogramme/workstreams/learning-from-incidents">https://www.gplusoffshorewind.com/workprogramme/workstreams/learning-from-incidents</a>	2022	The G+

### 21.4.4 Baseline Data Collection and Scope of Assessment

#### 21.4.4.1 North of Scotland - Community Risk Register 2021

The following hazards presented in Table 21.3, have been identified within the CRR for the North of Scotland, including Caithness. These have been reviewed to determine; whether the hazard could be a vulnerability for the Offshore Development; whether the hazard could be caused by the Offshore Development; and whether these hazards have the potential to cause a Major Accident and/or Disaster.

Hazards with the potential to result in a Major Accident and/or Disaster have been taken forward to be assessed within the risk assessment.

Table 21.3 Hazards identified from the North of Scotland Community Risk Register 2021

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
Human and animal health	Pandemic Diseases	No	<p>The Offshore Development will not cause the outbreak of pandemic diseases given the nature of the development.</p> <p>Project personnel will comply with the relevant government guidance and risk assessments to ensure that no significant consequence on the Offshore Development would result if a pandemic was to occur, as has been demonstrated by the</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			<p>project to date throughout the COVID 19 Pandemic. As such the Offshore Development is not vulnerable to this hazard.</p> <p>The Offshore Development will not cause the hazard to occur, and neither is the Offshore Development vulnerable to the hazard. This hazard is therefore not considered further within this chapter.</p>		
	Pollution and Contamination	Yes	<p>There is a pathway for the Offshore Development to cause potential pollution and contamination impacts throughout the lifetime of the Offshore Development from vessels servicing the Offshore Development infrastructure. These risks have been assessed in Chapter 8: Water and Sediment Quality; Chapter 9: Benthic Ecology; Chapter 10: Fish and Shellfish Ecology; Chapter 11: Marine Mammals and Other Megafauna; Chapter 12: Marine Ornithology; and Chapter 14: Shipping and Navigation and therefore have not been considered further within this chapter.</p> <p>The Offshore Development will not be vulnerable to pollution and contamination and therefore this hazard has not been assessed within this chapter.</p>	No	No
Environmental	Severe Weather	Yes	<p>The Offshore Development may be vulnerable to the occurrence of severe weather events including high winds and storm surges, particularly associated with climate change, given the location of the development. The Offshore Development's resilience to climate change has been assessed within Chapter 20: Climate Change and Carbon within this EIA and is therefore not considered further within this chapter.</p> <p>The potential impacts from the Offshore Development in combination with severe weather</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			associated with climate change is also considered to be a pathway for which an assessment has been undertaken within Chapter 20: Climate Change and Carbon and is therefore not considered further within this chapter further.		
	Flooding	No	<p>The Offshore Development is marine based and as such there is no pathway for the Offshore Development to contribute to flood events. The Offshore Development is therefore not vulnerable to this hazard and will not cause this hazard to occur. It is therefore not considered further within this chapter.</p> <p>Flooding risks pertain to the PFOWF Onshore Transmission Infrastructure (the Onshore Development) and have been assessed in the relevant Onshore consent application for the Project.</p>	No	No
Public Utilities	Interruption to Utilities	Yes	<p>There is a pathway for the Offshore Development to potentially cause this hazard to occur which may impact on utilities/services in the local area. These hazards have been risk assessed within Chapter 15: Aviation and Radar and Chapter 18: Other Users of the Marine Environment within this EIAR.</p> <p>System failures at the wider public utilities network (electricity, gas, water and telecommunications) could impact on the Offshore Development and affect operations temporarily; however, in line with the IEMA guidance, this is unlikely to cause a risk of a major accident and/or disaster and as such this hazard is not considered further within this chapter.</p>	No	No
Major Accidents	Industrial Site Accidents	Yes	<p>There is a pathway for the Offshore Development to cause a site accident based on human error.</p> <p>An industrial site accident in this regard is seen as one where the consequences are limited to the</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			workers directly undertaking the task, examples of this include: falls from height, manual handling injuries, ill effects resulting from exposure to excessive noise / vibration or hazardous substances, injury through the failure or the misuse of tools. However, as this is a workplace hazard and will be managed in accordance with Safety Management Systems (as discussed in Section 21.4.1.1), it is outwith the scope of the assessment and as such has not been considered further within this chapter.		
	Transport Disruptions	Yes	<p>There is a pathway for the Offshore Development to cause transport disruptions to vessel traffic throughout the lifetime of the Offshore Development. These hazards are risk assessed within Chapter 14: Shipping and Navigation and Offshore EIAR (Volume 3): Appendix 14.1: Navigation Risk Assessment and are therefore not considered further within this chapter.</p> <p>There is the potential that the Offshore Development could be vulnerable to any service disruptions at nearby ports servicing the Offshore Development which could affect operations temporarily; however, in line with the IEMA guidance, this unlikely to cause a risk of a major accident and/or disaster and as such this hazard is not considered further within this chapter.</p> <p>No transport disruptions to terrestrial transport services are anticipated as all offshore components will be transported via the sea from identified ports. Any vehicles used to transit components via roads to ports are managed through contractor risk assessments and are unlikely to result in transport disruptions.</p> <p>Risks to transport services from the Onshore Development have</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			been assessed within the relevant Onshore consent application for the Project.		
Malicious Attacks	Significant Cyber Attack affecting a public sector organisation	Yes	<p>There is the potential that the Offshore Development could be targeted and vulnerable to a Cyber Attack albeit the size, significance of effect and location of the Offshore Development limit this risk. Nonetheless, the Offshore Development will impose safeguarding procedures such as ensuring the Onshore Substation is physically secure, network segmentation is implemented where possible and practical, the systems are continuously monitored, all software is kept up to date along with general compliance with industry best practice, guidelines and procedures. As such, any attack would prevent any material damage to these assets therefore this hazard would not have the likelihood or resultant consequence that would result in a Major Accident and/or Disaster. Therefore this hazard has not been considered further within this chapter.</p> <p>Similarly, any attack on an external organisation through the Offshore Development would be mitigated against by these safeguarding measures and as such would not have the likelihood or resultant consequence that would result in a Major Accident or Disaster. Therefore this hazard has not been considered further within this chapter.</p>	No	No

#### 21.4.4.2 National Risk Register

The following hazard groups presented in Table 21.4, have been identified within the NRR for the UK. These have been reviewed to determine whether the hazard could be a vulnerability for the Offshore Development; whether the hazard could be caused by the Offshore Development; and whether these hazards have the potential to cause a Major Accident and/or Disaster.

Hazards with the potential to result in a Major Accident and/or Disaster will be taken forward to be assessed within the risk assessment.

