16 MAJOR ACCIDENTS AND NATURAL DISASTERS

16.1 INTRODUCTION

This section of the Environmental Impact Assessment Report (EIAR) describes the likely significant effects on the environment arising from the vulnerability of the Project as detailed in **Chapter 2: Project Description** to risks of major accidents and/or natural disasters. It has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in 'Guidelines on Information to be contained in Environmental Impact Statements' (EPA, 2022) and the European Commission in relation to Environmental Impact Assessment (Directive 2011/92/EU, as amended by 2014/52/EU), namely 'Guidance on the preparation of the Environmental Impact Assessment Report'.

The assessment of the vulnerability of the Project to major accidents and natural disasters is carried out in compliance with the EIA Directive, as amended, which states the need to assess:

"the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned."

The objective of this assessment is to ensure that appropriate precautionary actions are taken for those projects which *"because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment".*

Based on the requirements of the EIA Directive, this chapter seeks to determine:

- The relevant major accidents and/or natural disasters, if any, that the Project could be vulnerable to.
- The potential for these major accidents and/or natural disasters to result in likely significant adverse environmental effect(s).
- The measures that are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment.

16.1.1 Statement of Authority

This section has been prepared by Sarah Jones and David Kiely of Jennings O'Donovan & Partners Limited, with contributions from Ben Stevenson and Natalie Karmanov from Black and Veach and Jonathan Wiseman, David Rees and Nick Taylor of Risktec Solutions Ltd

Sarah Jones is an Environmental Scientist and Planner and holds a first-class MSc in Environmental Sustainability from University College Dublin and a Bachelor (Hons.) Degree in Geography from Manchester Metropolitan University. Sarah has recently developed a specialist knowledge of hydrogen production and her key capabilities include Environmental Impact Assessment (EIA) screenings, Appropriate Assessment (AA) screenings, Planning and Environmental reports and Applications, Environmental Impact Assessments, Feasibility Studies, Construction Environmental Management Plans, Stakeholder Engagement, Project Management.

David Kiely, Director of Jennings O'Donovan & Partners Limited, holds a BE in Civil Engineering from University College Dublin and MSc in Environmental Protection from IT Sligo. He is a Fellow of Engineers Ireland, a Chartered Member of the Institution of Civil Engineers (UK) and has over 40 years' experience. He has extensive experience in the preparation of EIAR and EIS for environmental projects including wind farms, solar farms, wastewater projects, quarries and various commercial developments. David has also been involved in the construction of over 50 wind farms since 1997.

Ben Stevenson is the hydrogen solution lead for the EMEA region at Black & Veatch. He has 4 years' experience in the renewable energy industry, with a particular focus on onshore wind and hydrogen. Ben began his career at Black & Veatch as an auditor of renewable energy installations. This involved the assessment of sites' compliance on both the Feed in Tariff and Renewable Obligation support schemes on behalf of the client, Ofgem. To date, Ben has completed c. 100 Ofgem audits and over 400MW of installed capacity, covering solar PV, wind, biomass, landfill gas and hydro technologies. After completing the graduate programme, Ben transferred to support the hydrogen energy team for the EMEA region and was involved with the UK businesses' first hydrogen energy projects for clients. This included feasibility, pre-FEED and cost estimation studies. Ben is now the hydrogen solutions lead for the region, and oversees a variety of green and blue hydrogen projects through to FEED level. Ben has completed additional internal and external training, including a hydrogen safety credential accredited by American Institute of Chemical Engineers, and also frequently represents Black & Veatch at hydrogen specific conferences. Education: MSc, Renewable Energy Engineering, University of Aberdeen, 2019, United Kingdom, BSc, Environmental Science, University of Edinburgh, 2015, United Kingdom, Construction Skills Certificate Scheme (CSCS), 2022, Fundamental Hydrogen Safety Credential, Center for Hydrogen Safety (American Institute of Chemical Engineers), 2023.

Natalie Karmanov is an experienced Project Manager in Black & Veatch's Power Generation Services group in the United Kingdom. She has worked for over 15 years across power generation and water infrastructure sectors, delivering innovative technically complex projects. She has experience delivering across the entire project lifecycle with significant experience of strategic asset management, professional services, and design and build. Natalie's key experience includes managing and leading projects as Owner's Engineer with power generation, electricity distribution, and utility clients, drawing on her technical expertise as a Mechanical Engineer. Education and Professional Registrations: Bachelor of Science (Hons), Mechanical Engineering, UCLA, 2006, United States. License, Professional Engineer, Mechanical, #34924, California, United States, 2010.

Nick Taylor has 21 years extensive system and safety experience gained working across a range of industrial sectors including Metals Processing, Marine Power Systems, Aerospace, Equipment Health Management, Hydrogen Fuel Cell systems and most recently Railway Infrastructure upgrade projects. Varied exposure has developed multidiscipline knowledge of engineering methods from practical decision making, to improvements in company engineering process. Nick is currently providing risk management and safety engineering support to the TUV Rheinland Hydrogen Centre of Competence. In addition to project work, Nick also provides training and MSc level education services in System Safety Engineering.

Jonathan Wiseman is a Chartered Physicist with over 14 years' experience in the field of safety and risk management in the nuclear, defence and oil and gas industries. Jonathan is experienced in safety case development, facilitation of HAZID and bowtie workshops and development of performance standards and verification schemes for safety critical equipment. He is experienced in the development of supporting technical safety studies including F&G mapping studies, QRA, Dropped Object Studies, FERA, EERA, Hazardous Area Classification and RAM studies. He is experienced in the application of consequence and risk modelling software such as Fault Tree+, Availability Workbench, PHAST, Safeti, SHEPHERD and FRED as well as development of bespoke software tools.

David Rees has over 15 years' experience providing safety and risk consultancy for high hazard industries including oil and gas, chemical, renewables, carbon capture and storage, nuclear, mining, logistics, transport and manufacturing sectors. David has predominantly worked with the oil and gas and renewables sector, delivering projects for offshore drilling and production, wind power generation, hydrogen generation and onshore refinery, chemical processing and logistics. David is experienced in the leading of safety and risk studies including facilitation of a large number of HAZID, HAZOP, Bowtie and ALARP assessments. He has extensive knowledge of producing safety cases to recognised standards including COMAH and the Offshore Safety Directive, including providing supporting safety studies such as QRA, FERA, EERA, ESSA, etc. David has experience of DSEAR and ATEX compliance and the development of hazardous area classification calculations and drawings for a range of industries within the UK and Europe.

16.2 ASSESSMENT METHODOLOGY

Major accidents or natural disasters are hazards which have the potential to affect the Project and consequently have potential impacts on the environment. These include accidents during construction, operation and decommissioning caused by operational failure and/or natural hazards. The assessment of the likelihood of significant adverse environmental effects arising from the vulnerability of the Project to major accidents and/or disaster considers all factors defined in the EIA Directive that have been considered in this EIAR, i.e., population and human health, biodiversity, land, soil (peat stability), water, air and climate and material assets, cultural heritage and the landscape. A stand alone Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Firlough Wind Farm and Hydrogen Plant Site has been prepared as part of this EIAR, the report is presented in **Appendix 9.1** – Site Flood Risk Assessment Firlough Wind Farm and **Appendix 9.2** – Site Flood Risk Assessment Firlough Hydrogen Plant. The potential for climate change to impact future flood events is also considered as part of these site-specific Flood Risk Assessments. This is also assessed in **Chapter 9: Hydrology and Hydrogeology.** Peat/soil instability is set out in **Chapter 8: Soils and Geology.** There are no inhabited dwellings within 725 m of the proposed wind turbines or Wind Farm Substation location or within 299 m of the Hydrogen Plant Site, therefore the risk to residential receptors from turbine collapse or industrial accidents including fires/explosions is not considered significant.

16.2.1 Legislative Context

16.2.1.1 Legislation

An assessment of the following key elements was undertaken in accordance with the EIA Directive as amended:

- The vulnerability of the Project to potential accidents and disasters
- The identification of the potential environmental effects arising from any such vulnerability; and
- An assessment of the likely significant adverse environmental effects.

The information relevant to major accidents and/or disasters to be included in the EIAR is set out in paragraph 8 of Annex IV of the EIA Directive as follows:

"(8) A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project 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 Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation 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".

16.2.1.2 Guidance Documents

The following sources of information and literature pertinent to the area and guidance documents have been consulted in the preparation of this section:

- European Commission (2017) Environmental Impact Assessment of Projects – Guidance on the preparation of Environmental Impact Assessment Reports
- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
- Environmental Protection Agency (2016) Local Authority Adaptation Strategy Development Guidelines
- Department of Environment, Heritage and Local Government (2010) A Guide to Risk Assessment in Major Emergency Management
- Environmental Protect Agency (2014) Guidance on Assessing and Costing Environmental Liabilities
- Department of Defence (2020) A National Risk Assessment for Ireland
- Mayo County Council Major Emergency Plan (2021)
- Sligo County Council Major Emergency Plan (2020)
- HSE Emergency Management Area 1 (2022) (Donegal, Sligo, Leitrim, Cavan and Monaghan) Emergency Plan
- HSE Emergency Management Area 2 (2022) (Galway, Mayo and Roscommon) Emergency Plan
- HSA Guidance on Technical Land Use Planning Advice (2023)
- HSE Emergency Plan hazard types (2022)
- Census of Ireland
- The Regional Spatial and Economic Strategy (RSES) for The Northern and Western Region (2020)
- Mayo County Development Plan 2022-2028

- Mayo County Council Website
- Sligo County Development Plan 2017-2023
- Sligo County Council Website
- Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances COMAH) Regulations, S.I. No. 209 of 2015
- The Safety, Health and Welfare at Work Act, 2005
- S.I. No. 299/2007 - Safety, Health and Welfare at Work (General Application) Regulations 2007
- ISO 22734:2019 Hydrogen generators using water electrolysis – Industrial, commercial and residential applications.
- ISO/TR 15916:2015 Basic considerations for the safety of hydrogen systems.
- Directive 2012/18/EU - on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC
- Forestry Commission, Scotland (2006) Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low Cost Roads Over Peat
- CIRIA (2006) Control of water pollution from linear construction projects. Site guide (C649)).

16.2.2 Categorisation of the Baseline Environment

A desk-study has been completed to establish the baseline environment for which the proposed risk assessment is being carried out. This will influence both the likelihood and the impact of a major accident or natural disaster. Local and regional context has been established prior to undertaking the risk assessment to develop an understanding of the vulnerability and resilience of the area to emergency situations.

Further detail on the baseline environment is provided in **Section 16.3**.

16.2.3 Impact Assessment Methodology

16.2.3.1 Introduction

This assessment is focused on an understanding that the Project will be designed, built and operated in line with the methodologies and measures prescribed in this EIAR. As will be set out in detail in the subsequent sections of this chapter, taking account of these measures the residual vulnerability of the Project to major accidents and natural disasters is considered low.

An assessment of potential accidents and disaster scenarios such as pollution incidents to ground and watercourses as well as assessment of flooding events and peat instability are described in detail in the relevant EIAR assessment chapters (refer to **Chapters 8: Soils and Geology** and **Chapter 9: Hydrology and Hydrogeology** for further details).

16.2.3.2 Site-Specific Risk Assessment Methodology

A site-specific risk assessment identifies and quantifies risks focusing on unplanned, but possible and plausible events occurring during the construction, operation and decommissioning of the Project. The approach to identifying and quantifying risks associated with the Project by means of a site-specific risk assessment is derived from the EPA 'Guidance on Assessing and Costing Environmental Liabilities' document[1]. The following steps were taken as part of the site-specific risk assessment:

- Risk identification
- Risk classification,
- Likelihood and consequence; and
- Risk evaluation
- Evaluation of the Environmental Impacts

This has been used to assess the Proposed Development.

The Hydrogen Plant Site has also been assessed by Preliminary Hazard Analysis (PHA) and Quantitative Risk Assessment (QRA).

Risktec solutions Ltd., an independent and specialist provider of risk management consulting, resourcing, learning and inspection services, part of the TÜV Rheinland Group. undertook a PHA on the green hydrogen system at the Proposed Development and generated a hazard log. The full report can be found in **Appendix 16.1**.

A Technical Land Use Planning based Quantitative Risk Assessment (the "TLUP QRA") has been prepared in accordance with the guidelines set out in the HSA's Technical Land Use Planning (TLUP) Guidelines. The TLUP QRA has been submitted to the HSA as part of the planning application submission. The purpose of the TLUP QRA is primarily to assess the offsite risks to human health and the environment for the purposes of determining the suitably of the Hydrogen Plant Site.

The results of these two assessments have been incorporated into this chapter.

[1] EPA (2014) Guidance on assessing and costing environmental liabilities. [Accessed online 14/07/2022] Available at https://www.epa.ie/publications/compliance--enforcement/licensees/reporting/financial-provisions/EPA_OEE-Guidance-and-Assessing-WEB.pdf

16.2.3.2.1 Risk Identification

Risks have been reviewed through the identification of reasonably foreseeable risks in consultation with relevant contributors to this EIAR (please see **Chapter 1: Introduction** for *Curriculum Vitae* of contributors). The identification of risks has focused on non-standard but plausible incidents that could occur at or as a result of the Project during construction, operation and decommissioning phases.

In accordance with the European Commission EIAR Guidance, risks are identified in respect of the projects:

1. Potential to cause accidents and/or disasters,
2. Vulnerability to potential disaster/accident

16.2.3.2.2 Risk Classification

Classification of Likelihood

After identifying the potential risks, the likelihood of occurrence of each risk has been assessed. The likelihood was assessed taking into account the safety procedures and environmental controls inherent in the design of the Project. For the Hydrogen Plant Site, the results of the PHA and TLUP QRA were considered when defining the likelihood. **Table 16.1** defines the likelihood ratings that have been applied.

The approach adopted has assumed a 'risk likelihood' where one or more aspects of the likelihood description are met.

Table 16.1: Classification of Likelihood (Source: DoEHLG, 2010)

Ranking	Likelihood	Description
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years.
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communities; and / or little opportunity, reason or means to occur; may occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or

Ranking	Likelihood	Description
		comparable organisation's worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years.
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Classification of Consequence

The consequence assigned to each risk has assumed that all proposed mitigation measures and/or safety procedures have failed to prevent the major accident and/or disaster. Furthermore, the Mayo County Council Major Emergency Plan (2021) and Sligo County Council Major Emergency Plan (2020), along side the HSE's Emergency Management Area 1 (2022) (Donegal, Sligo, Leitrim, Cavan and Monaghan) Emergency Plan and HSE's Emergency Management Area 2 (2022) (Galway, Mayo and Roscommon) Emergency Plan if implemented as intended, would work to reduce the consequence of any major accident or disaster. The assessment in this chapter however has assumed these plans have not been implemented, i.e., impacts from the Project are assessed independently of the plans and is therefore a 'worst case scenario'. The consequence of the impact if the event occurs has been assigned as described in **Table 16.2**. The EPA guidance (2022) was used to identify the significance of the consequence in order to quantitatively assess the Proposed Development's vulnerability to and potential to cause Major Accidents and Natural Disasters.

The consequence of a risk to/from the Proposed Development has been determined where one or more aspects of the consequence description are met, i.e., risks that have no consequence have been excluded from the assessment.

Table 16.2: Classification of Impact (Source: DoEHLG, 2010)

Ranking	Likelihood	Impact	Description
1	Minor	Life, Health, Welfare	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment.

Ranking	Likelihood	Impact	Description
		Environment	No contamination, localised effects
		Infrastructure	<€0.5M
		Social	Minor localised disruption to community services or infrastructure (<6 hours).
		EIA Significance	Considered an imperceptible, not significant negative effect under EIA definitions; An effect capable of measurement but without significant consequences. And/or An effect which causes noticeable changes in the character of the environment but without significant consequences.
2	Limited	Life, Health, Welfare	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements.
		Environment	Simple contamination, localised effects of short duration
		Infrastructure	€0.5-3M
		Social	Normal community functioning with some inconvenience

Ranking	Likelihood	Impact	Description
		EIA Significance	Considered a slight or moderate, not significant negative effect under EIA definitions. An effect which causes noticeable changes in the character of the environment without affecting its sensitivities and without significant consequences. Or An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends and without significant consequences.
3	Serious	Life, Health, Welfare	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support.
		Environment	Simple contamination, widespread effects or extended duration
		Infrastructure	€3-10M
		Social	Community only partially functioning, some services available.
		EIA Significance	Considered a significant negative effect under EIA definitions.

Ranking	Likelihood	Impact	Description
			An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
4	Very Serious	Life, Health, Welfare	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated.
		Environment	Heavy contamination, localised effects or extended duration.
		Infrastructure	€10-25M
		Social	Community functioning poorly, minimal services available.
		EIA Significance	Considered a very significant or profound negative effect under EIA definitions; An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment. Or An effect which obliterates sensitive characteristics.
5	Catastrophic	Life, Health, Welfare	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated.
		Environment	Very heavy contamination, widespread effects of extended duration.
		Infrastructure	>€25M
		Social	Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period.

Ranking	Likelihood	Impact	Description
			Community unable to function without significant support.
		EIA Significance	Considered a profound effect under EIA definitions.

16.2.3.2.3 Risk Evaluation

Once classified, the likelihood and consequence ratings have been multiplied to establish a 'risk score' to support the evaluation of risks by means of a risk matrix.

The risk matrix sourced from the DoEHLG Guide to Risk Assessment in Major Emergency Management (and as outlined in **Table 16.3**) indicates the critical nature of each risk. This risk matrix has therefore been applied to evaluate each of the risks associated with the Proposed Development. The risk matrix is colour coded to provide a broad indication of the critical nature of each risk:

- The red zone represents 'high risk scenarios'
- The amber zone represents 'medium risk scenarios'
- The green zone represents 'low risk scenarios'

Table 16.3: Classification of Impact (Source: DoEHLG, 2010)

		Consequence Rating				
		1.Minor	2.Limited	3. Serious	4.Very Serious	5.Catastrophic
Likelihood Rating	5.Very Likely					
	4. Likely					
	3. Unlikely					
	2. Very Unlikely					
	1. Extremely Unlikely					

16.3 DEVELOPMENT HAZARD ANALYSIS

The HSE Emergency Management: Emergency Plans outline several hazard categories which may have the potential to lead to a major emergency. The hazard categories include

Natural, Transportation, Technological and Civil. The hazard categories, types and subtypes, and their relevance to the Proposed Development, are listed below in **Table 16.4**.