Table 21.4 Hazards identified from the UK National Risk Register 2020

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
Environmental	Flooding	No	As described above in Table 21.3.	No	No
	Severe Weather	Yes	As described above in Table 21.3.	No	No
	Severe Space Weather	No	Severe space weather e.g. high magnitude solar flares are highly unlikely to impact the operations of the Offshore Development and as such the Offshore Development is not vulnerable to this hazard. The Offshore Development will also not cause severe space weather. This hazard is therefore not relevant to the Offshore Development and is not considered further within this chapter.	No	No
	Volcanic Eruptions	No	Due to the geographic location of the Offshore Development it is not vulnerable to volcanic eruptions and the Offshore Development will not contribute to volcanic eruptions. This hazard is therefore not relevant to the Offshore Development and is not considered further within this chapter.	No	No
	Poor Air Quality	No	<p>The Offshore Development will not cause poor air quality given the nature of the renewable energy development. All vessels supporting the Offshore Development will adhere to air quality guidelines.</p> <p>An assessment of the air quality effects from the Onshore Transmission Infrastructure (the Onshore Development) has been assessed within the associated Onshore consent application as required through the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.</p> <p>The Offshore Development is also not vulnerable to poor air quality. Therefore this hazard</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			has not been considered further within this chapter.		
	Earthquakes	Yes	<p>Earthquakes in the UK are moderately frequent but rarely result in large amounts of damage. A review of British Geological Seismic hazard data (BGS, 2020) shows the magnitude of earthquakes experienced within the vicinity of the Offshore Site is extremely low. As such the vulnerability of the Offshore Development is considered to be extremely low and this hazard is therefore not considered further within this chapter.</p> <p>Although subsea drilling may take place it is highly unlikely that these operations will cause an earthquake to occur, as such this is not a credible hazard, and it has not been considered further in this chapter. The risk of ground instability is considered in Section 21.4.4.3 below.</p>	No	No
Human and animal health	Human Diseases	No	As described above in Table 21.3.	No	No
	Animal Diseases		<p>The potential for the Offshore Development to adversely affect animal health from pollution and contamination on marine ecology receptors has been considered within Chapter 8: Water and Sediment Quality; Chapter 9: Benthic Ecology; Chapter 10: Fish and Shellfish Ecology; Chapter 11: Marine Mammals and Other Megafauna and Chapter 12: Marine Ornithology and is therefore not considered further within this chapter.</p> <p>The Offshore Development will not cause any specific animal related diseases e.g. foot and mouth disease and is not vulnerable to such diseases. Therefore, these hazards are not considered further in this chapter.</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
	Antimicrobial resistance		The Offshore Development has no pathway in which to contribute to antimicrobial resistance or be vulnerable to antimicrobial resistance. This hazard is therefore not relevant to the Offshore Development and is not considered further within this chapter.	No	No
Major Accidents	Widespread electricity failure	Yes	<p>There is a pathway for the Offshore Development to potentially impact on utilities/services in the local area. This has been assessed within Chapter 15: Aviation and Radar and Chapter 18: Other Users of the Marine Environment within this EIAR and therefore is not considered further within this chapter.</p> <p>There is no potential for the Offshore Development to cause a widespread electricity failure, any event that has the potential to disrupt the network will be controlled via the implementation of software and hardware solutions that are required to be implemented and tested as part of grid code compliance prior to the Offshore Development commencing operation. As such this hazard has not been considered further within this chapter.</p> <p>There is the potential that widespread electricity failure could impact upon the operations of the Offshore Development, however, any effects on the Offshore Development would likely only temporarily impact operations and would not result in a major accident or disaster and as such this hazard has not been considered further within this chapter.</p>	No	No
	System failures	Yes	There is the potential that system failures of the Offshore Development components could occur and cause the Offshore Development to malfunction	Yes	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			<p>potentially resulting in, for example, a loss of a blade at sea, or fire, which could cause injury or harm. This hazard has therefore been considered further within this chapter.</p> <p>As described above, there is the potential that external system failures of the wider national grid could impact on the Offshore Development. However, any effects on the Offshore Development would not result in a major accident or disaster and as such this hazard has not been considered further within this chapter. No other external system failures are considered to be a vulnerability for the Offshore Development.</p>		
	Major transport accidents	Yes	<p>The primary mode of transport for the construction and operation of the Offshore Development will be by vessels. The potential for a vessel accident to be caused by the Offshore Development has been considered within Chapter 14: Shipping and Navigation within this EIAR and within Offshore EIAR (Volume 3): Appendix 14.1: Navigational Risk Assessment. As such, these risks are not considered further within this chapter.</p> <p>Risks of transport accidents from the Onshore Development have been considered within the relevant Onshore consent application for the Project.</p> <p>Hazards associated with transport disruptions are discussed above in Table 21.3.</p>	No	No
	Major industrial accidents	Yes	<p>Major industrial accidents differ to those detailed in Table 21.3 above as they have the potential to impact on a much wider scale than just workers. There is a chance that if a major industrial accident occurred, such as an explosion, electrical fault or fire, that a turbine blade or other components could be lost which</p>	Yes	Yes

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			<p>could result in a major accident. Therefore this hazard has been considered further within this assessment.</p> <p>Additionally, there is the potential that the Offshore Development could be vulnerable to a major industrial accident associated with the nuclear establishments at the coast. Therefore this hazard has been considered further within this assessment.</p>		
	Major fires	Yes	<p>There is the potential that electrical faults could occur resulting in fires from the Offshore Development infrastructure. As such this hazard has been considered further within this assessment.</p> <p>External fire hazards such as lightning strikes at the Offshore Development could also occur, and in turn result in fires or electrical surges which could cause injury or harm. As such this hazard has also been considered further.</p>	Yes	Yes
Societal risks	Various risks identified	No	The Offshore Development will not cause and are not considered to be vulnerable to societal hazards. These hazards are considered to be controlled through UK legislation, policy and strategy which the Offshore Development will comply. These hazards are therefore not considered further within this chapter.	No	No
Malicious attacks	Attacks on publicly accessible locations	No	<p>The Offshore Development will not be publicly accessible without specialist vehicles and equipment and as such there is no pathway for this, as such this hazard has not been considered further within this chapter.</p> <p>The security of the onshore substation, control room and compound will be dealt with under a separate consent application where adequate</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			control measures will be identified.		
	Attacks on transport systems	No	The Offshore Development is not a transport system and transport systems used to support the Offshore Development are not open to the public. As such there is no pathway for this hazard. Potential for attacks on vessels supporting the Offshore Development will be managed by vessel operators in line with UK guidelines for these industries. As such this hazard has not been considered further within this chapter.	No	No
	Attacks on infrastructure (including cyber-attacks)	Yes	As described above in Table 21.3.	No	No
	Chemical, biological, radiological and nuclear (CBRN) attacks	Yes	The risk of a CBRN attack on the Offshore Development is highly unlikely given the nature of the development. The UK government continues to improve methods to detect and monitor the likelihood of an attack in the UK and to ensure emergency response protocols are in place should such an attack happen. The Offshore Development will not cause such an attack. This hazard is not one which the Offshore Development is significantly vulnerable to. As such, this hazard has not been considered further within this chapter.	No	No
	Disinformation	No	Disinformation is the concerted effort to create and deliberately spread false or manipulated information to deceive and mislead for political, personal or financial gain. Although falsehoods may be spread surrounding the Offshore Development, the Project will be regulated via licences and consent conditions and has a dedicated website which will accurately publish any press releases or updated information	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			on the Project to the public. This hazard will not be a hazard which could result in a major accident or disaster occurring. As such this hazard has not been considered further in this chapter.		
Risks occurring overseas	Risks occurring overseas	Yes	The Offshore Development is located wholly in the UK. Protocols put in place by the UK government, such as working with international partners including the UN and NATO are considered to mitigate against these hazards. Project protocols and risk assessments will be adhered to by employees of the Offshore Development travelling overseas. These hazards are not considered further within this chapter.	No	No

#### 21.4.4.3 Offshore Development CDM Register

Additional low likelihood but potentially high consequence risks have been identified from review of the Offshore Development CDM Register. These risks are considered in Table 21.5.

Table 21.5 Additional Hazards identified from the Offshore Development CDM Register

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
Marine Hazards	Unexploded Ordnance (UXO) within the Offshore Site	Yes	<p>UXO may be unintentionally encountered during the construction and decommissioning of the Offshore Development which could pose health and safety risks to people and the Offshore Development. As such this hazard has been considered further within this chapter.</p> <p>If UXO is encountered there may be additional risks to marine ecology. These risks have been considered within Chapter 10: Fish and Shellfish Ecology and Chapter 11: Marine Mammals and other Megafauna within this EIAR, and as such are not considered further within this chapter.</p>	Yes	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
	Radioactive particles in FEPA Closure Zone (and wider)	Yes	<p>Disturbance of radioactive contaminants within the FEPA Closure Zone have been considered in Chapter 8: Water and Sediment Quality, Chapter 9: Benthic Ecology and Chapter 10: Fish and Shellfish Ecology within this EIAR. As such these risks are not included further within this chapter.</p> <p>Disturbance of radioactive particles through construction activities could result in the public and/or workforce coming into direct contact with the significant particles resulting in injury. This hazard has therefore been considered further within this chapter.</p>	Yes	No
Subsea Operations	Ground Instability	Yes	<p>The Offshore Development will be working on the seabed and potentially drilling at depth. Therefore there is the potential for the Offshore Development to cause seabed collapse which may impact the marine environment, and therefore this hazard is considered further within this chapter.</p> <p>As detailed above in Table 21.4, the Offshore Site is not vulnerable to earthquakes or other seismic events and therefore, this hazard is not considered further within this chapter.</p>	Yes	No
Equipment Failure	Vessel collision and allision	Yes	Vessel collision and allision during the lifetime of the Offshore Development has been considered within Chapter 14: Shipping and Navigation within this EIAR and within Offshore EIAR (Volume 3): Appendix 14.1: Navigational Risk Assessment. As such these risks are not included further within this chapter.	No	No
	High elevation of WTG tower and rotor	Yes	Aircraft collision due to the presence of the Offshore Development has been considered within Chapter 15: Aviation and Radar within this EIAR. As such this risk is not	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			included further within this chapter.		
	Latent Design Errors	Yes	<p>Health or safety incident occurs due to latent design error, for example unnecessary working at height activity having to be carried out due to not applying the General Principal of Prevention as per CDM-15. However, all designs carried out for the Offshore Development are in line with relevant standards and all designers on the Project are trained and experienced. Furthermore, there will be an appointment of a Principal Designer to ensure design risk management activities are carried out and Project Basis of Design documents are in place to define Project design expectations.</p> <p>As this is a workplace hazard, it is outwith the scope of the assessment and therefore has not been considered further within this assessment.</p>	No	No
Workplace accidents/errors	e.g. Fall from height, confined space working hazards (suffocation, fire, fumigation), electrocution from working with live electrical conductors etc.	Yes	<p>These hazards are classified as workplace hazards and will be managed in accordance with Safety Management Systems (as discussed in Section 21.4.1.1). These hazards are therefore outwith the scope of the assessment and as such have not been considered further within this chapter.</p>	No	No
Disruption to Industry	Proximity of Offshore Development to Nuclear Facilities	Yes	<p>Potential for the Offshore Development to impact upon nuclear sites due to its proximity to these sites has been considered within Chapter 18: Other Users of the Marine Environment, and as such is not considered further within this chapter.</p>	No	No
	Mooring suspended in the water column and anchors elevated above seabed	Yes	<p>The potential for entanglement and snagging of fishing gear, anchors or other industrial equipment has been considered within Chapter 13: Commercial Fisheries; Chapter 14: Shipping and Navigation and Offshore</p>	No	No

Hazard		Pathway Identified	Rationale	Taken forward to the Risk Assessment	
Group	Type			Internal	External
			EIAR (Volume 3): Appendix 14.1: Navigational Risk Assessment. As such these risks are not included further within this chapter.		

#### 21.4.5 Data Gaps and Uncertainties

It is noted within the UK National Risk Register 2020 that the register is to be updated every two years with the next iteration due to be published in 2022. At the time of writing no publication of this document is available and this chapter has therefore been drafted on best available information.

There are considered to be no further gaps or uncertainties associated with the baseline data.

#### 21.4.6 Hazard Identification

As set out in Section 21.1 there are two main areas of vulnerability for the Offshore Development. These are:

- > Internal project risks: Risks of the Offshore Development's potential to cause a major accident and/or disaster.
- > External project risks: The vulnerability of the Offshore Development to a potential major accident and/or disaster.

The hazards identified during the baseline characterisation have been considered within these two groups.

#### 21.4.7 Summary of Hazards Scoped in for Assessment

A summary of the hazards identified through the baseline characterisation which are considered for the risk assessment within this chapter is provided in Table 21.6 below. These hazards have been assigned to each relevant phase of the Offshore Development. Each hazard has also been attributed to receptor groups which have the potential to be affected (for further details on receptor groups see Section 21.8.1.2).

These hazards are then analysed in Section 21.9 below, to determine the level of risk and, those which, if necessary, warrant further assessment.

Table 21.6 Potential Hazards requiring assessment

Hazard Group	Individual Hazard Covered	Hazard	Receptor*	Phase
<b>External Project Risks</b>				
Lightning Strike	Fire/ electrical surge		People / Environment / Material Asset	Construction, Operation and Maintenance
Major Industrial Accidents	Industrial Accident at neighbouring site		People / Material Asset	All phases
<b>Internal Project Risks</b>				
Electrical Systems Failure	Systems Failure / Electrical Fault / Explosions / Fires		People / Environment / Material Asset	Operation and Maintenance

Hazard Group	Individual Hazard Covered	Hazard	Receptor*	Phase
Marine Hazards	UXO encountered during Construction / Decommissioning (Mariners)		People	Construction and Decommissioning
	Radioactive particles in FEPA Closure Zone (and wider)		People	All phases
Subsea Operations	Ground Instability		Environment	Construction and Decommissioning

\* Note: for further details on receptor groups see Section 21.8.1.2

### 21.4.8 Summary of Hazards Scoped Out

Table 21.7 below shows the hazards identified within the baseline characterisation which have been scoped out for further consideration, either because the hazards are adequately risk assessed elsewhere within the EIAR, or because the hazards identified are not relevant to the Offshore Development and are therefore scoped out in line with the IEMA Guidance (Section 21.4.4 above).