The hazard types identified as relevant to the Project are shown in **Table 16.4**

Table 16.4: HSE Emergency Plan hazard types (HSE, 2022)

Category	Type	Subtype	Relevance to the Project
Natural Hazards			
Meteorological	Storm / Gale Both coastal and inland areas can be affected by high winds	Both coastal and inland areas can be affected by high winds	Poor driving conditions Loss of infrastructure (Tower collapse, blade disintegration, power outages) Flooding Falling Trees
	Heavy Snow	Blizzards- 'Poor visibility	Poor Driving conditions
	Severe Cold / Frost extremes of Temperature	Icy Roads/Impassable Roads Hypothermia Freezing of Supply Network	Poor Driving Conditions Public Health Risk Ice throw from blades Lack of Road Grit
	Thunder & Lightening Dense/ Persistent Fog Heat Wave /Drought	Road Traffic collisions	Loss of Infrastructure Poor driving conditions Public Health Risk Water Shortage
Hydrological	Flooding	Coastal / Inland	Potential for flooding via on-site rivers
	Heavy Rain		May lead to flooding in Low Lying areas or areas with poor drainage
Geological	Landslide		Peat Instability
	Forest / Wilderness fire- Air Pollution		Some of surrounding area of both Wind Farm and Hydrogen sites is forested, including near to Wind Farm Substation.
Transportation Hazards			
Aviation	Aircraft Collision /Loss	Mid Air and Land	Not Applicable
Road	Multiple Road Traffic		Public Roads via which

Category	Type	Subtype	Relevance to the Project
	Collision		construction staff and materials access the Wind Farm Site and Hydrogen Plant Site.
	Hazmat		Fuel Transport to/from Hydrogen Plant Site.
	Bridge		Not Applicable
Water	Inland Water ways	Pleasure Craft/Cruises Pollution from above	Not Applicable
	Coastal	Car Ferry/ passenger Ferries	Not Applicable
Technological Hazards			
Industrial Accidents	Explosions		Damage to Infrastructure Personal Injuries/ fatalities
	Petrochemical Fires		Personal Injuries, severe burns/ fatalities. Air Pollution
	Industrial Fires	LPG Tank Fire	Hydrogen fire
	Gas Emission		Hydrogen Leak
	Fluid/ Fuel Emission		Refuelling on site
Explosions	Domestic	Natural Gas explosion	Not Applicable
	Bomb		Not Applicable
	LPG		Not Applicable
	Pipeline		Not Applicable
Fires			Hydrogen fire Turbine fire
Building Collapse			Damage to Infrastructure Personal Injuries/ fatalities
Hazardous substance		Accident at site	Hydrogen release in enclosed spaces
		Transportation accident	Hazmat on roads
		Weapons	Not Applicable
	Biological	Leak/Weapons	Not Applicable
	Radiological	"Dirty Bomb"	Not Applicable
		Industrial Accident	Damage to Infrastructure Personal Injuries/ fatalities
		Health facilities	Not Applicable
Pollution/ Contamination	Air/Water Pollution		Fire Sediment-laden Water Run Off Fuel/hydrocarbon spill/leak
Civil Hazards			
Major Crowd Safety	(Movement, crushing etc.)	Pop Concerts Sports Events Fireworks displays Air shows	Not Applicable

Category	Type	Subtype	Relevance to the Project
Loss of Critical Infrastructure	Energy and Power Supply	Electricity	Connection to national grid
		Natural Gas	Not Applicable
		Fuel Oil	Not Applicable
		Communications	Telecom operators, mobile phone networks
Food Situation Crisis		Food Contamination Drought	Not Applicable
Water Supply		Shortage/ Contamination Freezing /Flooding	Wastewater discharge Water Pipes Freezing
Epidemics and pandemic		Communicable diseases	Not Applicable
Animal Disease		Foot & Mouth Avian Influenza	Not Applicable
Terrorism	Bombs	Car-bombs	Not Applicable
		Bombs in buildings	Not Applicable
		Fire-bombing	Not Applicable
	CBRNE		Not Applicable
	Disruption	Bomb scares	Not Applicable

Operational wind farms in Ireland are considered not to be vulnerable to major accidents or adverse impacts from natural disasters and therefore significant environmental effects are unlikely. The Department of the Environment, Heritage and Local Government (DoEHLG)'s 'Wind Energy Development Guidelines for Planning Authorities 2006' state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines.

Health and Safety has been a key consideration in the initial design of the Hydrogen Plant Site and will be continually addressed throughout the Proposed Development lifecycle. The likelihood of a major accident or natural disaster with serious adverse consequences for employees, the environment and the public is very low during the operational phase of the Hydrogen Plant Site as evidenced through the findings of the PHA and the conclusions of the TLUP QRA. The Seveso III Directive, the main EU legislation dealing specifically with the control of onshore major accident hazards, along with the Chemical Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 which implements the SEVESO directive, governs the inventory of substances stored at the Hydrogen Plant Site. The facility will be designed, constructed and operated in line with the requirements set out by COMAH Regulations, including 24/7 monitoring. The maximum onsite storage of hydrogen (approximately 40.128 tonnes) classifies the facility as a 'Lower-tier' COMAH site as this is below 50 tonnes.

Design standards specific to hydrogen production facilities (shown in Table 2.4 in **Chapter 2: Project Description**) have been used throughout the preliminary design phase. Given the evolving nature of the hydrogen industry, design standards will be monitored, and future iterations adopted during detailed design stages. Various stakeholders have been engaged during the initial design phase including the HSA, HSE, EPA, Mayo County Council and Sligo County Council, with feedback and comments being addressed in the design.

Risktec Solutions Limited is an independent and specialist provider of risk management consulting, resourcing, learning and inspection services, and is part of the TÜV Rheinland Group. Risktec undertook Preliminary Hazard Analysis (PHA) on the green hydrogen system at the Proposed Development and generated a hazard log. The full report can be found in **Appendix 16.1**.

The PHA was completed for the concept design and covered the full lifecycle of the hydrogen plant from installation through to decommissioning. The PHA identified known hazards and their causal factors associated with the Proposed Development, as well as appropriate safety risk mitigation strategies for each hazard.

Hazard Analysis and Risk Assessment Steps

1. Define the scope of work
2. Identify hazards
3. Evaluate the impact of the hazards on
   a) the environment and public
   b) the facility and institution
   c) the equipment and personnel
4. Assess the likelihood and severity of each hazard
5. Resolve hazards
6. Follow up actively with periodic review of work scope and hazards

Results

The Hazard Log presents the potential sources of harm arising from the current system design and suggests 62 safety requirements for reduction of risk associated with the listed hazards. The assessment identified 23 actions which should be used to support activities during the design phase of the facility which are listed in **Table 3 of Appendix 16.1**. The Hazard Log also provides a set of actions shown in **Table 16.5.** These actions will be resolved during final technology selection process. The Hazard Log will be treated as a living document throughout the project lifecycle.

Table 16.5: Actions Required to Identify Safety Requirements

Hazard	Action Text
Radon gas	Borehole survey work package included as part of planning application.
Heavy metals within the water course	Identification of heavy metals within watercourse to be included in borehole surveys.
Material incompatibility in the O_2 vent line	HAZOP to be conducted on the selected design. Identify design basis for material compatibility in the O_2 vent line.
External fire source	Fire risk from external sources to be assessed as part of layout design.
Rare weather event	Weather issues e.g. wind loading and temperature change to be included in design requirements.
Security breach	Security assessment to be included in overall work package planning.
Future risk	Future risk assessment activities should use the risk parameters presented in Appendix D of the PHA when design maturity allows.

The report includes mitigation for each hazard identified and formalised into safety requirements. The full list of safety requirements is outlined in **Appendix 16.1**.

The TLUP QRA has been prepared in accordance with the guidelines set out in the HSA's Technical Land Use Planning Guidelines. The TLUP QRA has been submitted to the HSA as part of the planning application submission. The purpose of the TLUP QRA is primarily to assess the offsite risks to human health and the environment for the purposes of determining the suitably of the preferred site for the Hydrogen Plant. Further on-site QRAs will be prepared as the Hydrogen Plant progresses towards construction, into and during operations.

The PHA and TLUP QRA outputs have been incorporated into the Hydrogen Plant layout and operational concept. As per COMAH requirements, the Developer is required to provide a Major Accident Prevention Policy (MAPP) to the HSA prior to commencement of operations, to detail their approach to controlling the risks associated with the facility, an outline MAPP has been produced and is included in **Appendix 16.2**. In addition, an Emergency Response Plan will also be generated (recommended, but not required for lower-tier COMAH sites). A Risk Management Programme, Operational Management Plan, Traffic Management Plan, ATEX Assessment and Safety Management System will also be in place for the facility prior to commencement of operations, in accordance with guidance from the HSA.

16.3.1 Natural Hazards

16.3.1.1 Meteorological

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The dominant influence on Ireland's climate is the Atlantic Ocean. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence.

The Met Éireann weather station at Belmullet is the nearest weather and climate monitoring station to the Proposed Development that has meteorological data recorded for the 30- year period from 1991 to 2021. The monitoring station is located approximately 68 kilometres west of the Proposed Development. Meteorological data recorded at Belmullet over the 30-year period from 1991 - 2021 is shown in **Chapter 10: Air and Climate**. The wettest months are October and December, June is usually the driest. August is the warmest month with a mean daily temperature of 15° Celsius(C) and January is the coldest with a mean daily temperature of 6.3°C. The average annual temperature is 10.3°C.

The works programme for the construction stage of the Proposed Development will take account of weather forecasts and work will be suspended in the case of extreme weather events.

The following forecasting and weather warning systems are available and will be used on a daily basis at the Wind Farm Site and Hydrogen Plant Site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates.
- Weather Warning or Advisories: Met Éireann's main suite of warnings are issued by the duty forecaster between 10am and midday and are updated as necessary as new information becomes available. In general, warnings will not be issued more than 60-hours ahead of the expected adverse weather but advisories on potential hazards are issued up to a week in advance. The three warning categories are:

  - Yellow: Not unusual weather. Localised danger.
  - Orange: Infrequent. Dangerous/disruptive.
  - Red: Rare. Extremely dangerous/destructive.
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale.
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events.
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive.
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Due to the exposed nature of windfarm sites, wind turbines are designed to withstand extreme weather conditions including:

- *Extreme Winds* - Modern turbines are fitted with sensors which will automatically shut down and brake the turbines should very high wind speeds occur that exceed safe operating limits (wind speeds greater than 25 m/s).
- *Lightning Strike* - Modern turbines are equipped with lightning protection equipment. If lightning strikes a turbine, this equipment effectively and safely conducts the lighting strike into the earth. Generally lighting protection is also provided at the substation(s) compound.
- *Ice Throw* - As a result of certain meteorological conditions, such as still, cold weather, ice can form on the rotor blades. In the event that this happens, two types of risk may occur:
  - Ice fragments may be thrown from the rotor; and
  - Ice may fall from the turbines while shut down.

Ice throw has been noted as a risk in extremely cold conditions that occur in locations such as the high latitudes of Scandinavia or high altitudes in mainland Europe. Ice fall can occur if ice accumulates on the turbine and falls to ground as the melting process begins. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades.

The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation. Safety signage will be put in place.

The Hydrogen Plant Site has been designed to withstand extreme weather events. The electrolyser package will be contained within a dedicated building and will not be open to the elements. Water treatment equipment, compressors and the substation control rooms will also be housed within buildings. Other process equipment, such as the cooling system and filling station will not be housed within enclosures, but adverse weather conditions, such as extreme cold, heat waves, high winds, heavy rain events, or dry spells, are not expected to impact on the operations of these areas of the Proposed Development.

Weather conditions may however impact the roads in the surrounding area, if poor driving conditions or weather warnings mean roads will be closed and/or driving conditions would be unsafe, the Hydrogen Plant would cease operations in order to limit the hydrogen stored at the Hydrogen Plant Site. Management of traffic on and off the Hydrogen Plant Site will be set out in the Traffic Management Plan.

Rainfall in the region is abundant and current predictions of the impacts of climate change suggest rainfall will increase in the future. However, extreme weather events such as heavy rain fall or droughts could potentially impact the source water supply to the Hydrogen Plant Site. Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Firlough Wind Farm and Hydrogen Plant Site has have been prepared, the reports are presented in **Appendix 9.1** and **Appendix 9.2**. The reports conclude that both sites are not at risk of flooding.

During extreme weather events (1 in 100 year) runoff in the order of 373.68 m^3/hour will be attenuated on the Hydrogen Plant Site (Note: Assessment at catchment scale presumes the same environmental conditions across the entire catchment during a theoretical storm event taking into account for climate change). Storage of raw water required for the electrolysis process will be provided via two separate underground storage tanks for water extracted from groundwater and from rainwater harvesting with a total volume of 15,058 $m^{3.}$ This equates to approximately 40 hours of rain during a 1 in 100 year storm event. The management of rainwater storage on site will include limiting volumes in storage to allow excess emergency space for attenuation up to 6 hours rain during a 1 in 100 year storm event. This equates to approximately 2,242 m^3 or approximately 15% of total storage capacity will be left empty in expectation of future storm events in the rainwater tank. In the event storage does reach capacity, the storm system will be equipped with an overflow diverting excess water (>6 hours during a 1 in 100 year event) greenfield run off.

The underground water storage tank can provide 12,816 m^3 of useable storage (allowing for 2,242 m^3 attenuation void), to provide between 1.5 and 4 months (depending on the month) backup water supply for the Hydrogen Plant operations should there be an extreme dry period. Ongoing monitoring of the aquifer will be in place during the operational period. Should there be indications of a low water supply, there is an additional back up supply from the mains water. Alternatively, hydrogen production, and thus water consumption, can be ceased temporarily.

Wastewater storage is adequately sized (e.g. c. 1500 m^3) to achieve ability to significantly reduce (e.g. 50%) discharge rates to surface water, or in emergency situations to completely halt discharging for a minimum duration of one month. Emergency situations in the context of this report includes observing prolonged drought conditions and prolonged low dry weather discharge rates in the receiving river, discharging under such conditions could significantly adversely impact on water quality in the receiving river. Therefore, this is an important piece to consider in the management of wastewater and effluent discharge.

16.3.1.2 Vulnerability to Climate Change

The potential causes of accidents / disasters associated with the vulnerability of the EIA Development to climate change are identified in **Table 16.6**. Information is drawn from 'Local Authority Adaptation Strategy Development Guidelines' (EPA 2016)[2].

[2] http://www.epa.ie/pubs/reports/research/climate/EPA_Research_Report164.pdf

Table 16.6: Impact of Climate Change

Variable	Summary Climate impact projections: 30-year overview	Confidence of projection	Projected changes	EIA Project Exposure	EIA Project Assessment	Project Risk
Sea level Rise (SLR)	Strong increase Sea levels are rising and will continue to do so for the foreseeable future.	High	Projections of SLR to 2100 suggest a global increase in the range of 0.09–0.88 m with a mean value of 0.48 m. For 2050 it is reasonable to assume a sea level rise in the region of 25 cm above present levels. It should be noted that due to an as yet limited understanding of some of the important effects that contribute to rates of increase, these estimates of sea level rise may prove optimistic, and estimates of up to 4–6 m have been projected by some models.	The Wind Farm Site is located on land with an elevation of greater than approximately 120 m above sea level and 11 km from the sea. The Hydrogen Plant Site is located on land with an elevation of approximately 48 m above sea level and approximately 8 km from the sea.	Due to Wind Farm Site and Hydrogen Plant Site elevation and location it is considered highly unlikely sea level rise will affect the Proposed Development during the operational lifetime.	Neutral, Imperceptible
Storm Surge	Strong increase (N&W) In the north-west, surges between 50 and 100cm will be 30 % more frequent.	Medium	An increase in the number of intense cyclones and associated strong winds are expected over the north-east Atlantic. By the 2050s, storm surge heights in the range of 50–100 cm are expected to increase in frequency for all coastal areas with the exception of the southern coast.	The Wind Farm Site is located on land with an elevation of greater than approximately 120 m above sea level and 11 km from the sea. The Hydrogen Plant Site is located on land with an elevation of approximately 48 m above sea level and approximately 8 km from the sea.	Due to Wind Farm Site and Hydrogen Plant Site elevation and location it is highly unlikely a storm surge will affect the Proposed Development during the operational lifetime.	Neutral, Imperceptible
Coastal Erosion	Moderate increase Increasing sea levels and wave heights may result in increased levels of coastal erosion.	Low	Currently approximately 20% of Ireland's coastline is at risk of coastal erosion, particularly areas of the south and east coast and also in isolated areas on the west coast. Rates of increase will be determined by local circumstances; however, it is expected that areas of the south-west are likely to experience the largest increases.	The Wind Farm Site is located inland approximately 11 km from the coast and the Hydrogen Plant Site is located approximately 8 km from the sea.	Due to Wind Farm Site and Hydrogen Plant Site location coastal erosion is not possible.	Neutral, Imperceptible

Variable	Summary Climate impact projections: 30-year overview	Confidence of projection	Projected changes	EIA Project Exposure	EIA Project Assessment	Project Risk
Cold Snaps/Frost	Moderate decrease (winter/night) Increasing average air temperatures may act to decrease the duration and intensity of cold snaps.	High	By mid- century, minimum temperatures during winter are projected to increase by ~2ºC in the south-east and ~2.9ºC in the north. This change will result in fewer frost days and milder night-time temperatures.	The wind turbines and all other EIA Development infrastructure are designed and operated with temperature considerations. Wind turbines can be shut-down during conditions where ice may form on rotor blades. Water storage tanks and piping will be insulated onsite at the Hydrogen Plant Site. The cooling system utilizes a coolant fluid which contains glycol and water and has a freezing point of below -12ºC. As such, it is less susceptible to freezing. If freezing of pipework occurs, or the cooling system is impacted by low temperatures, hydrogen production will be shutdown until the issue is rectified.	The effect of cold periods and freezing/frost conditions is expected to be minimal in regards to hydrogen production. The expected increase in temperature over time may reduce, the currently already low, potential duration of turbine shutdown due to icy conditions. The increase in temperature and reduction in the number of frost days will reduce the risk to freezing pipework onsite at the Hydrogen Plant Site.	Positive, Imperceptible
Heatwaves	Strong increase (summer) Increasing average air temperatures are likely to increase the duration and intensity of heatwaves.	High	Seven significant heatwaves (defined as 5+ days @ >25ºC) have been recorded in Ireland over the past 30 years, resulting in approximately 300 excess deaths. By mid-century, a projected increase in summer maximum daily temperature of approximately 2ºC will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.	The wind turbines and all other EIA Project infrastructure are designed and operated with temperature considerations. Increased temperatures may reduce the effectiveness of the hydrogen production facility's cooling system.	Higher temperature air is generally less dense and this may very slightly reduce turbine power output. The current cooling system has been designed with excess cooling capacity. If the system is unable to maintain a suitable operating temperature for the electrolysers and compressors, hydrogen production will be shutdown.	Negative, Imperceptible
Dry Spells	Strong increase (summer)	Medium	There have been seven periods of insignificant rainfall in Ireland in the past	The wind turbines and all other EIA Development infrastructure are	The Wind Farm will continue to generate during dry spells. The	Wind Farm Neutral, Imperceptible

Variable	Summary Climate impact projections: 30-year overview	Confidence of projection	Projected changes	EIA Project Exposure	EIA Project Assessment	Project Risk
	Increased seasonality in precipitation is very likely to result in more severe dry spells in summer.		40 years. Of these, the events of 1976 and 1995 were the most severe, averaging 52 and 40 days in duration respectively across Irish rainfall stations. An approximate 20% decrease in summer precipitation receipts in many areas is strongly indicated under a high emissions scenario. This decrease is likely to result in progressively longer periods without significant rainfall, posing potentially severe challenges to water-sensitive sectors and regions.	designed and operated without any need for a cooling water supply. There may be greater dust emission potential from access roads.	separation distance to dust sensitive receptors is high and effect potential very low. The Hydrogen Plant Site uses ground water abstraction and rainwater harvesting, both of which could be impacted by dry spells. However a backup water storage tank with between 1.5 and 4 months supply and a backup connection to the water grid will provide a water supply should there be a shortage.	Hydrogen Plant Site; negative, slight
Extreme Rainfall	Strong increase (winter) Increasing seasonality in rainfall distribution is likely to result in a >20 % increase in the number of very Extreme Rainfall wet days.	Low	Heavy precipitation days (in which more than 20 mm of rain falls) are likely to increase in frequency in winter. By the 2050s an increase in the number of heavy precipitation days of around 20 % above the level of 1981–2000 is projected under both low–medium and high emissions scenarios. This may have serious consequences for flood risk in sensitive catchments.	The wind turbines and all other EIA Development infrastructure can operate during heavy rainfall events.	The Wind Farm Site is in an upland location with some local steep slopes in river gulley's. River crossing culverts, and the Wind Farm Site and Hydrogen Plant drainage systems is designed for 1 in 100 year rainfall events. Approximately 2,242 m^3 or approximately 15% of total water storage capacity at the Hydrogen Plant Site will be left empty in expectation of future storm events in the rainwater tank. In the event storage does reach capacity, the storm system will be equipped with an overflow diverting excess water (>6 hours during a 1 in 100 year event) greenfield run off.	Neutral, Imperceptible

Variable	Summary Climate impact projections: 30-year overview	Confidence of projection	Projected changes	EIA Project Exposure	EIA Project Assessment	Project Risk
Flooding	Moderate increase (winter) Projected increases in winter rainfall will likely increase the risk of fluvial flooding in "fast response" catchments.	Low	An Irish Reference Network of hydrometric stations has been established to assess signals of climate change in Irish hydrology. This network has detected an increasing trend in high river flows since 2000. Projections of future flows are beset by uncertainties at the catchment scale, but a broad signal of wetter winters and drier summers is evident across a number of independent studies.	The EIA Development infrastructure is not located in areas prone to flooding.	The Proposed Development infrastructure is designed to allow for flooding and high-water table areas. Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Firlough Wind Farm and Hydrogen Plant Site has been prepared, the report is presented in Appendix 9.1 and Appendix 9.2. The reports conclude that both sites are not at risk of flooding.	Negative, Imperceptible
Wind Speed	Minor increase (winter) Models predict a slight increase in wind energy in winter of between 0 and 8 %, with a minor decrease in summer of 4–14 %.	Medium	Observed wind speed over Ireland has not changed significantly in recent times, but it is anticipated that the distribution of wind will alter slightly in future, with winters marginally windier and summers marginally less so. Though the average wind speed is anticipated to change in only a minor way over the coming decades, the frequency of extreme windstorms is expected to increase due to alterations Wind Speed in the origin and track of tropical cyclones.	The EIA Development is located in a higher wind speed area and the operation benefit will be positively affected by higher wind speeds. Turbines will shut down when the wind speed is greater than approximately 25 m/s.	The higher wind speeds will increase annual energy capture, and the greater winter energy capture tends to match greater demand for electricity. Increased electricity generation would also potentially lead to increased hydrogen production and water consumption. However, the maximum 80 MW capacity electrolyser limits the hydrogen production and is the used for impact assessment.	Positive, Imperceptible

To summarise, the vulnerability of the Project to climate change has been assessed in **Table 16.5**, no significant vulnerabilities of the Project to climate change have been identified. It is therefore unlikely that the vulnerability of the Project to climate change would result in significant adverse environmental effects in terms of the potential causes of accidents or disasters.

16.3.1.3 Hydrological

Increased runoff, or an increased hydrological response to rainfall has the potential to exacerbate flooding events and impact on hydro morphology of waterbodies downstream of the Proposed Development, and/or to exacerbate flooding and erosion within the boundary of the Wind Farm Site or Hydrogen Plant Site.

A stand alone Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Firlough Wind Farm and Hydrogen Plant Site has been prepared as part of this EIAR, the report is presented in **Appendix 9.1** – Site Flood Risk Assessment Firlough Wind Farm and **Appendix 9.2** – Site Flood Risk Assessment Firlough Hydrogen Plant. This FRA assessment details site-specific rainfall and evapotranspiration rates as well as a preliminary water balance assessment for the estimated baseline runoff conditions and the estimated post Development conditions at both sites. As detailed in **Chapter 9: Hydrology and Hydrogeology,** there is no residual flood risk on either the Wind Farm or Hydrogen Plant Site. Based on the information gained through the flood identification process, no parts of the Wind Farm Site or Hydrogen Plant Site are mapped within any fluvial flood zones. Flood Risk Assessments conclude that the likelihood of exacerbating flood risk or behaviours at the Site is very low, and the potential to exacerbate effects on local receptors including dwellings is very low.

16.3.1.3.1 Wind Farm

No recurring or historic flood incidents are recorded within the Wind Farm Site or along the Grid Connection, Interconnector, Galway Turbine Delivery Route and the Killybegs Turbine Delivery Route.

Where complete, the CFRAM[3] Study OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the PFRAM maps. No areas of the Proposed Development are within a zone mapped as being either low (0.1% AEP[4]), medium (1 % AEP) or high (10 % AEP) probability of fluvial flooding. There are no areas of pluvial flood extents mapped near the Wind Farm Site. All proposed works (except for watercourse crossings) are located at least 50 m from a watercourse.

As the associated drainage - some of which is permeant for the lifetime of the Proposed Development, will be attenuated for greenfield run-off, the Proposed Development will not increase the risk of flooding elsewhere in the catchment. Based on this information, the

[3] CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011, and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.
[4] AEP is the annual exceedance probability.

Proposed Development complies with the appropriate policy guidelines for the area and is at no risk of flooding.

A 1 in 100-year storm event scenario results in a net increase of surface water runoff associated with the Proposed Development, calculated to be c 0.124 m^3/sec (or 124 l/sec). This net increase relative to the scale of the Wind Farm Site or the scale of the associated catchment is considered an adverse but imperceptible or negligible impact of the Proposed Development.

The Proposed Development will use the latest best practice guidance to ensure that flood risk within or downstream of the Wind Farm Site is not increased as a function of the Proposed Development, i.e., a neutral impact at a minimum.

The risk of the Wind Farm Site contributing to downstream flooding is very low, as the long-term plan for the Wind Farm Site is to retain and slow down drainage water prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. Please refer to the **Chapter 9** of this EIAR and the Surface Water Management Plan in the CEMP in **Appendix 2.1** for further details.

With appropriate environmental engineering controls and mitigation measures any potential impacts will be significantly reduced. Furthermore, if considered adequately mitigation measures have the potential to have a beneficial impact on the hydrological response to rainfall at the site, where by; if the development can reduce discharge rates at the site below estimated *greenfield* or baseline runoff rates, the Wind Farm Development will have a beneficial impact by reducing the site hydrological response to rainfall and mitigate against potential flood events downstream.

Minimal land take is required for the Grid Connect Route, Interconnector Route, Killybegs Turbine Delivery Route and the Galway Turbine Delivery Route considering a majority of the routes will traverse already existing roadways (i.e., existing Site Access Roads, public and local road networks. There are some areas of the delivery route that will require the widening of existing portions of roads which traverse greenfield / green verge areas, however considering the small scale of disturbance (shallow excavation, superficial paving) the impact is considered slight. Similarly, there is unlikely to be an increase in the rate of runoff from the construction of both these routes due to utilization of pre-existing road infrastructure.

16.3.1.3.2 Hydrogen Plant Site

As detailed in **Chapter 9: Hydrology and Hydrogeology,** no recurring or historic flood incidents are recorded within the Hydrogen Plant Site or immediately downstream. No areas of the Hydrogen Plant Site are within a zone mapped as being either low (0.1% AEP[5]), medium (1% AEP) or high (10% AEP) probability of fluvial flooding according to the CFRAM[6] Study OPW Flood Risk Assessment Maps. There are no areas of pluvial flood extents mapped near the Hydrogen Plant Site and no parts of the Hydrogen Plant Site are mapped within any fluvial flood zones. All proposed works are located at least 70 m from a watercourse apart from the discharge point.

A 1 in 100-year storm event scenario results in a net increase of surface water runoff associated with the Proposed Development, calculated to be c. 103.8 l/second, or 373.68 m^3/hour. This net increase relative to the scale of the Site or the scale of the associated catchment is considered an adverse but imperceptible or negligible impact of the Proposed Development.

The Proposed Development will use the latest best practice guidance to ensure that flood risk within or downstream of the Hydrogen Plant Site is not increased as a function of the Proposed Development, i.e., a neutral impact at a minimum.

The risk of the Hydrogen Plant Site contributing to downstream flooding is very low, as the long-term plan for the site is to retain and slow down drainage water prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. Please refer to the **Chapter 9** of this EIAR for further details.

16.3.1.4 Geological; Peat Stability

On the 12th of November 2020, a peat failure occurred on the site of the Meenbog Wind Farm, County Donegal as construction was being carried out on a floating road which was to provide access to a turbine hardstand and foundation. The failure occurred in an area comprising very weak peat upslope of the access road that was under construction[7].

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[5] AEP is the annual exceedance probability.

[6] CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011, and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.

[7] Dykes, A. P. (2022) Landslide investigations during pandemic restrictions: initial assessment of recent peat landslides in Ireland. Landslides 19, pp.515–525 https://link.springer.com/article/10.1007/s10346-021-01797-0

Given the upland nature of the Proposed Development and the presence of peat, geotechnical and peat stability considerations have been central to the design phase of the Proposed Development.

A comprehensive and robust Peat Stability Assessment was undertaken for the Proposed Development and used to inform the design process including the siting of all proposed main infrastructure locations and drainage control measures. The Peat Stability Assessment was informed by the Scottish Government's 2017 guidance document, Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Intrusive ground investigation works were carried out as part of the Peat Stability Assessment included peat depth probing, shear strength testing, ground augering/coring and trial pitting. The extensive suite of ground investigations, the robust peat stability assessment and the lessons learned from the Meenbog Wind Farm peat slide will ensure that the risk of such an event occurring during the construction, operation or decommissioning at the Proposed Development is minimised. Please see **Chapter 8: Soils and Geology** and **Appendix 8.1** for more details.

Peat depths across the proposed Wind Farm Site are generally shallow with the exception of minor isolated pockets of moderately deep and deeper peat delineated by shallow subsoils and/or bedrock at or near the surface. There was no very deep peat observed at the Wind Farm Site. The Wind Farm layout utilises existing tracks for the majority (approximately 70%) of the access roads.

The Hydrogen Plant Site is situated on an area of 'improved' agricultural land. The area of peatland to the south and bounding the river is relatively shallow (<1.9 m depth) and with very minor incline if not flat. There are no floating roads proposed at the Hydrogen Plant Site. Significant peat or slope stability issues at this location are therefore unlikely. There remains the risk of localised stability issues arising during construction works (e.g. excavation for foundations).

Emergency responses to potential stability incidents will be established and form part of the CEMP before construction works initiate. The following potential emergencies and respective emergency responses are addressed in brief:

- Peat stability issues at a localised scale during excavation works – In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the Site will cease immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed.

- Significant peat or slope stability issues during construction activities – In the unlikely event that soil and slope stability issues arise during construction activities, all ongoing activities in the vicinity will cease immediately, operators will evacuate the area by foot, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed.

Considering the highly dynamic nature of peat or soil stability issues at any particular site, it is important to establish an equally dynamic yet robust framework to follow in the event of an incident. Establishment of an emergency framework will follow relevant guidance to initially qualify any incident (by on site competent geotechnical engineer) and risk assess the area, and to then apply initial measures and design a complete emergency / contingency plan in line with an established structured emergency response. Relevant guidance includes:

- Forestry Commission, Scotland (2006) Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low Cost Roads Over Peat
- CIRIA (2006) Control of water pollution from linear construction projects. Site guide (C649)).

Emergency response will prioritise isolating and containing any materials which is being or will be intercepted by the established drainage network or receiving surface water network. Emergency materials and equipment requirements will be identified, incorporated in the CEMP, and will be managed on site with a view to be being easily accessible and readily available. On site training and toolbox talks will ensure any response to any potential incident is escalated quickly and efficiently.

The combination with mitigation measures as described under **EIAR Chapter 9: Hydrology and Hydrogeology** whereby precautionary measures e.g. silt screen fencing etc. will be in place. Emergency response above existing or in place measures might include crudely building dams with an excavator to attenuate or direct flow until conditions stabilise, depositing subsoil or crushed rock material to dam drainage channels, and reactionary dewatering through silt bags to appropriate areas of the site i.e. vegetated area and without impacting on problem area in terms of stability.

16.3.2 Technological Hazards

16.3.2.1 Health andSafety

Hydrogen has a proven safety track record as a fuel for more than 100 years worldwide. Hydrogen has various properties that make it an ideal energy carrier:

- Hydrogen is non-toxic and non-poisonous, unlike conventional fuels. A hydrogen leak will not contaminate the environment or endanger the health of humans or wildlife. Hydrogen does not create "fumes."
- Hydrogen is 14 times lighter than air, consequently when it is released it dilutes quickly into a non-flammable concentration, significantly reducing the risk of ignition at ground level.
- Hydrogen has a higher oxygen requirement for explosion than conventional gasoline.
- Hydrogen has a lower radiant heat than conventional gasoline, i.e. the air around the hydrogen flame is less hot than around a gasoline flame, reducing the risk of secondary fires.

The Developer has been engaging with various stakeholders and safety specialists for almost 2 years. Actions to date include:

- Review of internationally recognised safety standards and codes
- Incorporation of safety considerations to initial Hydrogen Plant Site design
- Organisation of Preliminary Hazard Analysis (PHA) Identification sessions
- Development of PHA Report
- Development of TLUP QRA
- Engagement with the Health and Safety Authority (HSA)
- Engagement with Sligo Fire Service
- Engagement with Sligo and Mayo County Councils
- Development of a Major Accident Prevention Policy
- Continued engagement with local councils and HSA

Actions underway and planned for future phases include:

- Completion of onsite Quantitative Risk Assessment
- Update of TLUP QRA
- Development of a Risk Management Programme
- ATEX Assessment (workplace /employee based assessment)
- Development of a Safety Management System
- Completion of Major Accident Prevention Policy

During construction of the Proposed Development, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the Health and Safety Plan. An Emergency Response Plan

(ERP) (**Appendix 2.1**) will be implemented and adhered to. The ERP provides details of procedures to be adopted in the event of an emergency in terms of health and safety and environmental protection.

A comprehensive health and safety assessment is required for all major construction projects in Ireland. This would generally be carried out prior to construction by the selected contractor in accordance with legislation.

The operational phase of the Wind Farm poses little threat to the health and safety of the public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s 'Wind Energy Development Guidelines for Planning Authorities 2006' state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines. The DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised.

A Major Accident Prevention Policy has been developed for the Hydrogen Plant Site. This was prepared by senior management and establishes a commitment to ensuring the achievement of high standards of control of major accidents and hazards, specifically in relation to the operation of Hydrogen Plant. Guaranteeing a high level of protection to human health and the environment. Senior management have commissioned and participated in the preparation of a Preliminary Hazard Analysis and Technical Land Use Planning Quantitative Risk Assessment, the results and mitigating measures of which have been incorporated into the design of the Hydrogen Plant layout. As part of the Major Accident Prevention Policy, a Safety Management Plan, Risk Management Plan, Traffic Management Plan and Emergency Response Plan will be produced for the Hydrogen Plant Site. These processes will help identify and mitigate hazards onsite and reduce the risk to employees, the public and the environment during the construction and operational phase of the Hydrogen Plant.

Access to the Hydrogen Plant will be restricted to authorised personnel and security fencing will prevent egress by the public as is standard with hydrogen facilities in operation.

16.3.2.2 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s 'Wind Energy Development Guidelines for Planning Authorities 2006' state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines.

The DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.

Turbine blades are manufactured of glass reinforced plastic which will prevent any likelihood of an increase in lightning strikes within the Wind Farm Site or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations.

16.3.2.3 Industrial Accident

There is limited potential for significant industrial accidents to occur at the Firlough Wind Farm and Hydrogen Plant. Ireland is a geologically stable country with a mild temperate climate. A wind farm is not a recognised source of pollution. Should an industrial accident occur, the potential sources of pollution onsite during both the construction and operational phases are limited.

It is considered that the risk of significant fire occurring, affecting the Wind Farm Site and causing the Wind Farm to have significant environmental effects is unlikely. A 2020 article in Wind Power Engineering Magazine estimated that 1 in 2,000 wind turbines catch fire each year[8]. Overall, the data shows that wind turbine fires are relatively rare[9]. It is therefore

[8] https://www.windpowerengineering.com/is-rope-based-descent-emergency-evacuation-at-the-end-of-its-tether/ [Accessed 27/01/2022]
[9] https://www.firetrace.com/fire-protection-blog/wind-turbine-fire-statistics [Accessed 27/01/2022]

considered that the risk of significant fire occurring, affecting the Wind Farm and causing the Wind Farm to have significant environmental effects is highly unlikely.

There are no significant sources of pollution in the Wind Farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is addressed in **Section 16.3.8**.

As with all fuels, the production and handling of hydrogen has an inherent degree of risk. Whilst some properties of hydrogen make it safer than other fuels, there is still a requirement to adopt controls and best practice to ensure safety. Hazards and issues involved with handling hydrogen include combustion, the size of the molecule, interactions with materials and pressure hazards. Health and Safety has been a key consideration in the design of the Hydrogen Plant, and the approach has incorporated good practice principles such as inherently safer design, the hierarchy of controls and safety standards as set out in **Table 2.4** in **Chapter 2: Project Description.**

The European Union's Seveso-III (Directive 2012/18/EU) outlines rules and regulations aimed at preventing the occurrence of major accidents involving dangerous substances. This is implemented in Ireland through the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations, 2015 (the "COMAH Regulations") which outlines various requirements covering the notification of on-site storage of dangerous substances and the Proposed Development of safety policies, reports and emergency plans. There are two tiers of establishment, which are related to the quantities of dangerous substances present. Depending on quantity, an establishment may be upper-tier or lower-tier. Upper-tier establishments have greater quantities of dangerous substances present and therefore are obliged to comply with additional requirements specified in the Regulations. Hydrogen is outlined as having a lower-tier requirement of 5 tonnes and an upper tier value of 50 tonnes. The Hydrogen Plant is expected to be designated a lower-tier COMAH site due to the provision of 26 tube trailer bays onsite, which based on current tube trailer technology could store a total of 31.2 tonnes of hydrogen at any one point in time. Maximum onsite capacity to store hydrogen is 40.128 tonnes, with 26 filled tube trailers occupying the tube trailer bays, plus 7 filled tube trailers at each of the filling stations plus buffer tank capacity of 528 kg. The upper-tier threshold is 50 tonnes.