Table 21.7 Hazards not requiring further assessment within this chapter

Hazard Group	Individual Hazard Covered	Chapter Assessed within this EIAR (if relevant)
<b>External Project Risks</b>		
Environmental	Severe Weather	> Chapter 20: Climate Change and Carbon
	Flooding	n/a – See Section 21.4.4 for rationale.
	Severe Space Weather	
	Volcanic Eruptions	
	Earthquakes	
	Poor Air Quality	
Human and animal health	Pandemic Diseases	n/a – See Section 21.4.4 for rationale.
	Pollution and Contamination	
	Human Diseases	
	Animal Diseases	
	Antimicrobial resistance	
Major Accidents	Widespread electricity failure/ external system failure	n/a – See Section 21.4.4 for rationale.
Transport Disruptions	Disruption at Ports	n/a – See Section 21.4.4 for rationale.
Electrical Systems Failure	Attack on Offshore Development Infrastructure (Cyber – attacks)	n/a – See Section 21.4.4 for rationale.
	Attacks on transport systems	

Hazard Group	Individual Hazard Covered	Chapter Assessed within this EIAR (if relevant)
	Chemical, biological, radiological and nuclear (CBRN) attacks	
	Disinformation	
Societal risks	Various risks identified	n/a – See Section 21.4.4 for rationale.
Risks occurring overseas	Risks occurring overseas	n/a – See Section 21.4.4 for rationale.
<b>Internal Project Risks</b>		
Environmental Risks	Severe Weather and Climate Change	> Chapter 20: Climate Change and Carbon
Public Utilities	Interruption to Public Utilities	> Chapter 15: Aviation and Radar > Chapter 18: Other Users of the Marine Environment
Electrical Systems Failure	Attack on Offshore Development Infrastructure (Cyber – attacks)	n/a – See Section 21.4.4 for rationale.
Workplace Accidents / errors	e.g. Fall from height, confined space working hazards (suffocation, fire, fumigation), electrocution from working with live electrical conductors etc.	n/a – See Section 21.4.4 for rationale.
Transport Disruptions	Vessel Transport Disruptions	> Chapter 14: Shipping and Navigation > Offshore EIAR (Volume 3): Appendix 14.1 Navigation Risk Assessment
Unexploded Ordnance (UXO)	UXO encountered during construction/ Decommissioning (Marine Ecology)	> Chapter 10: Fish and Shellfish Ecology; > Chapter 11: Marine Mammals and other Megafauna).
FEPA Closure Zone	Disturbance of radioactive contaminants within the FEPA Closure Zone	> Chapter 8: Water and Sediment Quality > Chapter 9: Benthic Ecology > Chapter 10: Fish and Shellfish Ecology
Human and animal health	Pollution and Contamination	> Chapter 8: Water and Sediment Quality > Chapter 9: Benthic Ecology > Chapter 10: Fish and Shellfish Ecology > Chapter 11: Marine Mammals and Other Megafauna > Chapter 12: Marine Ornithology
Equipment Failure	Vessel collision and allision	> Chapter 14: Shipping and Navigation

Hazard Group	Individual Hazard Covered	Chapter Assessed within this EIAR (if relevant)
		> Offshore EIAR (Volume 3): Appendix 14.1: Navigational Risk Assessment
	High elevation of WTG tower and rotor	> Chapter 15: Aviation and Radar
	Latent Design Errors	n/a – See Section 21.4.4 for rationale.
Disruption to Industry	Proximity of Offshore Development to Nuclear Facilities.	> Chapter 18: Other Users of the Marine Environment
	Mooring suspended in the water column and anchors elevated above seabed.	> Chapter 13: Commercial Fisheries > Chapter 14: Shipping and Navigation > Offshore EIAR (Volume 3): Appendix 14.1: Navigational Risk Assessment

## 21.5 Project Description

Full details of the Offshore Development are provided in Chapter 5: Project Description within this EIAR. This Chapter should be read in conjunction with the assessments presented herein to provide context to the risk assessment.

## 21.6 Existing Baseline Information

The existing baselines for the hazards scoped out as they have been risk assessed elsewhere within the EIAR can be found within the following chapters:

- > Chapter 8: Water and Sediment Quality;
- > Chapter 9: Benthic Ecology;
- > Chapter 10: Fish and Shellfish Ecology;
- > Chapter 11: Marine Mammals and Other Megafauna;
- > Chapter 12: Marine Ornithology
- > Chapter 13: Commercial Fisheries;
- > Chapter 14: Shipping and Navigation
- > Chapter 15: Aviation and Radar; and
- > Chapter 18: Other Users of the Marine Environment.

## 21.7 Embedded Mitigation and Management Plans

As part of the Offshore Development design process, a number of designed-in measures and management plans have been proposed to reduce the potential for impacts from Major Accidents and/or Disasters (Table 21.8). As there is a commitment to implement these measures, they are considered inherently part of the design of the Offshore Development and have therefore been considered in the assessment of risks scoped into the assessment and presented below (i.e. the determination of magnitude of consequence and therefore significance of effects assumes implementation of these measures).

Other embedded mitigations and management plans pertaining to other potential impacts from the Offshore Development which have been identified but assessed in other chapters of this EIAR e.g. Vessel Collision, are not repeated here. Only those which are relevant to the assessment within this chapter are included within the table below.

Table 21.8 Embedded Mitigation Measures and Management Plans specific to Major Accidents and/ or Disasters for the Offshore Development

Embedded Mitigation and Management Plans	Description
<b>Management Plans</b>	
Safety Management Plan (SMP)*	The Project will adopt a SMS to outline a systematic and proactive approach to management safety risks. The system ensures the correct policies, procedures, process and systems are in place to identify, assess and manage risk to ALARP through the use of Hazard Identification Risk Assessment (HIRA), Hazard Identification and Hazard & Operability (HAZOP) and other Project safety management tools.
Design Management Plan (DMP)*	The Project has developed a DMP which outlines the Project's process for design management to ensure the products and services are delivered in line the Project's needs, key design decisions are logged, changes to the design baseline are managed and the roles and responsibilities of the project team are clearly defined.
Construction Environmental Management Plan (CEMP)	A CEMP will be developed for the Offshore Development, this will set out procedures to ensure all activities with potential to affect the environment are appropriately managed and will include: a description of works and construction processes, roles and responsibilities, description of vessel routes and safety procedures, pollution control and spillage response plans, incident reporting, chemical usage requirements, waste management plans, plant service procedures, communication and reporting structures and timeline of work. It will detail the final design selected and take into account Marine Licence Conditions.
Emergency Response Cooperation Plan (ERCoP)	The ERCoP will be in place for the Offshore Development. The ERCoP will refer to the marking and lighting of the wind turbines and will consider helicopters undertaking SAR operations when rendering assistance to vessels and persons in the vicinity of the PFOWF Array Area.
Offshore Construction Method Statement (CMS)	A CMS will be developed in accordance with the CEMP detailing how project activities and plans identified within the CEMP will be carried out, and also highlighting any possible dangers/risks associated with particular Offshore Development activities.
Development Specification and Layout Plan (DSLSP)	A DSLP will be produced for the Offshore Development which will allow stakeholders to see the specifics of the Offshore Development, e.g. WTG positions within the array and mooring arrangement position.
Piling Strategy (PS)	A PS will be prepared for the Offshore Development if impact piling is selected as the optimal installation mechanism for the turbine foundations. The strategy will provide full details of the piling activities and parameters, including expected noise levels, duration of activities and any required mitigations associated with this installation technique, e.g. Marine Mammal Observer (MMO) or Passive Acoustic Monitoring (PAM).
Operational Environmental Management Plan (OEMP)	An OEMP will be developed to guide on-going operations and maintenance activities during the lifetime of the project. The OEMP will also set out the procedures for managing and delivering the specific environmental commitments as per each technical chapter for each receptor over the operational period.