There are two European directives that address potentially explosive atmosphere. ATEX Directive 2014/34/EU covers equipment and protective systems in potentially explosive atmosphere and outlines various health and safety requirements as well as assessment procedures to ensure conformity. This is implemented in Ireland through SI No 230 of 2017 European Union (Equipment and Protective Systems for use in Potentially Explosive Atmosphere) Regulations 2017. ATEX Directive 1999/92/EC also addresses explosive atmospheres but focusses on the health and safety of workers in such environments. Ireland's 2007 Safety Health & Welfare at Work Regulations implements this directive (Part 8) and sets out the minimum requirements that should be deployed to ensure workers are protected from potential hazards.

A Major Accident Prevention Policy (MAPP) has been prepared for the Hydrogen Plant Site and will continue to be refined and updated prior to commencement of operations. The MAPP sets out the various steps the Developer will take throughout the lifecycle of the project to ensure the safety of people in contact with the operations at the plant and the environment in which the Hydrogen Plant is located. Through the adoption of best practice principles, the mitigation of hazards through design, and the following of relevant guidance and regulations, the Hydrogen Plant Site will be designed and operated to reduce the risk of industrial accidents in so far as is reasonably practicable.

16.3.2.4 Accidents to Personnel

Potential risks associated with the Proposed Development for personnel may arise in the construction, operation and decommissioning phases, as follows:

- General construction and demolition (of the sheds and house near the Hydrogen Plant Site entrance) accidents;
- Land and peat slides;
- Driving to and from the construction sites;
- Slips, trips, and falls;
- Climbing inside turbine towers;
- Working on live electrical equipment;
- Working on pressurised hydraulic equipment;
- Rotating machinery;
- Asphyxiation due to a gas leak in a confined area;
- Burns due to a hydrogen fire;
- Injuries or death due to a hydrogen explosion;
- Cooling fan blade failure;
- Alkaline leakage;
- Coolant leakage;
- Working at height; and

- Working in confined spaces.

Due to the health and safety legislative environment associated with the construction, operation and decommissioning of projects such as windfarms and hydrogen production, this embedded mitigation reduces the risk materially.

The construction of the Proposed Development will be managed in accordance with the Safety Health and Welfare at Work (Construction) Regulations 2006 – 2013.

A comprehensive health and safety assessment is required for all major construction projects in Ireland. This will be carried out prior to construction by the selected contractor in accordance with legislation and best practice guidelines.

All construction and operational personnel will require evidence of completion of construction safety training, typically in the form of a Safe Pass Card. The Contractor's H&S Plan will detail the site induction and access requirements. Equipment operators/specialist works will require personnel to hold a valid Construction Skills Scheme Card where relevant. All equipment and machinery used on-site will be appropriately certified and maintained in good working order. The Developer will ensure that only competent contractors are appointed to carry out the construction works on both the Wind Farm Site and the Hydrogen Plant Site. Public safety will be addressed by restricting access during construction works and the erection of security fencing as appropriate at construction works areas. The entrances to both sites will be controlled by the Contractor. Site entrance gates will be securely locked outside of construction hours to prevent unauthorised entry and will be monitored during construction hours to regulate access for authorised personnel.

A Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) will be appointed by the developer in accordance with the provisions of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2103), as amended.

The PSCS will prepare a Construction Stage H&S Plan addressing all aspects of the construction process, including the demolition of the house and agricultural sheds near to the Hydrogen Plant Site entrance and providing relevant contact details and emergency response procedures for the Proposed Development. The H&S Plan will identify the potential safety hazards associated with the Proposed Development and the works and assess the associated risks. Mitigation and control measures will be implemented to minimise the identified risks.

A Senior Health and Safety Professional ("SHSP") shall be appointed to the senior management team at a suitable time following submission of the planning application to An Bord Pleanála. The SHSP will be responsible for establishing a team of internal and external health and safety professionals commensurate with a facility like the Hydrogen Plant. The SHSP shall establish training, design and implementation protocols to ensure all staff, contractors, third party employees onsite are trained to a high level of technical competence.

A training needs analysis report will be prepared to determine what training is required for which employees/operators at the Hydrogen Plant Site. This analysis will be used to produce a timeline of training of employees/operators to ensure that a competent and correctly trained team is operating the Hydrogen Plant. As part of the training needs analysis, a competency requirements plan will be produced to identify what competencies each employee/operator requires. This will be informed by the safety critical activity identification described previously, with additional assessment with support of human factors experts where required.

A detailed Emergency Response Plan (ERP) (recommended, not required for lower-tier COMAH sites) for the proposed works, to cover health and safety emergencies as well as environmental emergencies will be developed. This ERP shall be activated in the event of an emergency such as an accident, fire, spillage, collapse etc. and will provide details on who is required to be notified, first aid facilities and closest hospitals. The ERP will also include details of all personnel inducted and authorised to work on the Wind Farm Site and Hydrogen Plant Site as well as next of kin contact details and relevant medical information.

Regulations 9 and 10 of COMAH set out the following objectives for an ERP:

1. Identification of significant sources, types, scales and consequences of potential major accidents, including malicious acts;
2. Establishment of the objectives of the response, both technical and organisational;
3. Identification of the components (procedures, roles, resources – hardware and software) required to achieve the response;
4. Identification of the organisations and key post holders involved;
5. Identification of the expertise, arrangements and capabilities of the organisations and individuals which are relevant to the procedures and the roles needed, and the adequacy of the resources identified for responding to the identified major accident scenarios;
6. Determination of how all the responses will be coordinated including any 'sub-plans';

7. Allocation of responsibilities for the response and associated components;
8. Identification of situations where the routine procedures and resources are not appropriate or sufficient, what to do instead; and
9. Identification of the means to ensure the plans will be put into effect as intended.

The ERP will consider the long and short-term recovery plans; and a timeline of events should be produced to detail key tasks to be completed to mitigate the risk. The four key parts of creating an emergency response plan are:

1. Contain and control incidents so as to minimise the effects and to limit damage to persons, the environment and property;
2. Implement the measures necessary to protect persons and the environment from the effects of major accidents;
3. Communicate the necessary information to the public and to the emergency services and authorities concerned in the area; and
4. Provide for the restoration and clean up of the environment following a major accident

In addition to the above, the ERP will include contact details for site personnel and emergency services, maps and plans of the Hydrogen Plant Site, emergency procedures, chemical inventories, and equipment lists, as well as a fire response strategy and appropriate training requirements for onsite staff.

Emergency situations to be planned for within the ERP will be identified through a series of workshops to be conducted by the Developer. These workshops will be held prior to the commencement of construction works at the Project and will be reviewed annually as part of a wider internal audit process.

Appropriate responses to emergencies will be developed using industry best practice and where possible by reference to examples in Ireland and elsewhere around the world. The SHSP will work with the Sligo Fire Department and other appropriate authorities (for example the HSA) where applicable in refining the appropriate responses included within the ERP and as part of the MAPP. The SHSP shall seek external input or review from suitably qualified professionals to consider the completeness of the ERP as well as the appropriateness of the responses contained therein.

The ERP must include contact names and telephone numbers for the relevant local authorities (all sections/departments) including ambulance, fire brigade, An Garda Siochána and the HSA. Reporting of environmental emergencies to the local authority will be required as well as other relevant stakeholders such as IFI, NPWS or the EPA.

The regular review and update of the ERP shall be defined at a later date in accordance with industry best practice and with guidance from the HSA, Sligo Fire Department and other appropriate authorities.

As part of the ERP, an evacuation drill will be carried out on a regular basis to make all personnel aware of the procedure to be followed in the event of an emergency where a full evacuation is required. Emergency muster point(s) will be identified at suitable locations in the construction compounds and the ERP will outline the persons responsible for checking names at the safety muster points. Records will be maintained of such drills.

16.3.2.5 Accidents to Infrastructure

Potential risk to infrastructure for the construction, operation and decommissioning phases are mainly from:

- Fire in turbine or electrical substation;
- Loss of power and control of turbine;
- Loss of mechanical break;
- Failure of gearbox;
- Blade separation from rotating turbine rotor.
- Offload of turbine during haulage;
- Turbine tower collapse;
- Forestry fire posing risk to wind farm equipment;
- Hydrogen fire/explosion;
- Cooling fan blade failure;
- Alkaline leakage.

On very rare occasions, the structural integrity of wind turbines has failed. This is an extremely rare occurrence and given that the turbines will be designed and installed by an experienced turbine contractor and are located away from public roads and inhabited houses (490 m from the nearest public road which runs through the western portion of the Wind Farm Site boundary, near T6 and 750 m from the nearest inhabited house), it is not considered that the unlikely event of an accident of this type would result in any significant impacts to population or human health or any other environmental factors. There are no inhabited dwellings within 299 m of the Hydrogen Plant Site, it is not considered that the unlikely event of an accident of this type would result in any significant impacts to population or human health or any other environmental factors.

16.3.2.6 Loss of containment of hydrogen from storage or during tube trailer loading

Hydrogen is the lightest gas and significantly lighter than air (approximately 14 times lighter), therefore rapidly diffusing when vented/released. In enclosed spaces, this can lead to the accumulation of hydrogen and has the potential to act as an asphyxiant. Therefore, adequate ventilation systems are required when handling hydrogen within enclosures. Diffusion can occur through materials and systems not normally considered porous, including walls. Some metals can suffer from embrittlement when exposed to hydrogen. Material selection as well as joints in piping systems will be designed to accommodate the use of hydrogen. The Hydrogen Plant will be designed to address each of these potential issues in accordance with best practice including; NFPA 55; Compressed gases and cryogenic fluids code, EIGA IGC 15/06; Gaseous hydrogen stations, ASTM D7265-12; Standard Specification for Hydrogen Thermophysical Property Tables, NFPA 2 Hydrogen Technologies Code, ISO 19880; Gaseous Hydrogen – Fuelling stations, BCGA CP 33; The Bulk Storage of Gaseous Hydrogen at Users' Premises 2012. The full list of standards and codes can be found in **Chapter 2; Project Description, Table 2.4**.

A release of hydrogen from the high-pressure storage vessels could result in a fire or explosion. See **Section 16.3.4.6**.

16.3.2.7 Loss of containment of hydrogen from road vehicles (tube trailers)

Hydrogen will be moved offsite by road in specially designed tube trailers pulled by HGVs. Tube trailers are currently widely used to transport a number of compressed gas products on Ireland's roads including natural gas, compressed air, nitrogen and oxygen. Hydrogen is currently transported in Ireland and elsewhere in Europe, via tube trailer. These will be filled from the high-pressure storage tanks in one of 7 filling bays within the facility. The cylinders onboard the tube-trailers will be fitted with pressure relief devices that will release the contents in the event of a fire. This reduces the risk of explosions as the pressure is released. See **Section 16.3.4.6**.

A 'sick tank bay' has been incorporated into the design of the Hydrogen Plant Site. This is a designated area for any damaged or faulty tube-trailers and is located a safe distance away from equipment, personnel and operations.

16.3.2.8 Loss of containment of oxygen from process or storage vessels.

Oxygen is an oxidising gas, which promotes combustion (although oxygen itself cannot burn). This increases the risk of a fire, although it does not directly cause one to occur. A significant release of oxygen could lead to an increased risk of fires involving combustible materials that would not usually burn. The design does not incorporate onsite storage of oxygen, and all produced oxygen will be vented to atmosphere reducing this risk to imperceptible with no impacts predicted.

16.3.2.9 Hydrogen fire or explosion

Hydrogen has a proven safety track record as a fuel for more than 100 years worldwide. Hydrogen has various properties that make it an ideal energy carrier:

- Hydrogen is non-toxic and non-poisonous, unlike conventional fuels. A hydrogen leak will not contaminate the environment or endanger the health of humans or wildlife. Hydrogen does not create "fumes."
- Hydrogen is 14 times lighter than air, consequently when it is released it dilutes quickly into a non-flammable concentration, significantly reducing the risk of ignition at ground level.
- Hydrogen has a higher oxygen requirement for explosion than conventional gasoline.
- Hydrogen has a lower radiant heat than conventional gasoline, i.e. the air around the hydrogen flame is less hot than around a gasoline flame, reducing the risk of secondary fires.

As with most combustion fuel sources, hydrogen is flammable, so any storage or handling of it has the potential to lead to a fire. A release of hydrogen from the high-pressure storage vessels could also result in a fire or explosion. Hydrogen fires are different than natural gas fires in in that the radiant heat of hydrogen fires is lower and because hydrogen is buoyant (lighter than air). These factors mean hydrogen fires tend to have a smaller area at risk for a comparable natural gas fire. Hydrogen also burns with a pale blue flame, which is difficult to detect visually as its hard for the human eye to see in daylight. Hydrogen also may be stored at higher pressures and has a wider flammable range than natural gas which may increase the area at risk.

Hydrogen has higher design standards for protection as it is easier to ignite and is extremely flammable in air (flammability limits of between 4 percent and 75 percent by volume) and has a low ignition energy (0.019 mJ). Ignition can occur when a hydrogen/oxidizer is exposed to processes such as flames, electrical spark or shock waves. This can ultimately lead to the occurrence of explosions under certain circumstances. Separation distances and fire barriers have been designed into the Proposed Development to mitigate the effects of fires and explosions In addition, hydrogen leak and fire detection system will also be installed. These are in line with the design standards set out in **Table 2.4** in **Chapter 2: Project Description.**

To prevent loss of oxygen containment increasing fire risks, the oxygen systems would be physically separated from the hydrogen systems and stores of any combustible materials in line with good practice design standards.

A Quantitative Risk Assessment (the "TLUP QRA") has been prepared by Risktec Solutions Ltd, an independent and specialist provider of risk management consulting, resourcing, learning and inspection services, in accordance with the guidelines set out in the HSA's Technical Land Use Planning Guidelines. This is included in **Appendix 16.3**. It includes consequence mapping using software to model loss of containment scenarios which show:

- Distances to the lower flammability limit (LFL) and upper flammability limit (UFL) from flammable gas dispersion (showing the flash fire extent);
- Distances to specified thermal radiation levels from jet fires; and
- Distances to specified vapour cloud explosion overpressure levels.

The individual location-based risk contours relevant to new establishments are presented in **Figure 16.1** as follows:

- 1E-06 /year - maximum tolerable risk to a member of the public; and
- 5E-06 /year - maximum tolerable risk to a person at an off-site work location.

It can be seen from **Figure 16.1** that there are no buildings or occupied areas within the contours.

The nearest occupied areas (which are all located outside the 1E-06 /year contour), can be summarised as follows:

- Location A (located 134 m outside the 1E-06 /year contour, to the north): Residential house with one person living in the premises. There is no elevated occupancy (e.g. contractor work) during temporary periods. A maximum occupancy of one can therefore be assigned to this location.
- Location B (located 120 m outside the 1E-06 /year contour, to the east): Premises includes farm shed that houses small number of beef cattle during winter months. The owner of the farm is also resident at the house at premises. Farmer would be considered temporarily onsite / temporary worker as well as one further temporary worker. A maximum occupancy of two can therefore be assigned to this location.
- Location C (located 43 m outside the 1E-06 /year contour, to the south west): Automated milking parlour which has the following occupancy:
  - One full time worker on site seven days a week;
  - Milk collection by one person from the farm occurring once every two days; and

- Feed delivery by one person occurring every two days.

A maximum occupancy of three can therefore be assigned to this location, noting that coincident occupancy of the above personnel is an unlikely situation.

The risk contours have been derived on the basis that the facility is shutdown and isolated within 60 seconds, as per the isolation points outlined in the TLUP QRA. To determine the sensitivity of the contours to this assumption, an alternative case is presented in Appendix E of the TLUP QRA for a theoretical worst-case scenario whereby no isolation points are implemented. In the worst-case contours with no isolation also do not affect the nearest occupied locations.

Beyond the green risk contour in **Figure 16.1**, the risk of a major accident resulting in a loss of life is less than 0.0001% or 1 in a million years. By comparison, the National Weather Service in the United States estimates, the risk of dying from lightening strike is 1 in 500,000 (0.0002%). In Ireland, the death rate in traffic accidents is 3 per 100,000 (0.003%) according to data published by WHO in 2020

Societal risk is a measurement of the potential for accidents from the facility to affect multiple people. To take account of societal risk from the Hydrogen Plant, an estimate of the Expectation Value (EV) is necessary. The EV of a single release scenario is the product of the individual risk (expressed in chances per million) and the potential number of people affected. Due to the very limited occupancy/populations around site the EV of the Hydrogen Plant Site is less than 1. This is significantly below the level required for further evaluation (100). On this basis societal risk is considered broadly acceptable at the location.

These results provide evidence that the facility location satisfies the HSA criteria for new establishments. The results of the analysis show that the proposed site of the Hydrogen Plant is within the tolerable risk region as per the HSA's TLUP guidance criteria for new establishments. Due to the broadly acceptable results, no recommendations are drawn from the study in relation to the proposed location of the Hydrogen Plant.

Figure 16.1 Individual Risk Contours from the Hydrogen Plant (relevant to new establishments).

The Hydrogen Plant has been designed to address each of these potential issues in accordance with best practice and design standards including; EN 14373; Explosion suppression systems, EN 14460; Explosion resistant equipment, EN 16020; Explosion diverters, EN 15089;Explosion isolation systems, EN 14797; Explosion venting devices, EN 14986; Designs of fans working in potentially explosive atmospheres, EN 1127-1;Explosive atmospheres – Explosion prevention and protection – Basic concepts and methodology, BS EN 50495; Safety devices required for the safe functioning of equipment with respect to explosion risks, PD CEN/TR 15281; Guidance on inerting for the prevention of explosions. EN 60079; Explosive Atmospheres, BS 60080; Explosive and toxic atmospheres.

Safety equipment installed at the Hydrogen Plant will include:

- Leak/fire detection + isolation/automatic shut-off
- Emergency stops
- Building ventilation (passive + active)
- Piping pressure/flow rate monitoring
- Impact sensors at dispensers
- Audible and visual alarms
- Fire protection and suppression equipment
- Pressure-relief systems will be installed on relevant equipment.

Consultation with the Health and Safety Authority of Ireland and the Sligo Fire Service was undertaken during the design phases. Their comments and recommendation for the design and operation of the Hydrogen Plant are included in **Chapter 1: Introduction, Section 1.10.2** and have been incorporated in to the design.

The detection system in place at the Hydrogen Plant will be capable of detecting hydrogen gas or hydrogen leak or fire and a Supervisory Control and Data Acquisition ("SCADA") system will monitor the facilities performance. Firefighting systems will include alarms, water spray deluge systems, sprinkler systems, carbon dioxide suppression systems and mobile fire protection equipment in accordance with the relevant codes and standards shown in **Table 2.4** in **Chapter 2: Project Description.**

Water for firefighting purposes will be contained within two dedicated fire water storage tanks of 636 m^3 designed for 120 minute operation in the event of a fire. These will have sprinkler and manual hose operation.

Hydrogen fires do not typically produce noxious or toxic combustion products and do not produce exhaust fumes, the only product is water and is therefore not considered to be a threat with the potential to affect watercourses, the ground or groundwater.

There is a potential that without mitigation, other materials at the Hydrogen Plant could be impacted by a hydrogen fire or explosion and create emissions that impact air quality, cause the loss of containment of chemicals and result in impacts to the environment. These include:

- Potassium hydroxide (KOH), also known as lye, has been selected as the electrolyte for the electrolyser stacks and will be stored as a 25 % KOH solution in tanks within the electrolyser building. KOH itself does not burn however poisonous gases can be produced in fires including potassium oxides. Inhaling potassium hydroxide can irritate the lungs and higher exposures can cause a build up of fluid in the lungs (pulmonary edema). Exposure can cause headache, dizziness, nausea and vomiting.
- Sodium bisulphite is used for the for de-chlorination of raw water. This is not combustible, however during a fire it produces irritating and toxic gases.
- Glycol for coolant. This is mixed with water, it is not consumed in the process but on site storage is required in case minor system losses need to be replenished. Thermal decomposition can lead to the release of irritating gases and vapours including Carbon monoxide (CO) and Carbon dioxide (CO_2).
- Nitrogen gas and will be used at the facility to purge equipment and piping for both safety and maintenance purposes. Nitrogen is an inert gas and so is not toxic.
- Antiscalant used to prevent/reduce scaling of water treatment equipment (i.e. from build up of salts).
- Building materials used in the construction of the Hydrogen Plant.
- Oils and lubricants.
- Cleaning Chemicals.

The release of these materials due to a fire or explosion, or any other major accident or natural disaster could have significant environmental impacts and cause contamination or impact air quality. In addition to direct adverse impacts on ecological sensitivities downgradient of the site, runoff of contaminants could potentially impact on the WFD status and objectives associated with the receiving surface water networks associated with the Proposed Development.

Adjacent habitats and agricultural land could potentially be damaged by fire. The likelihood of fire spreading from the Hydrogen Site, given the surrounding land uses are largely agricultural grasslands, containing few buildings or combustible materials, is low. There is a risk of causing a peat or forest fire due to both environments occurring in close proximity to the Hydrogen Site. However, with the appropriate fire detection and suppression equipment, firefighting equipment and the ERP in place this is significantly reduced.

There is a risk that water used in the event of a fire could potentially be contaminated with the materials outlined above which could have impacts to water quality, habitats, soils, agricultural lands and ecological life should it be allowed to migrate off the site.

Harmful constituents such as hydrocarbons and chemicals also pose a to human health if found in drinking water sources. No drinking water designated surface waters, National Federation of Group Water Schemes (NFGWS), GSI Public Supply Source Protection Areas or mapped well buffer zones (250 m) were identified within or downstream of the Hydrogen Plant Site. The closest mapped well (GSI Ref. 1131NEW005, Agri & domestic use) to the Hydrogen Plant Site is approximately 1.1 km to the north. Full details can be found in **Chapter 9: Hydrology and Hydrogeology.**

The release of contaminants could be intercepted by soils, the surface water network or groundwater potentially effecting the water quality in either. In addition to direct adverse impacts on ecological sensitivities downgradient of the site, runoff of contaminants could potentially impact on the WFD status and objectives associated with the receiving surface water networks associated with the Proposed Development. In the absence of mitigation, there is a risk that contaminants released in the event of an industrial accident could enter local watercourses and ultimately flow to designated sites where there could be resultant adverse effects on water quality and aquatic life and relevant qualifying interests within the sites. Pollutants entering the watercourses could result in direct mortality of aquatic biota with the scale and extent dependant on the volumes and toxicity of the pollutant. The potential for release of pollutants, chemicals and the spillage of hydrocarbons is primarily associated with the unlikely occurrence of an industrial accident such as fire or explosion. The potential impact of pollutant release in the absence of mitigation is therefore considered unlikely, short term but significant negative at the local scale and likely to be reversible through mediation.

The impact of any pollution event will depend on the volumes of discharged waters, concentrations and types of pollutants (in the case of the proposed development these being comprised of chemicals such as Potassium hydroxide (KOH), Sodium bisulphite and Glycol along with hydrocarbons), volumes of receiving waters, and the sensitivity of the ecology of the receiving waters. With respect to the Proposed Development, this includes all freshwater habitat and ecological receptors downstream of the Proposed Development that have been identified as ecological receptors. The significance of any effect would also be dependent on the magnitude and duration of a pollution event.

Mitigation by design means that chemicals accidentally introduced to the environment will be intercepted by drainage and surface water networks associated at the Hydrogen Plant Site. In line storage throughout wastewater treatment process will facilitate buffering flow and discharge rates. This includes a wastewater storage tank, sized c.1500 m^3 this will achieve the ability to stop discharging completely. If firewater run off cannot be treated on site to reach acceptable levels it will be pumped out and tankered off site to a licenced disposal facility. This reduces the potential effect to an unlikely, not significant, negative, indirect impact.

Operational mitigation includes that all liquid chemicals will be stored in a bunded area on the Hydrogen Plant Site and will be subject to requirements of the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 to 2021 (as amended) and compliance with the requirements of REACH, i.e., European Communities Regulation 1907/2006 for the Regulation, Evaluation, Authorisation and Restriction of Chemicals. Chemicals will be managed in accordance with European Chemicals Agency's Guidance for Downstream Users (2014). Final selection of bulk chemicals will be subject to an assessment of trace elements to ensure that they are within acceptable limits. Storage of large volumes of oils and other hazardous substances will have a secondary containment such as a bund to prevent hydrocarbon contamination to land/water. Waste oils and other chemicals, including oil rags/wipes will be disposed of as hazardous waste. Operational staff will receive training on the handling, containment, use, and disposal requirements for all potentially polluting products on the Hydrogen Plant Site.

A detailed Emergency Response Plan (ERP) for the proposed works, to cover health and safety emergencies as well as environmental emergencies, as part of the H&S Plan will be developed. This ERP shall be activated in the event of an emergency such an industrial accident and will provide details on who is required to be notified, e.g. the Sligo Fire Service, first aid facilities and closest hospitals.

The ERP will consider the long and short-term recovery plans; and a timeline of events should be produced to detail key tasks to be completed to mitigate the risk. The four key parts of creating an emergency response plan are:

1. Contain and control incidents so as to minimise the effects and to limit damage to persons, the environment and property;
2. Implement the measures necessary to protect persons and the environment from the effects of major accidents;
3. Communicate the necessary information to the public and to the emergency services and authorities concerned in the area; and
4. Provide for the restoration and clean up of the environment following a major accident

In addition to the above, the ERP will include contact details for site personnel and emergency services, maps and plans of the Hydrogen Plant Site, emergency procedures, chemical inventories, and equipment lists, as well as a fire response strategy and appropriate training requirements for onsite staff.

The Sligo Fire Department will be responsible for coordinating responses for emergencies and have already incorporated firefighting water reservoirs on the Hydrogen Plant Site as well as fire hydrants and backup power supplies following the Sligo Fire Department's review of preliminary drafts of the Hydrogen Plant layout. The Developer will continue to engage openly with the Sligo Fire Department in the preparation of an ERP in advance of commencement of operations.

In terms of air quality, the Hydrogen Plant Site location is a significant distance from receptors. The public would have no access to the Hydrogen Plant. The nearest public road L6611 is 600 m to the west and the nearest buildings which are not associated with the facility are 299 m away. Due to these separation distances, fire safety mechanisms and the dilution effect of any air pollution created during a fire, the effects to air quality have been assessed as a temporary small adverse and direct impact in the event of a fire or explosion. Air Quality is assessed in **Chapter 10: Air Quality and Climate**.

16.3.2.10 Contamination

A wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur, the potential sources of pollution on-site during both the construction and operational phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited.

The Proposed Development has the potential to cause contamination and pollution of groundwater and surface water from potential release of hydrocarbons, earthworks and excavations. A Construction Environment Management Plan (CEMP) (**Appendix 2.1**) has been prepared in conjunction with the Environmental Impact Assessment Report and the Natura Impact Statement which accompanies the planning application for the Proposed Development.

Section 3 of the CEMP sets out details of the environmental controls to be implemented. The CEMP provided details on-site drainage measures, peat stability monitoring measures, waste management and pollution prevention measures for refuelling and managing hazardous materials and cement-based products. The CEMP also sets out the Emergency Response Procedure (**Management Plan 1**) to be adopted in the event of an emergency including contamination, health and safety and environmental protection.

The CEMP provides details on all mitigation and monitoring measures to be actioned prior to construction, during the construction, operation and decommissioning phase. The CEMP will be subject to ongoing review through regular environmental auditing and site inspections during the construction phase. This will confirm the efficacy and implementation of all mitigation measures and commitments identified in the application documentation. Please see **Chapter 2: Project Description** and **Appendix 2.1 Construction Environmental Management Plan** for further details.

The Hydrogen Plant will produce hydrogen and oxygen. Both gases are non-toxic and pose no contamination or pollution risks.

There is a potential that other materials at the Hydrogen Plant could be impacted by a major accident or natural disaster and create emissions that impact the environment. These include:

- Potassium hydroxide (KOH)
- Sodium bisulphite
- Glycol
- Nitrogen gas
- Antiscalant
- Building materials used in the construction of the Hydrogen Plant.
- Oils and lubricants.
- Cleaning Chemicals.

The release of these materials due to major accident or natural disaster could cause contamination of soils, water or air.

The hazard posed by contamination to soil is significant in terms of adversely impacting on the health of the soils associated with the proposed site and the flora and fauna it supports.

While sensitive terrestrial biodiversity receptors have not been identified within the site of the Hydrogen Plant or the immediate surroundings, a contamination incident, would have a significant, long term to permanent, negative impact on soil quality on the Hydrogen Plant Site. However, this potential impact is considered to be localised (considering the movement of same is limited), naturally reversible (natural attenuation over a relatively medium to long term period of time), or theoretically reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced. The more significant risk of contamination of soils is the eventual and likely migration to surface water systems, a potentially significant negative impact (see **Chapter 8: Soils and Geology)**.

In the absence of mitigation, there is a risk that contaminants released in the event of a major accident or natural disaster could be intercepted by either the surface water network or groundwater potentially effecting the water quality in either potentially impacting the surrounding agricultural lands and habitats and ultimately flow to designated sites where there could be resultant adverse effects on water quality and aquatic life and relevant qualifying interests within the sites. In addition, runoff of contaminants could potentially impact on the WFD status and objectives associated with the receiving surface water networks associated with the Hydrogen Plant Site.

Pollutants entering the watercourses could result in direct mortality of aquatic biota, a change in hydrochemistry and impact on sensitivities such as ecology, with the scale and extent dependant on the volumes and toxicity of the pollutant. Potassium hydroxide and glycol are used only in the closed-loop electrolysis process and will not enter the waste water stream. As the source water for the Hydrogen Plant will be groundwater or rainwater, this should be free of chemicals or dangerous substances. Sodium bisulphite will only be used if mains water is used in the process which would require de-chlorination. In large quantities sodium bisulphite can depress pH and dissolved oxygen, causing mortality of fish (Ryon et al, 2002). However, expected levels of treatment that would be required are at most 5 mg/l (5ppm), typically 2-3 mg/l. Sodium bisulphite is regularly used in the treatment of drinking water supplies and is a non-hazardous solution commonly used as a waste water de-chlorination agent. While high concentrations will contribute to elevated chemical oxygen demand in aquatic environments, but it is subject to rapid biological decomposition (Product

Data Sheet). Antiscalants will be used in small quantities to prevent/reduce scaling of water treatment equipment and therefore is likely to occur in the waste water stream. While the specific Antiscalant to be used has not been identified, most antiscalants are proprietary organic man-made polymers. These products are considered non-hazardous as defined by the US Occupational Safety and Health Act regulations. It should also be noted that non-natural materials deposited, even if inert, are considered contaminants. Hydrocarbons are a pollutant risk due to their toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface (whether surface water or groundwater). Hydrocarbons adsorb ('stick') onto the majority of natural solid objects they encounter, such as vegetation, animals, and earth materials such as soil. They burn most living organic tissue, such as vegetation, due to their volatile chemistry. They are also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life.

The Proposed Development, without mitigation has the potential to result in the leakage of wastewater or chemicals associated with waste water sanitation onto soils, and into the drainage network in the event of a major accident or natural disaster. Waste water and waste water sanitation chemicals are pollutant risks due to their potential impact on the ecological productivity or chemical status of surface water systems, and toxicity to water-based flora and fauna.

Considering the quality of the surface water draining from the Hydrogen Plant Site (baseline), and the 'Very High' sensitivity and importance of the associated surface water networks downstream, any introduction of contaminants is considered a potentially significant adverse impact of the Proposed Development (see **Chapter 9: Hydrology and Hydrogeology)**.

While sensitive terrestrial biodiversity receptors have not been identified within the site of the Hydrogen Plant or the immediate surroundings, in the absence of mitigation there is a risk that contaminants released in the event of an industrial accident could enter the watercourse to the south of the Hydrogen Plant Site; the Dooyeaghny River, and ultimately travel to the Killala Bay/Moy Estuary SAC and the Killala Bay/Moy Estuary SPA. In such a scenario, some of the qualifying interests of the SAC and the Special Conservation Interests of the SPA could be affected adversely. The significance of any effect would be dependent on the concentration and type of pollutant, as well as the magnitude and duration of a pollution event. This potential significant adverse effect on European sites is discussed in full detail in the accompanying NIS. Unmitigated discharging to surface waters could potentially impact adversely on the receiving surface water quality and potentially human health if these enter drinking water supplies. (**Chapter 9: Hydrology and Hydrogeology** provides an assessment of the hydrological impacts in relation to the Proposed Development, including the potential for water contamination and any impacts to private water supplies. **Chapter 4** assesses these impacts in terms of their effect on Population and Human Health).

Potential incidents of release of contaminants at the Hydrogen Plant will likely be short lived or temporary, however the potential impacts to downstream receptors can be long lasting, or permanent. The potential for release of pollutants, chemicals and hydrocarbons is primarily associated with the unlikely occurrence of a major accident or natural disaster. The potential impact of pollutant release to water in the absence of mitigation is therefore considered unlikely, long term and significant negative at the local scale and likely to be reversible through mediation.

In the event of a major accident or natural disaster chemicals and materials stored at the site also have the potential to be released into the air, posing a risk to air quality potentially posing a risk to human health. The Hydrogen Plant Site location is a significant distance from receptors. The public would have no access to the Hydrogen Plant. The nearest public road L6611 is 600 m to the west and the nearest buildings which are not associated with the facility are 299 m away. Due to these separation distances and the dilution effect of any air pollution created during a fire, the effects to air quality have been assessed as unlikely, temporary and not significant, direct impact in the event of a major accident or natural disaster. Air Quality is assessed in **Chapter 10: Air Quality and Climate**.

With appropriate environmental engineering controls and mitigation measures these potential impacts can be significantly reduced. Appropriate environmental engineering controls and mitigation measures are outlined in the relevant EIAR chapters. Mitigation by design means that chemicals accidentally introduced to the environment will be intercepted by drainage and surface water networks associated at the Hydrogen Plant Site. In line storage throughout wastewater treatment process will facilitate buffering flow and discharge rates. This includes a wastewater storage tank, sized c.1500 m^3 this will achieve the ability to stop discharging completely. If contaminated water cannot be treated on site to reach acceptable levels it will be pumped out and tankered off site to a licenced disposal facility.

All chemicals will be stored in a bunded area on the Hydrogen Plant Site and will be subject to requirements of the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 to 2021 (as amended) and compliance with the requirements of REACH, i.e., European Communities Regulation 1907/2006 for the Regulation, Evaluation, Authorisation and Restriction of Chemicals. Chemicals will be managed in accordance with European Chemicals Agency's Guidance for Downstream Users (2014). Final selection of bulk chemicals will be subject to an assessment of trace elements to ensure that they are within acceptable limits. Storage of large volumes of oils and other hazardous substances will have a secondary containment such as a bund to prevent hydrocarbon contamination to land/water. Waste oils and other chemicals, including oil rags/wipes will be disposed of as hazardous waste. Operational staff will receive training on the handling, containment, use, and disposal requirements for all potentially polluting products on the Hydrogen Plant Site.

A detailed Emergency Response Plan (ERP) for the proposed works, to cover health and safety emergencies as well as environmental emergencies will be developed. This ERP shall be activated in the event of an emergency such a major accident or natural disaster and will provide details on who is required to be notified.

The ERP will consider the long and short-term recovery plans; and a timeline of events should be produced to detail key tasks to be completed to mitigate the risk. The four key parts of creating an emergency response plan are:

1. Contain and control incidents so as to minimise the effects and to limit damage to persons, the environment and property;
2. Implement the measures necessary to protect persons and the environment from the effects of major accidents;
3. Communicate the necessary information to the public and to the emergency services and authorities concerned in the area; and
4. Provide for the restoration and clean up of the environment following a major accident.

In addition to the above, the ERP will include contact details for site personnel and emergency services, maps and plans of the Hydrogen Plant Site, emergency procedures, chemical inventories, and equipment lists, as well as a fire response strategy and appropriate training requirements for onsite staff.

16.3.3 Transportation Hazards

The Proposed Development will utilise the existing road network during the construction phase with some upgrading of Killybegs Turbine Delivery Route and Galway Turbine

Delivery Route required. Construction related traffic will originate from the delivery of materials to The Wind Farm Site and Hydrogen Plant Site, removal of surplus excavated material from site and transport of employees to, from and throughout the site. The localised traffic disruptions will be mitigated through the use of industry standard traffic management measures. **Chapter 15: Traffic and Transport** addresses the potential impacts of the Proposed Development on the road network, this includes an assessment of the safety of road users and pedestrians and hazards associated with the Proposed Development these include road traffic collisions both on the construction sites and on public roads during construction, operation and decommissioning and the potential hazards to pedestrians on the roads. During operation, the volume of additional traffic caused by the hydrogen tube trailers on roads was considered and no significant impacts are found in the assessment.

Hydrogen will be moved offsite by road in specially designed tube trailers pulled by HGVs. These will be filled from the high-pressure storage tanks in one of 7 filling bays within the Hydrogen Plant Site. Hydrogen on its own cannot burn or ignite, it requires an oxidant (air/oxygen) to do so, along with an ignition source, such as an electric spark. It is therefore transported in enclosed containers with high safety margins and be fitted with relief valves.

The Hydrogen Plant production capacity will be scaled up to a maximum 80 MW, to meet demand for green hydrogen in the Irish market. The smallest initial batch of electrolyser capacity will be 10 MW. If the project was to install 10 MW of electrolyser capacity in an initial phase, the maximum daily hydrogen production would be 3,900 kg, with a maximum daily number of tube trailers of 11. When the full 80 MW capacity electrolyser is installed, the maximum number of trailers transporting green hydrogen per day is 26 (see **Chapter 2: Project Description**, Section 2.6.6.12). However, based on the available wind data, this value will vary month to month therefore hydrogen production per year has been more conservatively estimated at 4,547 tonnes for an 80 MW electrolyser (average 12.5 tonnes per day). Daily average is based on annual estimated hydrogen production divided by capacity of tube trailers.