Embedded Mitigation and Management Plans	Description
Decommissioning Programme	A Decommissioning Programme will be provided pre-construction to address the principal decommissioning measures for the Offshore Development, this will be written in accordance with applicable guidance and detail the management, environmental management and schedule for decommissioning.
Protocols for Managing Radioactivity Risk	A Radioactive Risk Assessment has been completed to inform all stages of the Offshore Development (Nuvia, 2021). Associated with the risk assessment are a number of recommendations including protocols and procedures for managing and mitigating the risk of coming in contact with and spreading radioactive particles. These protocols and procedures are to be adopted and implemented as part of Offshore Development operations and will form part of the Offshore Development environmental management plans.
Contractor Safe Systems of Work (SSoW)*	Dependent on the nature of the potential harm, there will be appropriate systems in place to manage the risk. Major accidents and disasters are high consequence events which need significantly more robust control measures than low consequence events like slips and trips. It is anticipated that all accident scenarios will have safe ways of working, procedures and permits to ensure that risk is managed. There will also be processes in place (wherever possible) to forewarn and protect against the impacts of disasters such as flood warnings and wind forecasting.
<b>Embedded Mitigation</b>	
Minimum Spacing between WTGs	The minimum spacing between each WTG (from the centre of each WTG structure) will be 800 m.
Fisheries Liaison Officer (FLO)	A FLO will be appointed to establish effective communications surrounding the Offshore Development with local fishermen and other sea users. The FLO will distribute information on the safe operations of fishing activities at the site and will be a contact for fishermen and other sea users during the lifetime of the Offshore Development.
Notice to Mariners (NtMs), Kingfisher notifications and other navigational warnings on the location, duration and nature of works.	HWL will issue NtMs, Kingfisher notifications and other navigational warnings, as required and in a timely and efficient manner. This ensures navigational safety and minimises the risk of equipment snagging through the appropriate propagation of notices to other sea users.
Nacelle, Tower and Rotor Design	The nacelle, tower and rotor are designed and constructed in order to contain leaks thereby reducing the risk of spillage into the marine environment.
Marine Guidance Note (MGN) 654 compliance	The Offshore Development will comply with MGN 654 and its annexes as per its consent conditions to ensure that impacts on navigational safety and emergency response are considered, assessed and mitigated where necessary. This includes post-consent completion of the Search and Rescue Checklist, which includes the completion of an ERCoP.
The use of guard vessels and Offshore Fisheries Liaison Officers (OFLOs), where required.	The appointment of guard vessels and OFLOs during construction, major maintenance works and decommissioning works, where required ensures effective communication with the fishing community during the Offshore Development activities and reduces the potential for interactions with fishing activities.
Unexploded Ordnance (UXO)	UXO will be identified through pre-construction surveys. UXO will be avoided where possible. However, if further mitigation such as clearance or detonation is required, this would be subject to separate assessment and applications.
<i>*These plans will be developed and finalised prior to construction to ensure safe working and operations.</i>	

## 21.8 Risk Assessment Methodology

The risk assessment has been undertaken on the hazards which have been scoped in for assessment as detailed in Section 21.4.7 above.

The following steps are used to determine the significance of the risks identified within the risk assessment:

- > Step 1 – Hazard identification (based on the worst case for the grouped risk event);
- > Step 2 – Assigning a ‘Likelihood’ of risk occurring with the implementation of embedded mitigation and management plans;
- > Step 3 – Assigning a ‘Consequence’ if the risk did occur, cognisant of the implementation of embedded mitigation and management plans;
- > Step 4 – Assigning a ‘significance of effect’ based on the assigned likelihood and consequence;
- > Step 5 – If a risk is deemed significant in EIA terms additional mitigation measures are identified; and
- > Step 6 – If, following the application of additional mitigations, the risk is still deemed significant then more detailed assessment of the residual risk is required to eliminate or reduce the risk to acceptable levels.

### 21.8.1.1 Likelihood of risk

The following criteria set out in Table 21.9 is provided based on professional judgement, and in line with the FSA criteria developed for Offshore Renewable Energy Installations (OREIs) by the IMO (IMO, 2018) for determining the likelihood of the risk occurring.

Table 21.9 Description of Likelihood

Rank	Description of Likelihood	Definition
1	Negligible	<1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 – 10,000 years
3	Remote	1 per 10 – 100 years
4	Reasonably Probable	1 per 1 – 10 years
5	Frequent	Yearly

### 21.8.1.2 Consequence of Risk

The following description of consequence presented in Table 21.10 below are used within the risk assessment to determine whether the consequence of the risk identified would constitute either a Major Accident or a Major Disaster if the risks assessed are realised.

Receptors are features of the environment that are subject to assessment under Article 3 of the EIA Directive. The following receptor groups are used to assess the consequence of the risk:

- > People i.e. population and human health including the local community, project workforce, mariners etc.;
- > Material Assets e.g. the Offshore Development, external developments (e.g. the local grid), local properties etc.; and
- > Environment e.g. biodiversity, land, soil, water, air, climate, cultural heritage and landscape etc.

For the purpose of this assessment, any consequence ranked as a “4” or “5” is considered to have potential to result in a Major Accident and/or Disaster.

This criterion of consequence is derived from the FSA criteria (IMO, 2018), HSE Reducing Risks, Protecting People guidance (HSE, 2001) and professional judgement.

Table 21.10 Description of Consequence

Rank	Description	Definition		
		People	Material Asset	Environment
1	Negligible	No perceptible impact	No perceptible impact	No perceptible impact
2	Minor	Slight injury(s)	Minor damage to assets i.e., superficial damage	Local assistance required may result in very localised harm
3	Moderate	Multiple minor or single serious injury	Damage to asset not critical to operations	Limited external assistance required may result in moderate harm
4	Serious	Multiple serious injury or single fatality	Damage to asset resulting in critical impact on operations	Regional assistance required may result in widespread harm
5	Major	More than one fatality	Total loss of asset	National assistance required may result in irreversible harm

### 21.8.1.3 Significance of the effect

The risk ranking matrix used to determine the significance of effects from the frequency of occurrence and the severity of consequences is presented in Table 21.11. In EIA terms, impacts which are assessed as being Tolerable with Mitigation or Broadly Acceptable are considered not significant, while Unacceptable impacts are considered significant.

Table 21.11 Tolerability Matrix and Risk Rankings

<b>Consequence</b>	<b>Major</b>	Tolerable with Mitigation (intermediate risk)	Tolerable with Mitigation (intermediate risk)	Unacceptable (high risk)	Unacceptable (high risk)	Unacceptable (high risk)
	<b>Serious</b>	Broadly Acceptable (low risk)	Tolerable with Mitigation (intermediate risk)	Tolerable with Mitigation (intermediate risk)	Unacceptable (high risk)	Unacceptable (high risk)
	<b>Moderate</b>	Broadly Acceptable (low risk)	Broadly Acceptable (low risk)	Tolerable with Mitigation (intermediate risk)	Tolerable with Mitigation (intermediate risk)	Unacceptable (high risk)
	<b>Minor</b>	Broadly Acceptable (low risk)	Broadly Acceptable (low risk)	Broadly Acceptable (low risk)	Tolerable with Mitigation (intermediate risk)	Tolerable with Mitigation (intermediate risk)
	<b>Negligible</b>	Broadly Acceptable (low risk)	Tolerable with Mitigation (intermediate risk)			
	<b>Negligible</b>		<b>Extremely Unlikely</b>	<b>Remote</b>	<b>Reasonably Probable</b>	<b>Frequent</b>
			<b>Frequency</b>			

## 21.9 Risk Assessment

A risk assessment has been undertaken for the Offshore Development across all phases to assess if any of the hazards identified would result in significant effects on receptors with the embedded mitigation and management plans in place for the Offshore Development. The results of the risk assessment are provided in Table 21.12 and Table 21.13 below.

### 21.9.1 Risk Assessment – Construction and Decommissioning Phase

Table 21.12 Risk Assessment to inform Risk of Major Accidents and or Disasters – construction and decommissioning phases

Grouped Hazard	Source and/or pathways	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Management Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation / assessment Required?	Residual Risk	Further Assessment required
<b>External Project Risks</b>										
Major Industrial Accident	Industrial Accident at neighbouring site	People (Project workforce)	If there was a major accident at one of the coastal nuclear sites which resulted in a radioactive release, there is risk to the Project workforce and the Project due to the proximity of the Onshore Transmission Infrastructure (the Onshore Development) to the nuclear facilities.	<ul style="list-style-type: none"> <li>&gt; Dounreay Site Restoration Ltd/ Ministry of Defence Safety Management Systems</li> <li>&gt; Emergency Response Cooperation Plan</li> </ul>	<p>1 – Negligible</p> <p>There is a negligible likelihood that there will be a major site accident at the neighbouring nuclear sites. Both nuclear sites are in active decommissioning and are heavily regulated in terms of health and safety.</p>	<p>4 – Serious</p> <p>Radiation exposure to personnel working in the onshore substation and contamination of property. The impact on offshore personnel would depend on the size and nature of any explosion but is considered to have a lesser consequence to the offshore workforce due to the distance (7.5 km) from the nuclear facility.</p>	Broadly Acceptable (low risk)	No	Not Significant	No
		Assets (Offshore Development)	Given the distance from the PFOWF Array Area, no structural damage would be anticipated to the array itself. Nonetheless, there may be damage to the Offshore Export Cable(s) and/or onshore infrastructure at the landfall location.	<ul style="list-style-type: none"> <li>&gt; Dounreay Site Restoration Ltd/ Ministry of Defence Safety Management Systems</li> <li>&gt; Emergency Response Cooperation Plan</li> </ul>	<p>1 – Negligible</p> <p>There is a negligible likelihood that there will be a major site accident at the neighbouring nuclear sites. Both nuclear sites are in active decommissioning and are heavily regulated in terms of health and safety.</p>	<p>4 – Serious</p> <p>Damage to the Offshore Export Cable(s) and/or onshore infrastructure from an explosion at the nuclear site could result in critical impact on operations.</p>	Broadly Acceptable (low risk)	No	Not Significant	No

Grouped Hazard	Source and/or pathways	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation assessment Required?	Residual Risk	Further Assessment required
Lightning Strike	Lightning Strike at a WTG	People (Project workforce/ mariners)	A lightning strike could cause damage to the WTG structure and/or the electrical systems. Damage to structures could cause explosions or fires which could result in injury or death to project workforce or mariners working on or in close proximity to the structure.	<ul style="list-style-type: none"> <li>&gt; Emergency Response Cooperation Plan</li> <li>&gt; Construction Environmental Management Plan (CEMP)</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> <li>&gt; Following safe systems of work processes which will include the monitoring of weather forecasts for suitability</li> <li>&gt; NtMs, Kingfisher notifications and other navigational warnings on the location, duration and nature of works</li> </ul>	2 – Extremely Unlikely  Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike and periodic nature of manned offshore operation and maintenance activities make the likelihood extremely unlikely. Additionally, mariners are likely to avoid direct interactions with the array for health and safety purposes and as such this also reduces the likelihood of risk.	4 - Serious  If a lightning strike was to occur and overcome the identified mitigations in place it could still result in serious impact on the Project workforce or mariners.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No
		Environment (marine ecology and habitats)	A lightning strike could cause damage to the WTG structure and/or the electrical systems. Damage to structures could cause explosions or fires which could result in WTG system parts being lost to the environment which could result in pollution of the marine environment.	<ul style="list-style-type: none"> <li>&gt; Construction Environmental Management Plan (CEMP)</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely  Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	3 - Moderate  If a lightning strike was to occur and overcome the identified mitigations in place it could still result in a pollution event to the environment, which may require limited external assistance to remove potential sources of pollution.	Broadly Acceptable (low risk)	No	Not Significant	No
		Assets (Offshore Development)	A lightning strike could cause damage to the WTG structure and/or the electrical systems of one or all of the WTGs within the Offshore Development for a prolonged period.	<ul style="list-style-type: none"> <li>&gt; Construction Environmental Management Plan (CEMP)</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely  Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	4 - Serious  If a lightning strike was to occur and overcome the identified mitigations it would result in damage to the Offshore Development that would be critical to operations.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No