It is anticipated that tube trailers, powered by zero emissions green hydrogen will be used to transport green hydrogen resulting in no CO_2 or NO_x pollutants, these vehicles only emit water vapour and heat. However, it is recognised that these may not be commercially available or commercially competitive when hydrogen production commences at the Proposed Development, if this is the case then diesel vehicles will be used until hydrogen fuelled vehicles become viable. The risk of transportation incidents is reduced with hydrogen fuelled vehicles due to the absence of diesel which will increase the risk of fire and explosion and also contamination.

EU Directives which are relevant to the movement and transportation of hydrogen include:

- Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods. This Directive applies to the transport of dangerous goods by road, by rail or by inland waterway within or between Member States, including the activities of loading and unloading, the transfer to or from another mode of transport and the stops necessitated by the circumstances of the transport.
- Directive 2010/35/EU, the Transportable Pressure Equipment Directive (TPED) – This Directive applies to the design, manufacture, conformity assessment and periodic reassessment of transportable cylinders, tubes, cryogenic vessels and tanks for transporting gases.
- International Carriage of Dangerous Goods by Road (ADR); a European Agreement concerning the international carriage of dangerous goods by roads

In Ireland, The European Communities (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011 to 2021, as amended, apply to the transport of dangerous goods by road in tanks, in bulk and in packages and give effect to Directive 2008/68/EC, Directive 2010/35/EU and the ADR. This includes the consignment, packing, loading, filling and unloading of the dangerous goods in relation to their carriage. They apply the provisions contained in the technical Annexes to the "Agreement Concerning the International Carriage of Dangerous Goods by Road" (ADR).

As with most combustion fuel sources, hydrogen is flammable, so any storage or handling of it has the potential to lead to a fire or explosion. A release of hydrogen from the high-pressure storage vessels could also result in a fire or explosion. Hydrogen fires are different than natural gas fires in in that the radiant heat of hydrogen fires is lower and because hydrogen is buoyant (lighter than air). These factors mean hydrogen fires tend to have a smaller area at risk for a comparable natural gas fire.

The cylinders onboard the tube-trailers are designed to withstand impacts and will be fitted with pressure relief devices that will release the contents in the event of a fire. This reduces the risk of explosions. However, should a road traffic incident occur involving a hydrogen tube trailer, there remains a risk that a fire or explosion could occur. The environmental impacts could include injury and loss of life to people and damage to buildings or other structures.

Hydrogen is non-toxic and non-poisonous, unlike conventional fuels and a hydrogen leak will not contaminate the environment or endanger the health of humans or wildlife.

Hydrogen does not create "fumes". Hydrogen fires do not typically produce noxious or toxic combustion products and do not produce exhaust fumes, the only product is water and is therefore not considered to be a threat with the potential to affect watercourses, the ground or groundwater. There is a potential that other materials at the accident site could create emissions and that impact air quality or cause the loss of containment of chemicals for example diesel or petrol.

A detailed Emergency Response Plan (ERP) for the operational phase of the Hydrogen Plant, to cover health and safety emergencies as well as environmental emergencies will be developed and agreed with the Sligo Fire Service and other relevant authorities as required. This ERP shall be activated in the event of an emergency such as an accident, fire, spillage etc. and will provide details on who is required to be notified, first aid facilities and closest hospitals.

A Traffic Management Plan (**Appendix 2.1**) is provided specifying details relating to traffic management. Prior to the commencement of the construction phase of the Proposed Development, a detailed Traffic Management Plan will be prepared by the Contractor for agreement with the relevant local authorities and An Garda Síochána. The Traffic Management Plan includes recommendations for the following:

- Traffic Management Coordinator
- Delivery Programme
- Information to locals
- A Pre and Post Construction Condition Survey
- Liaison with the relevant local authority
- Implementation of temporary alterations to road network at critical locations
- Identification of delivery routes
- Delivery times of large turbine components
- Travel plan for construction workers
- Additional measures
- Re-instatement works

Please see **Chapter 15: Traffic and Transportation** and Traffic Management Plan (**Appendix 2.1**) for further details.

16.3.4 Civil Hazards

16.3.4.1 Loss of Critical Infrastructure

EirGrid operates and develops Ireland's electricity grid. This includes interconnecting to neighbouring grids and running the wholesale electricity market. The grid safely brings power from generators such as wind farms to the ESB network that supplies homes and business in Ireland. It also brings power directly to large energy users. There are two types of electricity generation: synchronous generation and non-synchronous generation. Synchronous generation produces the same amount of electricity all the time e.g., fossil fuels. Non-synchronous generation produces varying amounts of electricity depending on the energy available. EirGrid operate the grid from National Control Centres in Dublin and Belfast, matching electricity production to customer demand, switching from synchronous to non- synchronous where required to ensure no power outages. Therefore, any technical fault at the Proposed Development would not impact the local or national energy supply.

The Hydrogen Plant is linked to the Wind Farm via underground cable which provides the electricity needed for the electrolysis processes, water purification, fin fan cooling etc. The Hydrogen Plant Site will be connected to the grid for backup/emergency power and will have a diesel generator on-site in case of an issue with the power supply. This will ensure monitoring and control systems as well as fire and gas detection equipment remains operational.

16.3.4.2 Water Supply

The hydrogen production process requires a water input, there is the potential for this water supply to be interrupted during a major accident or natural disaster. This could be due to a shortage of water, contamination of the water supply or could be due to freezing or flooding.

Water will be supplied to the Hydrogen Plant by groundwater abstraction by borehole combined with rainwater harvesting during normal operation. The design of the Hydrogen Plant includes 12,816 m^3 of useable underground storage capacity to be maintained using a combination of borewater and rainwater. There will also be a back-up connection to Uisce Éireann with a metered water supply to the Hydrogen Plant. This contingency option could be used in the event of a shortage of water, preventing the need for production to be impacted. The Hydrogen Plant includes a water treatment process system involving double pass Reverse Osmosis (RO) and Continuous Electrode ionization (CEDI). In the event of contamination of the water supply, the water treatment system will remove these contaminants. The water supply system has been designed to reduce the likelihood of pipes freezing, the climate at the Hydrogen Plant Site also makes this a rare and unlikely occurrence. However, should this occur, hydrogen production can be shut down entirely until the situation is resolved.

There are two wastewater streams from the Hydrogen Plant; hydrogen process wastewater and welfare (toilets, canteen etc). Source water will be treated as part of the hydrogen production process. The process wastewater arising from this process will be treated through constructed wetlands and regulated discharge rates before being discharged to the Dooyeaghny River to the south of the Hydrogen Plant Site.

During the operational phase of the Hydrogen Plant, source water will be treated as part of the hydrogen production process. Welfare waste from toilet facilities will also be produced. This wastewater will be treated by means of a septic tank (welfare waste) and series of constructed wetland and regulated discharge (combined welfare and processes wastewater).

Apart from the discharge of the trade effluent from the Hydrogen Plant and effluent from welfare facilities on site, there are additional risks to aquatic environment from the accidental spillage or release of chemicals or other pollutants. A range of chemicals will be used within the Hydrogen Plant which include:

- Potassium Hydroxide (KOH) for the electrolysis process (lye).
- Sodium bisulphite for de-chlorination of mains water, should it be used for process.
- Antiscalant used to prevent/reduce scaling of water treatment equipment (i.e. from build-up of salts and calcite).
- Glycol for coolant.
- Oils used by hydraulic systems, compressors and transformers and diesel,
- Facility cleaning chemicals.

As all chemicals used in the Hydrogen Plant Site will be stored in bunded facilities in accordance with specified legislation (Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 to 2021), the risk of accidental spillage or release is considered to be unlikely.

Potassium hydroxide and glycol are used only in the closed-loop electrolysis process and will not enter the waste water stream. As the source water for the Hydrogen Plant will be groundwater or rainwater, this should be free of chemicals or dangerous substances. Sodium bisulphite will only be used if mains water is used in the process which would require de-chlorination. In large quantities sodium bisulphite can depress pH and dissolved oxygen, causing mortality of fish (Ryon et al, 2002). However, expected levels of treatment that would be required are at most 5 mg/l (5ppm), typically 2-3 mg/l. Sodium bisulphite is regularly used in the treatment of drinking water supplies and is a non-hazardous solution commonly used as a waste water dechlorination agent. While high concentrations will contribute to elevated chemical oxygen demand in aquatic environments, it is subject to rapid biological decomposition. Antiscalants will be used in small quantities to prevent/reduce scaling of water treatment equipment and therefore is likely to occur in the waste water stream. While the specific Antiscalant to be used has not been identified, most antiscalants are proprietary organic man-made polymers. These products are considered non-hazardous as defined by the US Occupational Safety and Health Act regulations.

The wastewater arising from the Hydrogen Plant will be treated through constructed wetlands and regulated discharge rates before being discharged to the Dooyeaghny River to the south of the Hydrogen Plant. Unmitigated discharging to surface waters will potentially impact adversely on the receiving surface water quality and potentially human health if these enter drinking water supplies.

The water treatment process, controls to avoid risks of accidental spillage or release of chemicals, controlled discharge and assimilative capacity of the receiving waters will mitigate this risk. Groundwater and surface water quality, levels and discharge rate in the receiving river will be monitored on a routine and continuous basis. In line storage throughout the process will facilitate buffering flow and discharge rates. A wastewater storage tank, sized c.1,500 m^3 will be constructed to achieve the ability to stop discharging to constructed wetlands or surface water completely for a minimum duration of one month. This means that should contaminants that could potentially impact human health be found in the wastewater discharge, the discharge can be halted and wastewater stored and recirculated until acceptable levels are attained or taken off site for disposal at registered waste water treatment facilities.

Any particular contaminant which is observed to be excessively high in incoming source water will be targeted with specific wastewater treatment. **Chapter 9: Hydrology and Hydrogeology** provides an assessment of the hydrological impacts in relation to the Proposed Development, including an assessment of wastewater discharge and the potential for water contamination. Precautionary measures and emergency response protocols have been established and specified in Management Plans 1 and 3 of the CEMP, **Appendix 2.1.**

16.3.5 External major accidents or natural disasters

External major accidents could potentially impact the Proposed Development, however, no other Major Accident Hazard sites have been identified in the vicinity of the Hydrogen Plant

Site. A fire in the nearby woodland could potentially pose a risk to the Hydrogen Plant Site. However, fires are not common in the woodland of western Ireland, especially due to high rainfall in the region. While small wildfires do occur in Ireland, there is not a considerable risk of fire in the surrounding environment which could cause a major accident at the Hydrogen Plant Site due to the separation distances and the fire protection systems.

A detailed Emergency Response Plan (ERP) for the proposed works, to cover health and safety emergencies as well as environmental emergencies, as part of the H&S Plan will be developed. This ERP shall be activated in the event of an emergency such an external major incident or natural disaster and will provide details on who is required to be notified, e.g. the Sligo Fire Service, first aid facilities and closest hospitals.

16.4 LIKELY SIGNIFICANT EFFECTS

16.4.1 Risk Assessment

This section outlines the possible risks associated with the Proposed Development for the construction, operational and decommissioning phases.

These risks identified from the HSE Emergency Plan hazard type shown in **Table 16.4,** have been assessed in accordance with the relevant classification as outlined in **Table 16.1** and **Table 16.2** and in line with the EPA's **'**Guidance on Assessing and Costing Environmental Liabilities' document as outlined in **Section 16.2.3.2**. The Environmental impacts of these potential hazards are outlined in **Section 16.3** and assessed in **Table 16.9**.

16.4.1.1 Assessment of Effects During Construction

A risk register has been developed which contains all potentially relevant risks identified during the construction phase of the Proposed Development. Six risks specific to the construction of the Proposed Development have been identified and are presented in **Table 16.6**.

Table 16.6: Risk Register - Construction Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
A	**Severe Weather** Risk to construction activity on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
B	**Flooding**	

Risk ID	Potential Risk	Possible Cause
	High levels of surface water on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
C	**Peat Stability** Movement of peat within the site during construction	Mismanagement of excavated material on site Severe weather conditions- storm, flooding
Potential to cause accidents and / or disasters		
D	**Traffic Incident** Collisions onsite and offsite with vehicles involved in construction of Development	Driver negligence or failure of vehicular operations on site roads. Traffic Management Plan not implemented
E	**Contamination** Discharge or spillage of fuel, chemical solvents into watercourse or percolated to groundwater	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation; Stockpiled excavated material providing a point source of exposed sediment; Construction of the Proposed Development cable trench resulting in entrainment of sediment from the excavations during construction; and, Erosion of sediment from emplaced site drainage channels.
F	Industrial Accident- Fire, gas explosion	Equipment or infrastructure failure; Electrical problems; and Employee negligence.

16.4.1.2 Assessment of Effect During Operation

Six risks specific to the operation of the Proposed Development have been identified and are presented in **Table 16.7**.

Table 16.7: Risk Register – Operational Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
G	**Severe Weather**	

Risk ID	Potential Risk	Possible Cause
	Risk to buildings and infrastructure on sites.	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
H	**Flooding** High levels of surface water on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
I	**Peat Stability** Movement of peat within the site during construction	Severe weather conditions- storm, flooding
Potential to cause accidents and / or disasters		
J	**Contamination** Discharge or spillage of fuel, chemicals, sewage or wastewater into soils, watercourses, percolated to groundwater or released to the atmosphere.	A vehicular incident on the public road involving fuel, wastewater or sewage transportation in the operational phase. Equipment or infrastructure failure or industrial accident. Employee negligence.
K	**Industrial Accident – Fire / Gas Explosion**	Equipment or infrastructure failure; Electrical problems; and Employee negligence.
L	**Hydrogen Fire/Gas Explosion**	Equipment or infrastructure failure; Electrical problems; stray bullet from outside the facility and Employee negligence.
M	**Collapse/ damage to structures**	Earthquakes; and Vehicular collisions due to driver negligence on public roads.
N	**Traffic Incident** Collisions onsite and offsite with vehicles involved in operation of Development	Driver negligence or failure of vehicular operations on site roads. Traffic Management not implemented
O	**Loss of Critical Infrastructure**	Electrical fault at substation bay

16.4.1.3 Assessment of Effect During Decommissioning

Six risks specific to the decommissioning of the Proposed Development have been identified and are presented in **Table 16.8**.

Table 16.8: Risk Register – Decommissioning Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
P	**Severe Weather** Risk to decommissioning activity on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
Q	**Flooding of site** High levels of surface water on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
Potential to cause accidents and / or disasters		
R	**Traffic Incident** Collisions onsite and offsite with vehicles involved in construction of Development	Driver negligence or failure of vehicular operations on site roads. Traffic Management not implemented
S	**Contamination** Discharge or spillage of fuel, chemical solvents into watercourse or percolated to groundwater	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation. Erosion of sediment from emplaced site drainage channels.
T	**Industrial Accident - Fire/Gas explosion**	Petrochemical Fires causing personal injury, structural damage and forest fires.
U	**Loss of Critical Infrastructure**	Electrical fault at substation bay

The likely significant environmental impacts of these hazards are outlined in section 16.3 and summarised in **Table 16.9**.