Grouped Hazard	Source and/or pathways	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation assessment Required?	Residual Risk	Further Assessment required
<b>Internal Project Risks</b>										
Subsea Operations	Ground Instability from Subsea Drilling	Environment (seabed geology, biodiversity)	Subsea drilling (or removal of drilled piles if these cannot be left <i>in situ</i> ) which results in instability and/ or collapse, potentially resulting in disruption to seabed geology, marine habitats and ecology	<ul style="list-style-type: none"> <li>&gt; Construction Method Statement</li> <li>&gt; Piling Strategy</li> <li>&gt; Pre-construction geotechnical studies</li> <li>&gt; Decommissioning Programme</li> </ul>	2 - Extremely Unlikely  Pre-construction geotechnical surveys will be used to map the subsea sediments and geology to ensure that the placement and installation of appropriate subsea infrastructure is carried out in stable environments and safely in line with advice sought from geotechnical engineers. It is extremely unlikely, based on the location of the operations and the scale at which subsea installation is undertaken, that there will be a risk of significant geological events during the construction (or decommissioning) works.	2 – Minor  The scale of a geological event caused by drilling if it were to occur would be relatively minor and localised given the proposed construction works and understanding of the geological environment. Mobile receptors would be able to flee from the immediate area and construction activities would cease rapidly if the event was to occur, in-keeping with risk assessments and CMS. As such the effect would be localised to the immediate area and consequence to the environment would be minor.	Broadly Acceptable (low risk)	No	Not Significant	No
Marine Hazards	UXO detonated during Construction/ Decommissioning	People (Project workforce / mariners)	Accidental detonation of UXO resulting in injury to the Project workforce or mariners	<ul style="list-style-type: none"> <li>&gt; Construction Environmental Management Plan</li> <li>&gt; Construction Method Statement</li> <li>&gt; Development Specification and Layout Plan</li> <li>&gt; NtMs, Kingfisher notifications and other navigational warnings on the location, duration and nature of works.</li> <li>&gt; Fisheries Liaison Officer</li> <li>&gt; MGN 654 compliance</li> <li>&gt; The use of guard vessels and Offshore Fisheries Liaison Officers, where required.</li> <li>&gt; Decommissioning Programme</li> </ul>	2 – Extremely unlikely  The Offshore Development will be conducting pre-construction UXO surveys to identify the presence of UXOs within the Offshore Development boundary. The project has sought guidance from specialists to establish the mitigation measures and operational protocols that are to be followed in the event that a UXO is found, which will be followed along with the statutory permitting process and required control measures (Ordtek 2021).	4 - Serious  If a UXO is accidentally detonated the consequence will be dependent on the UXO properties. Accidental UXO detonation could result in serious injuries to workers in the vicinity of the detonation zone. During construction, safety zones will be in place to mitigate any potential injury to mariners.	Tolerable with Mitigation (intermediate risk)	No	Not Significant	No
	Disturbance of radioactive contaminants within the FEPA Closure Zone (or wider)	People (Project workforce / public)	The Project construction activities, namely cable lay, through the FEPA zone (or peripheral areas), results in the disturbance and displacement of significant radioactive	<ul style="list-style-type: none"> <li>&gt; Construction Environmental Management Plan</li> <li>&gt; Construction Method Statement</li> <li>&gt; Development Specification and Layout Plan</li> </ul>	3 – Remote  The vast majority of significant particles released into the environment remain in the immediate vicinity (within a few hundred metres) of the discharge point (Nuvia, 2021). At its closest point the Offshore	3 – Moderate  If an individual was to come into contact with a significant particle through either Ingestion or contact with the skin, the result would be localised damage to cells	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No

Grouped Hazard	Source and/or pathways	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation assessment Required?	Residual Risk	Further Assessment required
			particles. This results in the public and/or Project workforce coming into direct contact with the significant particles, resulting in serious injury.	<ul style="list-style-type: none"> <li>&gt; Decommissioning Programme</li> <li>&gt; Protocols for Managing Radioactivity Risk</li> </ul>	Export Cable Corridor passes within 0.5 km to the west of the Dounreay outlet pipe and in the opposite direction of the prevailing current. Based on the reported survey results there is no evidence to suggest that potentially significant particles would be encountered within the Offshore Site. Regular monitoring of the beaches for particles (via DSRL) ensure any finds are disposed of. Mitigation measures will also ensure that works within the FEPA Zone are risk assessed and appropriate permissions, where required, are sought.	replaced by natural regeneration.				

### 21.9.2 Risk Assessment – Operation and Maintenance Phase

Table 21.13 Risk Assessment to inform Risk of Major Accidents and or Disasters – Operation and Maintenance phase

Hazard Group	Hazard Type	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation / assessment Required?	Residual Risk	Further Assessment required
<b>External Project Risks</b>										
Lightning Strike	Lightning Strike at a WTG	People (Project workforce / mariners)	A lightning strike could cause damage to the WTG structure and/or the electrical systems. Damage to structures could cause explosions or fires which could result in injury or death to project workforce or mariners working on or in close proximity to the structure.	<ul style="list-style-type: none"> <li>&gt; Emergency Response Cooperation Plan</li> <li>&gt; Operation Environmental Management Plan (OEMP)</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> <li>&gt; Following safe systems of work processes which will include the monitoring of weather forecasts for suitability</li> <li>&gt; NtMs, Kingfisher notifications and other navigational warnings on the location, duration and nature of works</li> </ul>	2 – Extremely Unlikely  Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	4 - Serious  If a lightning strike was to occur and overcome the identified mitigations in place it could still result in serious impact on the Project workforce or mariners.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No

Hazard Group	Hazard Type	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation / assessment Required?	Residual Risk	Further Assessment required
		Environment (marine ecology and habitats)	A lightning strike could cause damage to the WTG structure and/or the electrical systems. Damage to structures could cause explosions or fires which could result in WTG system parts being lost to the environment which could result in pollution of the marine environment.	<ul style="list-style-type: none"> <li>&gt; Operation Environmental Management Plan</li> <li>&gt; Compliance with recognised design standards.</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	3 - Moderate If a lightning strike was to occur and overcome the identified mitigations in place it could still result in a pollution event to the environment, which may require limited external assistance to remove potential sources of pollution.	Broadly Acceptable (low risk)	No	Not Significant	No
		Assets (Offshore Development)	A lightning strike could cause damage to the WTG structure and/or the electrical systems which could result in a ceasing of operation of one or all of the WTG's within the Offshore Development for a prolonged period.	<ul style="list-style-type: none"> <li>&gt; Operation Environmental Management Plan</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely Lightning and surge protection is an integral part of the WTG and overall electrical and structural design to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	4 - Serious If a lightning strike was to occur and overcome the identified mitigations it would result in damage to the Offshore Development that would be critical to operations.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No
Major Industrial Accident	Industrial Accident at neighbouring site	People (Project workforce)	If there was a major accident at one of the coastal nuclear sites which resulted in a radioactive release, there is risk to the Project workforce and the Project due to the proximity of the Onshore Transmission Infrastructure (the Onshore Development) to the nuclear facilities.	<ul style="list-style-type: none"> <li>&gt; Dounreay Site Restoration Ltd/ Ministry of Defence Safety Management Systems</li> <li>&gt; Emergency Response Cooperation Plan</li> </ul>	1 – Negligible There is a negligible likelihood that there will be a major site accident at the neighbouring nuclear sites. Both nuclear sites are in active decommissioning and are heavily regulated in terms of health and safety.	4 – Serious Radiation exposure to personnel working in the onshore substation and contamination of property. The impact on offshore personnel would depend on the size and nature of any explosion, but is considered to have a lesser consequence to the offshore workforce due to the distance (7.5 km) from the nuclear facility	Broadly Acceptable (low risk)	No	Not Significant	No
		Assets (Offshore Development)	Given the distance from the PFOWF Array Area, no structural damage would be anticipated to the array itself. Nonetheless, there may be damage to the Offshore Export Cable(s) and/or onshore infrastructure at the landfall location.	<ul style="list-style-type: none"> <li>&gt; Dounreay Site Restoration Ltd/ Ministry of Defence Safety Management Systems</li> <li>&gt; Emergency Response Cooperation Plan</li> </ul>	1 – Negligible There is a negligible likelihood that there will be a major site accident at the neighbouring nuclear sites. Both nuclear sites are in active decommissioning and are heavily regulated in terms of health and safety.	4 – Serious Damage to the Offshore Export Cable(s) and/or onshore infrastructure from an explosion at the nuclear site could result in critical impact on operations.	Broadly Acceptable (low risk)	No	Not Significant	No

Hazard Group	Hazard Type	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation / assessment Required?	Residual Risk	Further Assessment required
<b>Internal Project Risks</b>										
Electrical Systems Failure	Systems Failure / Electrical Fault / Explosions / Fires	People (Project workforce / mariners)	If an explosion or fire did occur as a result of, or whilst inspection and maintenance activities were underway, it could result in multiple serious injuries or a single fatality.	<ul style="list-style-type: none"> <li>&gt; Contractors Safe Systems of Work</li> <li>&gt; Emergency Response Cooperation Plan</li> <li>&gt; Operation Environmental Management Plan</li> <li>&gt; Minimum spacing between WTGs</li> <li>&gt; NtMs, Kingfisher notifications and other navigational warnings on the location, duration and nature of works</li> <li>&gt; Nacelle, Tower and Rotor Design</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely Offshore wind turbines have an excellent safety record with a very low failure rate and fire detection and protection systems in place, to prevent the escalation of fires in the unlikely event of an occurrence. The electrical equipment will be designed in accordance with internationally recognised design standards and maintained in accordance with best practices. Fault detection systems will be in place and system protection will be built into the design to limit the likelihood of any ignition source. Flammable liquids will be stored in secure cabinets in accordance with COSHH regulations. With these measures in place the likelihood of an explosion or fire is extremely unlikely.	4 – Serious If the risk is realised it is anticipated that it would be an isolated and localised event leading to a serious impact on the Project workforce or mariners in the vicinity of the Offshore Development.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No
		Environment (biodiversity)	If an explosion or fire did occur it could result in parts of the offshore foundation or WTG being lost to the sea which could result in pollution of the marine environment.	<ul style="list-style-type: none"> <li>&gt; Emergency Response Cooperation Plan</li> <li>&gt; Operation Environmental Management Plan</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely Likelihood in line with statement above.	3 - Moderate If an explosion or fire did occur and overcome the identified mitigations in place it could still result in a pollution event to the environment, which may require limited external assistance to remove potential sources of pollution.	Broadly Acceptable (low risk)	No	Not Significant	No
		Assets (Offshore Development)	If an explosion or fire did occur, it may result in the ceasing of operation of one or all of the WTG's within the Offshore Development for a prolonged period.	<ul style="list-style-type: none"> <li>&gt; Emergency Response Cooperation Plan</li> <li>&gt; Operation Environmental Management Plan</li> <li>&gt; Compliance with recognised design standards</li> <li>&gt; Fire Protection Systems in place</li> </ul>	2 – Extremely Unlikely Lightning and surge protection is an integral part of the WTG and overall electrical and structural design, to minimise the impact of any lightning strikes and is governed by internationally recognised standards which will be adhered to. Compliance with such standards along with the unlikely event of a lightning strike make the likelihood extremely unlikely.	4 - Serious If a lightning strike was to occur and overcome the identified mitigations it would result in damage to the Offshore Development that would be critical to operations.	Tolerable with Embedded Mitigation (intermediate risk)	No	Not Significant	No

Hazard Group	Hazard Type	Receptor	Reasonable Worst Consequence if event did occur	Mitigations and/ or Plans Identified	Likelihood of risk with existing mitigation in place	Consequence of risk with mitigation measures in place	Significance of effect	Additional Mitigation / assessment Required?	Residual Risk	Further Assessment required
Marine Hazards	Disturbance of radioactive contaminants within the FEPA Closure Zone (or wider)	People (Project Workforce, public)	The Project activities during the Operational phase, namely cable repair, within the FEPA zone (or peripheral areas), results in the disturbance and displacement of significant radioactive particles. This results in the public and/or workforce coming into direct contact with the significant particles, resulting in serious injury.	<ul style="list-style-type: none"> <li>&gt; Operational Environmental Management Plan (OEMP)</li> <li>&gt; Development Specification and Layout Plan</li> <li>&gt; Decommissioning Programme</li> <li>&gt; Protocols for Managing Radioactivity Risk</li> </ul>	<p>2 – Extremely Unlikely</p> <p>The likelihood compared to the Construction phase in Section 21.9.1 is lower due to the limited maintenance activities expected to be required during the Operational phase.</p>	<p>3 – Moderate</p> <p>As per section 9.9.1</p>	Broadly Acceptable (low risk)	No	Not Significant	No

## 21.10 Residual Risk Assessment

From the risk assessment undertaken in Section 21.9 above, it has been assessed that there are no significant residual effects anticipated arising from the Offshore Development, or for which the Offshore Development is vulnerable. As such no residual risk assessment is required as per the IEMA Guidance.

## 21.11 Conclusions

This chapter presents an assessment of the potential Major Accidents and/or Disasters relevant to the Offshore Development, during construction, operation and decommissioning.

Overall, there were no risks identified for the Offshore Development that could result in a major accident and/or disaster with the embedded mitigation and management plans in place.

In EIA terms, the risks identified for the Offshore Development result in no significant effects on receptors, owing in principle to the design of the Offshore Development, which will be built in line with the identified embedded mitigations and management plans to safeguard, in so far as practicable, against these risks. As such, in line with the expectations of the IEMA Guidance, there is no need for a Residual Risk Assessment

Nonetheless, if consent is awarded for the Offshore Development, risk reduction will continue to be refined during detailed engineering design, to ensure that a hierarchy of controls are in place through the various management plans and method statements.

In line with this, and as outlined in Section 21.7, the Offshore Development will require all contractors and subcontractors to complete adequate risk assessments for all aspects of the construction and operation activities for the Offshore Development and these requirements will be captured within a the relevant consent plans including the CMS, CEMP, OEMP and internal Project procedures which will be prepared for the works to mitigate any internal project risks.

The Offshore Development will be a notifiable project for the purposes of the Construction (Design and Management) Regulations 2015 (UK Parliament, 2015), and the Offshore Development will require compliance with these Regulations in the design of the Offshore Development and throughout the construction process, through conditions of contract.

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## 21.12 References

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