16.4.1.4 Assessment of Effect – Summary

Table 16.9: Risk Assessment

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
Construction Phase								
A	Severe Weather	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.	Illness or loss of life; Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	3 "Unlikely"	The risk of severe weather is unlikely when considering the assessment in **Chapter 10: Air and Climate** and weather conditions recorded over the last 30 years within the area.	1 "Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	Severe weather conditions during the construction phase will result in a minor consequence in that a small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	3
B	Flooding	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds.	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	2 "Very Unlikely"	The risk of flooding is considered very unlikely when taking into account the baseline assessment in **Chapter 9: Hydrology and Hydrogeology** and due to no recurring or historic flood incidents being recorded within the Wind Farm Site, Hydrogen Plant Site or along the Grid Connection route.	1 "Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	The risk of flooding during the construction phase will result in a minor consequence in that a 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment' No contamination of environment (e.g., watercourses), localised effects of a temporary nature. Impact has been assessed as an unlikely, rare, not significant, negative, temporary and localised effect.	2
C	Peat Stability	Mismanagement of excavated material on site. Extreme weather conditions.	Movement of peat within the Proposed Development. Sedimentation of nearby watercourses. Damage to, or depletion of aquatic habitats and species.	2 "Very Unlikely"	The Wind Farm Site and Hydrogen Plant Site has been designed to minimise the potential for peat instability and failure. Refer to **Chapter 8 Soils and Geology.**	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	The risk of peat instability during the construction phase will result in a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration'. Contamination of environment (e.g., watercourses), localised effects of short duration.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
							Impact has been assessed as an unlikely, rare, not significant, negative, temporary and localised effect.	
D	Traffic Incident	Driver negligence or failure of vehicular operations on access roads. Traffic Management not implemented or not adhered.	Injury or loss of life.	3 "Unlikely"	A limited number of vehicles will be permitted on both construction sites as part of the construction phase. As such, it can be determined that there is some 'opportunity, reason or means' for a vehicle collision to occur on site, 'at some time.' An unlikely risk is therefore predicted.	1 "Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	A minor consequence is predicted. Having regard to on-site speed limits and vehicular movements, a 'small number of people would be affected' should a vehicular collision occur, with 'no fatalities and small number of minor injuries with first aid treatment.' Impact has been assessed as an unlikely, rare, not significant, negative, temporary and localised effect.	3
E	Contamination	Fuel spillage during delivery. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation. Stockpiled excavated material providing a point source of exposed sediment. Construction of the Proposed Development resulting in entrainment of sediment from the excavations during construction. Erosion of sediment from emplaced drainage channels.	Damage to, or depletion of aquatic habitats and species Release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies	2 "Very Unlikely"	As outlined in **Chapter 2: Project Description** and the **Appendix 2.1: Construction Environmental Management Plan**, fuel will be stored on-site but in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals or solvents will be stored outside of the confines of either site. Setback distances from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures as detailed in **Chapter 9: Hydrology and Hydrogeology.**	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	The risk of a fuel spillage or impact on surround drainage during the construction phase will result in a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration' through the use of bunded containment areas and proposed drainage mitigation measures during construction. Contamination of environment (e.g., watercourses), localised effects of short duration. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	4
F	Industrial Accident - Fire/Gas explosion	Equipment or infrastructure failure. Fuel spillage/ storage. Electrical problems; and	Illness or loss of life. Damage to, or depletion of habitats and species.	2 "Very Unlikely"	The demolition of the house and agricultural sheds will be completed under strict health and safety conditions. Fuel, mainly diesel will be stored on the Wind Farm Site and	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a fire/explosion occur at the Proposed Development, a limited consequence in that there would be 'a limited number of people affected' with	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		Employee negligence.	Negative impact on water quality. Impacts on ambient air quality.		Hydrogen Plant Site during construction. In accordance with Chapter 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Proposed Development shall be subject to a fire safety risk assessment which would assist in the identification of any major risks of fire on site e.g., wind turbines, substations, vandalism. There will be no hydrogen on the Hydrogen Plant Site during the construction phase. There are no Gas Networks within the vicinity of the Proposed Development. Therefore, there is low risk of explosion caused by gas.		'localised effects of short duration' due to the nature of the project and the volume of fuel storage during construction that would result in any such incident. There will be 'normal community functioning' in the area. Simple contamination of environment (e.g., watercourses), localised effects of short duration. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.	
Operational Phase								
G	Severe Weather	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds	Illness or loss of life; Sedimentation of nearby watercourse Damage to, or depletion of aquatic habitats and species;	3	The risk of severe weather is unlikely when considering the assessment in **Chapter 10: Air and Climate** and weather conditions recorded over the last 30 years within the area.	1 "Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	The risk of severe weather conditions during the operational phase will result in a minor consequence in that a small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	3
H	Flooding	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds	Illness or loss of life; Sedimentation of nearby watercourse; Damage to, or depletion of aquatic habitats and species;	2	The risk of flooding is considered very unlikely when taking into account the baseline assessment in **Chapter 9: Hydrology and Hydrogeology,** Flood Risk Assessments for both sites and due to no recurring or historic flood incidents being recorded within the Wind Farm Site, Hydrogen Plant site or along the Grid Connection or Interconnector routes.	1"Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	The risk of flooding during the operational phase will result in a minor consequence in that a 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination of environment (e.g., watercourses), localised effects.	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
I	Peat Stability	Severe weather conditions- storm, flooding	Movement of peat within the Proposed Development; Sedimentation of nearby watercourse; Damage to, or depletion of aquatic habitats and species;	1	The Proposed Development has been designed to minimise the potential for peat instability and failure, both sites are located in areas with low vulnerability to peat instability. Refer to **Chapter 8 Solis and Geology.**	2 “Limited” (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	The risk of peat instability during the operational phase will result in a limited consequence in that there would be ‘a limited number of people affected’ with ‘localised effects of short duration’. Simple contamination of environment (e.g., watercourses), localised effects of short duration. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	
J	Contamination	A vehicular incident, refuelling incident, wastewater or sewage transportation. Industrial accident via fire water run off or release of chemicals.	Damage to, or depletion of aquatic habitats and species. Release of suspended solids to surface watercourses could result in an increase in the suspended sediment load. Increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Adverse impacts on the health of the soils associated with the proposed site and the flora and fauna it supports including agricultural use. Negative impacts to air quality.	2 “Very Unlikely”	As outlined in **Chapter 2: Project Description** and **Appendix 2.1: Construction Environmental Management Plan**, fuel will be stored on-site in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals or solvents will be stored outside of the confines of either site. Setback distances from sensitive hydrological features means that adequate room is maintained for the proposed drainage measures as detailed in **Chapter 9: Hydrology and Hydrogeology**. The Hydrogen Plant has been subject to PHA, TLUP QRA which have evaluated and mitigated against industrial accidents. A MAPP outline has been developed and will be refined as development of the Hydrogen Plant progresses. An ERP Risk Management Programme, Operational Management Plan, ATEX Assessment and Safety Management System will also be in place for the facility. It has been designed to meet strict design standards as set out in Table 2.4 in Chapter 2.	2 “Limited” (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	The risk of a fuel or chemical spillage or impact on surrounding drainage during the operational stage will result in a limited consequence in that there would be ‘a limited number of people affected’ with ‘localised effects of short duration’ through the use of bunded containment areas during operation. Simple contamination of environment (e.g., watercourses), localised effects of short duration. Contaminants introduced to the water will be intercepted by drainage and surface water networks and wastewater treatment processes at the Hydrogen Plant Site, these provide in line storage and a storage tank with the ability to stop discharging completely. Contaminants introduced to the atmosphere will disperse; “Simple contamination, localised effects of short duration”. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
K	Industrial Accident - Fire/Gas explosion	Equipment or infrastructure failure. Fuel spillage/ storage. Electrical problems. Employee negligence.	Illness or loss of life. Damage to, or depletion of habitats and species; and Impacts on ambient air quality.	2 "Very Unlikely"	As outlined in **Chapter 2: Project Description**, fuel will not be stored on the Wind Farm Site post construction therefore fuel is not considered to be a significant fire or explosion risk. A Risk Management Programme in line with guidance from the HSA and COMAH regulations is to be developed for the Hydrogen Plant Site. This process has already commenced through a PHA, TLUP QRA and an outline MAPP. A detailed Major Accident Prevention Policy and Emergency Response Plan will be produced for the site prior to commencement of operations in accordance with HSA requirements. These processes will help identify and mitigate hazards onsite and reduce the risk to employees, the public and the environment during the construction and operational phase of the facility. Results of the PHA indicate that the likelihood of an Industrial Accident, such as fire or explosion is 'not expected to occur' and 'very few incidents in associated organisations, facilities or communities; and / or little opportunity, reason or means to occur; may occur once every 100-500 years.' The TLUP QRA concludes that societal risk is negligible due to the low density population in the vicinity of the Hydrogen Plant Site and the distance of existing residential and workplace establishments from the Hydrogen Plant Site. Access to the Hydrogen Plant will be restricted to authorised personnel and security fencing will prevent egress by the public.	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a fire/explosion occur at the Wind Farm Site, a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration' due to the nature of the Proposed Development and the lack of infrastructure or fuel storage during operation that would result in any such incident. There will be 'normal community functioning' in the area with 'some inconvenience'. Due to the location of the Hydrogen Plant in an unpopulated area, and distance to receptors, safety systems in place and design standards adhered to an industrial accident at the Hydrogen Plant Site would involve a 'limited number of people affected a few serious injuries with hospitalisation and medical treatment required.' Environmental impacts would include; 'Simple contamination, localised effects of short duration', these are reversible with remediation. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary, localised and reversible with remediation effect.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					In accordance with Chapter 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Proposed Development shall be subject to a fire safety risk assessment which would assist in the identification of any major risks of fire on site e.g. wind turbines, substations, vandalism.			
L	Hydrogen Fire or Explosion	Equipment or infrastructure failure. Fuel spillage/storage. Electrical problems. Employee negligence. External incident such as a stray bullet from activities outside the Hydrogen Plant Site.	Illness or loss of life; Damage to, or depletion of habitats and species; and Impacts on ambient air quality.	1 "Extremely Unlikely"	Heath and Safety has been a key consideration in the design of the hydrogen production facility, and the approach has incorporated good practice principles such as inherently safer design and the hierarchy of control. Strict ignition controls are in place in line with COMAH and ATEX regulations. PHA has identified hazards and TLUP QRA has assessed the likelihood and extent, the results indicate the likelihood of such an event is extremely unlikely, with 'some incidents in associated or comparable organisation's worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years'.	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a hydrogen fire/explosion occur at the site, a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration' due to the nature of the project, There will be 'normal community functioning' in the area. There could be 'simple contamination, localised effects of short duration' in terms of air quality. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.	3
M	Collapse/ damage to structures	Landslide/ Earthquake. Extreme weather conditions such as flooding and storms. Vehicular collisions due to driver negligence Mismanagement of excavated material on both sites	Injury or loss of life. Movement of peat within the sites. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species;	2 "Very Unlikely"	According to the Irish National Seismic Network, earthquakes measuring ~2 on the Richter Scale are "normal" in terms of seismicity in Ireland. These are known as microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. As such, buildings in Ireland are extremely unlikely to be damaged or collapse due to seismic activity. Having regard to public speed limits within the sites, it is not predicted that any collision of vehicles and any infrastructure would result in significant damage/collapse.	1 "Minor" (Considered a slight/not significant effect in EPA methodology/ nomenclature)	The risk of infrastructure collapse or damage to structures during the operational phase will result in a minor consequence in that a 'small number of people would be affected, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination of environment (e.g., watercourses), localised effects. Impact has been assessed as an unlikely, rare, slight, not significant, negative, temporary and localised effect.	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					The Proposed Development has been designed to take into account any issues on peat or spoil stability			
N	Traffic Incident	Driver negligence or failure of vehicular operations on access roads or public roads during operational transportation of hydrogen. Traffic Management not implemented	Injury or loss of life. Damage to nearby property. Hydrogen Fire or Explosion.	3 "Unlikely"	A limited number of vehicles will be permitted on the Wind Farm Site as part of the operation phase. As such, it can be determined that there is some 'opportunity, reason or means' for a vehicle collision to occur, 'at some time.' The Hydrogen Plant operational phase includes the transport of hydrogen in specially design tube trailers which will use the public road network. The safe design of hydrogen transportation vehicles, the standards and regulations which are required, the health and safety policies and procedures in place during the operational phase of the Hydrogen Plant and the regular inspection and maintenance of the transportation vehicles work to reduce the likelihood of a fire or explosion in the event of a traffic incident involving the hydrogen tube trailers.	3 "Serious" Considered a significant effect in EPA methodology/ nomenclature)	A serious consequence is predicted in the event of a tube trailer explosion on the public roads. The location of the tube trailers on the public road network means they could be in close proximity to other road users, with a 'Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation', depending on the scale of the traffic incident. 'External resources would be required for personal support' in terms of emergency services etc. However, with the potential for 'simple contamination, localised effects of short duration' from the Limited/rank 2 definition for environmental impacts. Impact has been assessed as an indirect, unlikely, rare, significant, negative, temporary and localised effect.	9
P	Loss of Critical Infrastructure	Equipment or infrastructure failure. Electrical problems. Employee negligence. Landslide/ Earthquake. Extreme weather conditions such as flooding and storms.	Injury or loss of life	1 "Extremely Unlikely"	EirGrid operate the grid from National Control Centres matching electricity production to customer demand, switching from synchronous to non- synchronous where required to ensure no power outages. The Proposed Development will be connected to the existing Glenree – Moy 110kV overhead line and any shortages or failures will not impact other connections to the over head line.	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a power failure occur at the existing Glenree – Moy 110kV overhead line at, it will result in a limited number of people affected- localised effects of short duration. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.	2
Decommissioning Phase								
P	Severe Weather	Extreme weather- periods of heavy rainfall, taking	Illness or loss of life.	2 "Very Unlikely"	The risk of severe weather is unlikely when considering the assessment in **Chapter 10:**	1 "Minor"	The risk of severe weather conditions during the decommissioning phase will	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		into account climate change and strong winds.	Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.		**Air and Climat**e and weather conditions recorded over the last 30 years within the area.	Considered a slight/not significant effect in EPA methodology/ nomenclature)	result in a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination of environment (e.g., watercourses), localised effects. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	
Q	Flooding	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds	Illness or loss of life. Sedimentation of nearby watercourse. Damage to, or depletion of aquatic habitats and species.	2 "Very Unlikely"	The risk of flooding is considered very unlikely when taking into account the baseline assessment in **Chapter 9: Hydrology and Hydrogeology** and due to no recurring or historic flood incidents recorded within the Site or along the Grid Connection route.	1 "Minor" Considered a slight/not significant effect in EPA methodology/ nomenclature)	The risk of flooding during the decommissioning phase will result in a minor consequence in that 'small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination of environment (e.g., watercourses), localised effects. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	2
R	Traffic Incident	Driver negligence or failure of vehicular operations on access roads. Traffic Management not implemented.	Injury or loss of life.	3 "Unlikely"	A limited number of vehicles will be permitted on both sites as part of the decommissioning phase. As such, it can be determined that there is some 'opportunity, reason or means' for a vehicle collision to occur on site, 'at some time.' An unlikely risk is therefore predicted.	1 "Minor" Considered a slight/not significant effect in EPA methodology/ nomenclature)	A minor consequence is predicted. Having regard to on-site speed limits and vehicular movements, a 'small number of people would be affected' should a vehicular collision occur, with 'no fatalities and small number of minor injuries with first aid treatment.' Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	3
S	Contamination	Fuel spillage during delivery. Failure of fuel storage tank or tanks in plant and machinery and vehicles.	Damage to, or depletion of aquatic habitats and species. Release of suspended solids to surface watercourses and could	2 "Very Unlikely"	As outlined in **Chapter 2: Project Description** and **Appendix 2.1: Construction Environmental Management Plan**, fuel will be stored on- site but in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals	2 "Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	The risk of a fuel spillage or impact on surrounding drainage during the operational phase will result in a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration'	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		Drainage and seepage water resulting from infrastructure removal. Erosion of sediment from drainage channels.	result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies.		or solvents will be stored outside of the confines of the sites. Setback distances from sensitive hydrological features means that adequate room is maintained for the proposed drainage measures as detailed in **Chapter 9: Hydrology and Hydrogeology**.		through the use of bunded containment areas during operation. Simple contamination of environment (e.g., watercourses), localised effects of short duration. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	
T	Industrial Accident- Fire/gas explosion	Equipment or infrastructure failure. Fuel spillage/ storage. Electrical problems. Employee negligence.	Injury or loss of life. Structural damage Forest fires Air Pollution Damage to, or depletion of habitats and species Contamination	2 "Very Unlikely"	Fuel, mainly diesel will be stored on the Wind Farm Site and Hydrogen Plant Site during decommissioning. In accordance with Chapter 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Proposed Development shall be subject to a fire safety risk assessment which would assist in the identification of any major risks of fire on site e.g., wind turbines, substations, vandalism. There will be no hydrogen on the Hydrogen Plant Site during the decommissioning phase. There are no Gas Networks within the vicinity of the Proposed Development. Therefore, there is low risk of explosion caused by gas.	2"Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a fire/explosion occur at the Proposed Development, a limited consequence in that there would be 'a limited number of people affected' with 'localised effects of short duration' due to the nature of the project and the volume of fuel storage during construction that would result in any such incident. There will be 'normal community functioning' in the area. Simple contamination of environment (e.g., watercourses), localised effects of short duration. Impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.	4
U	Loss of Critical Infrastructure	Equipment or infrastructure failure. Electrical problems. Employee negligence. Landslide/ Earthquake. Extreme weather conditions such as flooding and storms.	Injury or loss of life	1 "Extremely Unlikely"	EirGrid operate the grid from National Control Centres matching electricity production to customer demand, switching from synchronous to non- synchronous where required to ensure no power outages. The Proposed Development will be connected to the existing Glenree – Moy 110kV overhead line and any shortages or failures will not impact other connections to the same over head line.	2"Limited" (Considered a moderate/not significant effect in EPA methodology/ nomenclature)	Should a power failure occur at the Glenree – Moy 110kV overhead line it will result in a limited number of people affected- localised effects of short duration. Impact has been assessed as an unlikely, occasional, not significant, negative, temporary and localised effect.	2

The risk assessment for each of the potential hazards identified are consolidated in **Table 16.10** which provides their 'risk score.'

Table 16.10: Risk Scores

Risk ID	Potential Risk	Likelihood Rating	Consequence Rating	Risk Score
Construction Phase				
A	Severe Weather	3	1	3
B	Flooding	2	1	2
C	Peat Stability	2	2	4
D	Traffic Incident	3	1	3
E	Contamination	2	2	4
F	Industrial Accident - Fire/Gas explosion	2	2	4
Operational Phase				
G	Severe Weather	3	1	3
H	Flooding	2	1	3
I	Peat Stability	1	2	3
J	Contamination	2	2	4
K	Industrial Accident - Fire/Gas explosion	2	2	4
L	Hydrogen Fire/Gas Explosion	1	2	3
M	Collapse/ damage to structures	2	1	2
N	Traffic Incident	3	3	9
O	Loss of Critical Infrastructure	1	2	2
Decommissioning Phase				
P	Severe Weather	2	1	2
Q	Flooding	2	1	2
R	Traffic Incident	3	1	3
S	Contamination	2	2	4
T	Industrial Accident- Fire/gas explosion	2	2	4
U	Loss of Critical Infrastructure	1	2	2

A corresponding risk matrix is provided in **Table 16.11** which is colour coded to provide an indication of the critical nature of each risk. As outlined in **Table 16.3**, the red zone represents 'high risk' scenarios', the amber zone represents 'medium risk scenarios and the green zone represents 'low risk scenarios'. This presents the potential risks identified during the construction, operation and decommissioning of the Proposed Development.

The consequence rating for all identified risks bar one, in terms of the significance of the environmental impacts applying the methodology recommended in the EPA Guideline are classed as:

1; Minor Considered a slight/not significant effect under EIA definitions.

Or

2; Limited; Considered a moderate/not significant effect under EIA definitions.

These are in the "Green Zone" or low risk zone.

However, transportation risks, during the operational period are identified as 'Serious', although 'Unlikely' and considered a significant effect under EIA definitions. This falls into the amber zone on the risk assessment matrix, this represents 'medium risk scenarios'.

Table 16.11 Risk Matrix

		Consequence Rating				
		1.Minor	2.Limited	3. Serious	4.Very Serious	5.Catastrophic
Likelihood Rating	5.Very Likely					
	4. Likely					
	3. Unlikely	A, D, G, R		N		
	2. Very Unlikely	B, H, L, M, O, P, Q	C, E, F, J, K, S, T			
	1. Extremely Unlikely		I, U			

The scenarios with the highest risk score in terms of a major accident and/or natural disaster during the construction, operation and decommissioning phase of the Proposed Development is identified below:

Transportation during operation

Hydrogen will be moved offsite by road in specially designed tube trailers pulled by HGVs. Should a road traffic incident occur involving a hydrogen tube trailer, there is a risk that a fire or explosion could occur. This is due in part to the use of the public road network and the potential for external influence such as other drivers and location of the public on both the likelihood and consequence of an incident. This is inline with the risks associated with transporting other fuels, such as natural gas or home heating fuels by road. Tube trailers are currently used to transport a number of compressed gas products on Ireland's roads including natural gas, compressed air, nitrogen and oxygen. Tube trailers cylinders are designed to withstand impacts and the trailers have fitted temperature and pressure sensors that can be monitored remotely. Detailed telematics monitor vehicle and driver performance to ensure road safety.

The environmental impacts could include injury and loss of life to people and damage to buildings or other structures. However, as outlined in **Section 16.3.3**, the scope of this assessment has been based on the understanding that the hydrogen transport vehicles and equipment are designed, built and operated in line with current best practice. Therefore, the risk of fire/explosion occurring due to a traffic incident was given a risk score of 9. This indicates a scenario which is 'unlikely' to occur but having potentially 'serious' consequences. This represents a medium risk scenario and considered an indirect, unlikely, rare, significant, negative, temporary and localised effect under EIA definitions.

Peat Stability During Construction

There is a potential risk of peat instability during the construction of the Proposed Development. The risk of peat instability was given a risk score of 4. The risk of peat instability has been minimised through the careful design of the Proposed Development and will be further limited through the implementation of the best practice construction control measures outlined in **Chapter 8: Soils and Geology**.

The risk of peat instability is 'very unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction phase. **Chapter 8: Soils and Geology** includes an assessment of Peat Stability at both the Wind Farm Site and Hydrogen Plant Site. Peat and slope stability investigations at both sites indicate that the areas have a generally low risk probability with respect to slope failure. The impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.

Contamination During Construction, Operation and Decommissioning

There is a potential risk of contamination during the construction, operational and decommissioning phases from potential release of hydrocarbons. The risk of contamination was given a risk score of 4. However, as outlined in **Chapter 2: Project Description** and **Chapter 9: Hydrology and Hydrogeology**, measures are proposed and will be put in place to reduce the risk of accidental spillage and contamination of pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The risk of contamination is 'very unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction, operation and decommissioning phases. The impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary and localised effect.

Industrial Accident-Fire/Gas Explosion During Construction, Operation and Decommissioning

There is a potential risk of fire/explosion at the Proposed Development. However, as outlined in **Section 16.3.2**, the scope of this assessment has been based on the understanding that the Proposed Development will be designed, built and operated in line with current best practice. Further, in accordance with Chapter 19 of the Safety, Health and Welfare at Work Acts 2005 to 2014, the Proposed Development shall be subject to a fire safety risk assessment which will assist in the identification of any major risks of fire on-site e.g., Hydrogen Plant Site equipment, wind turbines, Wind Farm Substation, Hydrogen Plant Substation, vandalism.

Therefore, the risk of fire/explosion occurring at the Proposed Development resulting in a major accident and/or disaster was given a risk score of 4. This indicates a scenario that is 'very unlikely' to occur and having 'limited' consequences should it do so, representing a 'low-risk scenario' during the operational phase.

The impact has been assessed as an unlikely, rare, moderate but not significant, negative, temporary, localised and reversible with remediation effect.

16.4.2 Mitigation Measures

The risks above are identified as worse-case scenario and in the absence of mitigation. This section outlines the mitigation measures associated with these risks which will be adopted to eliminate or reduce these risks and/or the environmental effects if these risk events were to occur.

As outlined in **Section 16.4.1**, the scenarios with the highest risk score in terms of the occurrence of major accident and/or disaster was identified as:

- 'Transportation' of hydrogen by public road
- Peat Stability
- 'Industrial Accident- Fire/Gas Explosion' during the construction, operation and decommissioning phases.

The Proposed Development has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design.

The main mitigation measure is by design or avoidance.

During the PHA workshop, the design intent for hazard mitigation was, where known, captured, for each hazard identified, and formalised in the safety requirements presented in Table 4, of the PHA in **Appendix 16.1**.

16.4.2.1 Wind Farm Site

At the Wind Farm Site a suitable separation distance from turbines and other key infrastructure to properties has been embedded in the EIA Development design. Additional mitigation to protect site personnel and the public will also be implemented in the event of damage to a turbine and subsequent likely turbine or turbine component failure.

These are:

- Turbines will be procured from a reliable manufacturer and will have undergone vigorous safety checks during design, construction, commissioning and operation.
- Physical and visual warnings such as signs will be erected as appropriate for the protection of site personnel and the public.
- Facility for remote turbine deactivation will be provided.

Access to turbines for site personnel will be restricted in storm events. Where access by site personnel is required safety precautions may include remotely shutting down the turbine, yawing to place the rotor on the opposite side of the tower door and parking vehicles at a distance of at least 100 m from the tower. All personnel will be fitted with appropriate PPE.

Regular maintenance and inspections will take place during the 40-year operational phase. The final turbine model chosen will be in line with International Electrotechnical Commission IEC 61400-1 safety standards. Maintenance visits will take place as needed with the Scada control system monitoring turbine performance remotely. Access to the turbines will be via the door at the base of the turbines. The turbine access door will otherwise be securely locked at all times.

The application for the Proposed Development is accompanied by a CEMP (**Appendix 2.1**) which sets out details of the environmental controls to be implemented on site. The CEMP sets out the Emergency Response Procedure to be adopted in the event of an emergency including contamination, health and safety and environmental protection. The CEMP provides details on all mitigation and monitoring measures to be actioned prior to construction, during the construction, operation and decommissioning phase. The CEMP will be subject to ongoing review through regular environmental auditing and site inspections. This will confirm the efficacy and implementation of all mitigation measures and commitments identified in the application documentation.

The CEMP includes an Emergency Response Plan (**Management Plan 1**). It provides details of procedures to be adopted in the event of an emergency relating to health & safety or environmental protection. The Emergency Response Plan includes details on the response required and the responsibilities of all personnel in the event of an emergency. Please see **Appendix 2.1** for details.

16.4.2.2 Hydrogen Plant Site Mitigation

Health and Safety has been a key consideration in the design of the Hydrogen Plant Site, and the approach has incorporated good practice principles such as inherently safer design and the hierarchy of controls. The Seveso III Directive, the main EU legislation dealing specifically with the control of onshore major accident hazards involving, along with the Chemical Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 which implements the SEVESO directive, governs the inventory of substances stored at the Hydrogen Plant Site. Strict ignition controls are in place in line with COMAH and ATEX regulations. The Hydrogen Plant, as a lower tier SEVESO site, will be regulated by the Health and Safety Authority.

Design standards specific to hydrogen production facilities (Shown in Table 2.4 in **Chapter 2: Project Description**) have been used throughout the preliminary design phase and regulations and separation distances required by industry good practice have been incorporated into the design. A Major Accident Prevention Policy has been prepared and will be refined prior to commencement of operations. An Emergency Response Plan (recommended, not required for lower-tier COMAH sites) will be produced for the plant. A Risk Management Programme, ATEX Assessment and Safety Management System will be in place for the Hydrogen Plant Site.

Safety equipment installed will include:

- Leak/fire detection + isolation/automatic shut-off
- Emergency stops
- Building ventilation (passive + active)
- Piping pressure/flow rate monitoring
- Impact sensors at dispensers
- Audible and visual alarms
- Fire protection and suppression equipment

The detection system in place at the Hydrogen Plant Site will be capable of detecting hydrogen gas, oxygen level detection and hydrogen fire and a Supervisory Control and Data Acquisition ("SCADA") system will monitor the facilities performance. Hydrogen detection will be installed in the oxygen vent pipe. Lightning strike protection systems will be installed. The electrolysers shall be fitted with safety systems to shut down hydrogen production on loss of vital parameters, e.g. temperature, water level or water quality etc or in the event of over voltage. The electrolyser package includes measures to shutoff the hydrogen supply on detection of a hydrogen leak. The ability to shut down the electrolysers will be available in multiple locations. The electrolyser package has been designed to enable the purging of the hydrogen system prior to maintenance of systems. Fire fighting systems will include alarms, water spray deluge systems, sprinkler systems, carbon dioxide suppression systems and mobile fire protection equipment in accordance with the relevant codes and standards. It provides details of procedures to be adopted in the event of an emergency relating to health & safety or environmental protection. The Emergency Response Plan includes details on the response required and the responsibilities of all personnel in the event of an emergency, including a fire, this will be agreed with Sligo Fire Service prior to the operational phase of the Proposed Development. Please see **Appendix 2.1** for details.

Water for firefighting purposes will be contained within two dedicated fire water storage tanks of 636 m^3 designed for 120 minute operation in the event of a fire. These will have sprinkler and manual hose operation. This will be reviewed during further design stages.

The location of the Hydrogen Plant Site has been specifically selected to minimise the potential to affect any receptors. The public would have no access to the Hydrogen Plant Site. The nearest public road L-6612-1 is 600 m to the west and the nearest buildings which are not associated with the Hydrogen Plant Site are also 299 m away.

The current facility design adheres to ISO and NFPA standards, which includes guidance on equipment separation distances. Relevant codes and standards will be applied during the design and operation phases of the project.

To prevent loss of oxygen containment increasing fire risks, the oxygen systems would be physically separated from the hydrogen systems and stores of any combustible materials in line with good practice design standards. Strict ignition control regulations will also be adhered to.

The tube trailer parking area is set back by a minimum of 11 m from equipment and buildings to provide physical separation in the event of a fire or explosion. Any damaged or defected tube trailers will be stored separately in a containment area 24 m from other tube trailers.

To prevent over-pressurization events of storage tanks and tube-trailers, pressure-relief systems will also be installed. The filling process control system shall include measures for pressure regulation and delta pressure monitoring across the dispensing hose. The filling process control system shall include redundancy to ensure no single failure can lead to the overpressure of a tube trailer. Site specific safety measures will be in place for the full life of operation. Tube trailers and the high-pressure storage tanks will be designed to suitable standards and filled with trained and competent personnel to avoid any loss of containment during filling. All road going tube trailers shall be compliant with TPED-EN17339. The filling system include measures to prevent high pressure hydrogen release due to tube trailer leaving the filling location whilst a filling hose is attached. Filling hoses will be robust to their environment and foreseeable mechanical damage and the filling area included measures to ensure the tube trailer and attached vehicles cannot drive into the dispenser. Lighting of the filling locations and driving routes is designed into the Hydrogen Plant.

Limiting the volume of hydrogen stored on the Hydrogen Plant Site mitigates any accidents which could affect offsite receptors. Should external factors limit the removal of hydrogen from the Hydrogen Plant Site for transportation, a shutdown system will stop production in order to stay within COMAH lower tier regulation quantities.

Chemicals stored on the hydrogen production plant include:

- Oils used by hydraulic systems, compressors and transformers
- Electrolyte
- Coolants
- Cleaning products

All chemicals stored on-site will be subject to a COSHH (Control of Substances Hazardous to Health) assessment and compliance with the requirements of REACH, i.e., European Communities Regulation 1907/2006 for the Regulation, Evaluation, Authorisation and Restriction of Chemicals. Chemicals will be managed in accordance with European Chemicals Agency's Guidance for Downstream Users (2014). Final selection of bulk chemicals will be subject to an assessment of trace elements to ensure that they are within acceptable limits. Storage of large volumes of oils and other hazardous substances will have a secondary containment such as a bund to prevent hydrocarbon contamination to land/water. Waste oils and other chemicals, including oil rags/wipes will be disposed of as hazardous waste. Operational staff will receive training on the handling, containment, use, and disposal requirements for all potentially polluting products on-site. Spill trays in chemical storage areas and the drainage system will ensure no spillages can impact soils or enter surface or groundwater.

The application for the Proposed Development is accompanied by a CEMP (**Appendix 2.1**) which sets out details of the environmental controls to be implemented on-site. The CEMP sets out the Emergency Response Procedure to be adopted in the event of an emergency including contamination, health and safety and environmental protection. The CEMP provides details on all mitigation and monitoring measures to be actioned prior to construction, during the construction, operation and decommissioning phase. The CEMP will be subject to ongoing review through regular environmental auditing and site inspections. This will confirm the efficacy and implementation of all mitigation measures and commitments identified in the application documentation.

The CEMP includes an Emergency Response Plan (**Management Plan 1**). It provides details of procedures to be adopted in the event of an emergency relating to health & safety or environmental protection. The Emergency Response Plan includes details on the response required and the responsibilities of all personnel in the event of an emergency. Please see **Appendix 2.1** for details.

Hydrogen on its own cannot burn or ignite, it requires an oxidant (air/oxygen) to do so, along with an ignition source, such as an electric spark. It is therefore transported in enclosed containers with high safety margins and be fitted with relief valves. Hydrogen will be moved offsite by road Carriage of Dangerous Goods (ADR) approved tube trailers pulled by HGVs. While the likelihood of a traffic incident has a rating of 3; "Unlikely" the likelihood of an incident resulting in a fire or explosion is considered to be lower due to the design and safety standards of the hydrogen tube trailers.

Using specially designed tube trailers is mitigation by design, the tube trailer layout includes individual cylinders bundled together in steel racks and contained within a steel frame or cage, this offers more protection and lowers the likelihood of a large explosion or fire compared to a large single tank. The cylinders are usually made of steel or composite and designed to withstand impacts. The cylinders are constructed and tested to high safety standards, including ISO 11120 and EN1964-1.

Only cylinders that have been appropriately specified and selected for hydrogen transportation shall be used. Before filling all cylinders and transport vessels/tubes will be checked that they are free from obvious damage and harmful contaminants. Operating instructions shall be available at the filling station. Assemblies shall be bonded and earthed during filling.

EU Directives which are relevant to the movement and transportation of hydrogen include:

- Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods. This Directive applies to the transport of dangerous goods by road, by rail or by inland waterway within or between Member States, including the activities of loading and unloading, the transfer to or from another mode of transport and the stops necessitated by the circumstances of the transport.
- Directive 2010/35/EU, the Transportable Pressure Equipment Directive (TPED) – This Directive applies to the design, manufacture, conformity assessment and periodic reassessment of transportable cylinders, tubes, cryogenic vessels and tanks for transporting gases.
- International Carriage of Dangerous Goods by Road (ADR); a European Agreement concerning the international carriage of dangerous goods by roads

The cylinders onboard the tube-trailers are designed to these standards and are built to be strong enough to withstand impacts. They are fitted with pressure relief devices that will release the contents in the event of a fire. This reduces the risk of explosions. They are also identified with appropriate safety signage. Vehicles will regularly be inspected for damage, leaks or equipment malfunction and maintained in good working order. Vehicle operators will be suitable qualified. High-pressure hydrogen tanks are designed not to rupture and are held to rigorous performance requirements. Cylinders undergo extensive testing, this includes, cycling tests in which they are pressurized and depressurized many more times than they would be during their lifetime to make sure that they meet these performance requirements. Hydraulic stress testing to test the strength of the cylinders is performed. Low and high heat temperate tests and fire simulation tests are used to ensure the cylinder and its safety components can withstand a temperature of at least 800°C for 12 minutes without rupturing. In testing, cylinders are exposure to pressures above normal to simulate fault management, dropped from height, undergo impact tests, are shot with a rifle, burned, and exposed to chemicals such as automotive fluids and acids, salts, and other road hazards to validate that they are safe even under severe or unusual conditions[10,11]. Gaseous hydrogen is currently delivered by tube trailers in the U.S.[12] and across Europe[13] including England and Wales[14].

A detailed Emergency Response Plan (ERP) for the operational phase of the Hydrogen Plant, to cover health and safety emergencies as well as environmental emergencies, as part of the H&S Plan will be developed. This ERP shall be activated in the event of an emergency such as an accident, fire, spillage etc. and will provide details on who is required to be notified, first aid facilities and closest hospitals.

The safe design of hydrogen transportation vehicles, the standards and regulations which are required, the health and safety policies and procedures in place during the operational phase of the Hydrogen Plant and the regular inspection and maintenance of the transportation vehicles work to reduce the likelihood of a fire or explosion in the event of a traffic incident involving the hydrogen tube trailers.

16.4.2.3 Safety Management Plan (SMP)

The safety management activities will generate and present the evidence to demonstrate that the risk of harm from hazards associated with the plant will be mitigated by the Proposed Development to an acceptable level once planning consent has been obtained.

Hydrogen safety, like all flammable gas, relies on these key safety considerations:

- Eliminate hazards or define mitigation measures
- Ensure system integrity
- Provide proper ventilation to prevent accumulation
- Manage discharges
- Detect and isolate leaks
- Train personnel

[10] U.S Gov. Office of Energy and Renewable Energy. https://www.energy.gov/eere/fuelcells/high-pressure-hydrogen-tank-testing
[11] Hydrogen Tech World. https://hydrogentechworld.com/hydrogen-cylinders-design-testing-and-certification
[12] Bayo Tech. (2023). https://bayotech.us/
[13] Airliquide. (2023) https://cn.airliquide.com/en/about-us/our-activities/hydrogen-energy/gas-hydrogen-and-liquid-hydrogen-distribution
[14] BOC. (2023) https://www.boconline.ie/en/gases-and-equipment/bulk-gases/compressed-bulk-hydrogen.html

16.4.3 Residual Effects

The risk of a major accident and/or disaster during the construction of the Proposed Development is considered 'low' in accordance with the 'Guide to Risk Assessment in Major Emergency Management' (DoEHLG, 2010).

It is considered that when the mitigation and monitoring measures outlined in the CEMP are implemented and adhered to there will not be significant residual effect(s) associated with the construction, operation and decommissioning of the Proposed Development.

16.4.4 Assessment of Cumulative Effects

16.4.4.1 Cumulative Impact Assessment

A search in relation to projects that may have the potential to result in a cumulative impact with the Proposed Development on the environment was carried out as part of the EIAR (please see **Appendix 2.3**). The Proposed Development has been considered, cumulatively with these projects.

Following a detailed assessment of the potential for any further impact when considered cumulatively with any or all of the projects, the Proposed Development, with mitigation measures in place, was found to have no potential for significant cumulative increase in likely significant adverse environmental effects arising from the vulnerability of the Proposed Development to major accidents and/or natural disasters or its potential to cause major accidents and/or natural disasters.

16.5 SUMMARY OF SIGNIFICANT EFFECTS

This chapter, in accordance with the European Commission EIAR Guidance, has identified risks in respect of the Projects:

1. Potential to cause accidents and/or disasters,
2. Vulnerability to potential disaster/accident

During both the construction and operational phases of the Proposed Development, activities will take place at the Wind Farm Site, Hydrogen Plant Site, along the Grid Connection Route, Interconnector Route, Killybegs Turbine Delivery Route and Galway Turbine Delivery Route that will have the potential to cause accidents and/or disasters and that could be vulnerable to potential disaster/accident.

The implementation of mitigation through design, avoidance principles, choice of best alternatives for location of works, pollution control measures, surface water drainage measures and other preventative measures incorporated into the project design in order to minimise potential significant adverse effects on major accidents and disasters at the Wind Farm Site, Hydrogen Plant Site and along the Interconnector Route, Grid Connection Route Killybegs Turbine Delivery Route and Galway Turbine Delivery Route.

Layout design amendments along with application of the specified mitigation during each phase of the Project have reduced the potential significance to all receptors related to the Development to not significant in terms of risk likelihood and consequence aside from risk 'N; Transport' during the operational phase, specifically in relation to transporting hydrogen on the public road network. Which falls into the amber zone on the risk assessment matrix, this represents 'medium risk scenarios'.

Risktec Solutions Ltd., an independent and specialist provider of risk management consulting, resourcing, learning and inspection services, part of the TÜV Rheinland Group. undertook a PHA on the green hydrogen system at the Proposed Development and generated a hazard log. The full report can be found in **Appendix 16.1**.

A detailed Emergency Response Plan (ERP) (recommended, not required for lower-tier COMAH sites) for the proposed works, to cover health and safety emergencies as well as environmental emergencies will be developed. This ERP shall be activated in the event of an emergency such as an accident, fire, spillage, collapse etc. and will provide details on who is required to be notified, first aid facilities and closest hospitals.

A Technical Land Use Planning based Quantitative Risk Assessment (the "TLUP QRA", **Appendix 16.3**) has been prepared by Risktec in accordance with the guidelines set out in the HSA's Technical Land Use Planning Guidelines. The TLUP QRA has been submitted to the HSA as part of the planning application submission. The purpose of the TLUP QRA is primarily to assess the offsite risks to human health and the environment for the purposes of determining the suitably of the preferred site for the Hydrogen Plant.

The TLUP QRA concluded the Hydrogen Plant location is acceptable. The Preliminary Hazard Analysis reports includes safety requirements as mitigation for each hazard identified. This mitigation, along with implementation of the Major Accident Prevention Policy (MAPP), means that the environmental impacts arising from the vulnerability of the Hydrogen Plant to Major Accidents and Natural Disasters have been assessed as an imperceptible, long-term effect.

16.6 STATEMENT OF SIGNIFICANCE

This chapter has assessed the Proposed Development in terms of its potential to cause accidents and/or disasters and its vulnerability to potential disaster/accident.

The Proposed Development has been assessed as having the potential to result in effects of a slight but not significant, long-term impact overall. Through the implementation of mitigation measures, the cumulative effects associated with the Proposed Development are predicted to be not significant.