16. Major Accidents and Disasters

16.1 Introduction

16.1.1 This chapter presents the preliminary assessment of the likely significant effects of the Project with respect to Major Accidents and Disasters (MA&D). The preliminary assessment is based on information obtained to date. It should be read in conjunction with the project description provided in **Chapter 2: The Project** and with respect to relevant parts of the following chapters:

- **Chapter 5: Biodiversity**.
- **Chapter 6: Historic Environment**.
- **Chapter 7: Water Environment**.
- **Chapter 11: Traffic and Transport**.
- **Chapter 12: Ground Conditions**.
- **Chapter 15: People and Communities**.
- **Chapter 18: Climate Change Resilience**.

16.1.2 This chapter describes:

- the legislation, policy and technical guidance that has informed the assessment (**Section 16.2**);
- consultation and engagement that has been undertaken to date and how comments from consultees relating to MA&D have been addressed (**Section 16.3**);
- the Study Area for MA&D (**Section 16.4**);
- the methods used for baseline data gathering (**Section 16.5**)
- overall baseline (**Section 16.6**);
- embedded environmental measures relevant to MA&D (**Section 16.7**);
- the scope of the assessment for MA&D (**Section16.8**);
- the methodology applied for the assessment (**Section 16.9**);
- the preliminary assessment of MA&D effects (**Section 16.10**);
- Preliminary assessment of cumulative effects (**Section 16.10.130**);
- a summary of the preliminary significance conclusions (**Section 16.11**); and
- an outline of further work to be undertaken for the Environmental Statement (ES) (**Section 16.12**).

Limitations and assumptions

16.1.3 The information provided in this Preliminary Environmental Information Report (PEIR) is preliminary, and based upon the information currently available to the Project. The final assessment of likely significant effects will be reported in the ES. The PEIR has been produced to fulfil the Applicant's consultation duties and enable consultees to develop an informed view of the likely significant effects of the Project.

16.1.4 For the PEIR, due to the ongoing industry and academic development with regards to the assessment of hydrogen explosion hazards affecting human populations, it is not possible to categorically rule out the potential for a significant effect at this stage. The embedded measures, particularly the design engineering processes, have the aim to reduce the risk of all potential major accidents to As Low As Reasonably Practicable (ALARP). The preliminary assessment of this scenario is based on the precautionary principle, and considers that the Project is still at an early stage of design and there are ongoing industry and academic trials in the assessment of hydrogen distribution pipelines at this scale. This has led to the preliminary assessment conclusion that there is potential for a significant effect arising from the release of hydrogen from the HAGIs, but that it may not be significant following further development of the Project design.

16.1.5 However, it should be considered that there are currently hydrogen pipelines in operation at a smaller scale in the UK and the USA. The Project, through the Development Consent Order will be issued to the Health and Safety Executive for review as a Statutory Consultee. If the project does not satisfy the Statutory Consultees the Project would not reach construction, with the Project likely abolished or substantially redesigned.

16.1.6 There are no further limitations relating to MA&D that affect the robustness of the preliminary assessment of the potential likely significant effects of the Project.

16.2 Relevant legislation, planning policy and technical guidance

16.2.1 This section identifies the legislation, planning policy and technical guidance that has informed the assessment of effects with respect to MA&D. Further information on policies relevant to the Project is provided in **Chapter 4: Legislation and Policy Overview**.

Legislation

16.2.2 A summary of the relevant legislation is given in **Table 16.1**.

Table 16.1 Legislation relevant to the MA&D assessment

Legislation	Legislative context
Health and Safety at Work etc. Act 1974[1] (HSWA) (as amended) and associated regulations made thereunder including: • Construction (Design and Management) Regulations 2015[2] (CDM Regulations) (as amended); • Management of Health and Safety at Work Regulations 1999[3] (as amended); • Dangerous Substances and Explosive Atmospheres Regulations 2002[4] (DSEAR) (as amended); and • Pipelines Safety Regulations 1996[5] (as amended) (PSR).	HSWA sets out the legal requirements and regulatory framework within which the Project must be designed, constructed and operated. It incorporates in UK law the requirement to undertake a suitable and sufficient risk assessment, to apply the hierarchy of controls to favour elimination over mitigation, and to reduce any residual risks to As Low As Reasonably Practicable, generally known as 'the ALARP principle'. The regulations made under the HSWA, incorporate these principles and make specific requirements for implementation in defined contexts. For example, CDM Regulations make requirements for the design and construction of significant facilities by requiring the nomination of a Principal Designer and Principal Contractor who are ultimately responsible for managing the design and construction respectively.

[1] UK Government (1974). Health and Safety at Work etc. Act 1974. (Online) available at: https://www.legislation.gov.uk/ukpga/1974/37/contents (accessed June 2022).
[2] UK Government (2015). The Construction (Design and Management) Regulations 2015. (Online) available at: https://www.legislation.gov.uk/uksi/2015/51/contents/made (accessed June 2022).
[3] UK Government (1999). The Management of Health and Safety at Work Regulations 1999. (Online) available at: https://www.legislation.gov.uk/uksi/1999/3242/contents/made (accessed June 2022).
[4] UK Government (2002). The Dangerous Substances and Explosive Atmospheres Regulations 2002. (Online) available at: https://www.legislation.gov.uk/uksi/2002/2776/contents/made (accessed June 2022).
[5] UK Government (1996). The Pipelines Safety Regulations 1996. (Online) Available at: https://www.legislation.gov.uk/uksi/1996/825/contents/made (Accessed June 2022).

Planning policy

16.2.3 A summary of the relevant national and local planning policy is given in **Table 16.2**.

Table 16.2 Planning policy relevant to the MA&D assessment

Policy	Policy context
National planning policy	
Draft Overarching National Policy Statement for Energy (EN-1)[6]	Section 4.6 describes the requirements for Good Design with Paragraph 4.6.3 specifically stating that infrastructure must be 'fit for purpose'. This requirement is interpreted to mean that the risk of a Major Accident occurring be reduced to ALARP. Paragraph 4.11.5 states that *'The Secretary of State should work on the assumption that the relevant pollution control regime and other environmental regulatory regimes, including those on land drainage, water abstraction and biodiversity, will be properly applied and enforced by the relevant regulator. The Secretary of State should act to complement but not seek to duplicate them.'* The Project interprets that this section also applies to the Regulatory Regimes described in **Table 16.1**.
Overarching National Policy Statement for Energy (EN-1), July 2011[7]	Section 4.10 highlights that the Planning and Pollution Control regimes are distinct but complementary regimes which should not seek to duplicate regulation but have their own purpose. The planning regime should seeks to prevent '*harmful development which cannot be made acceptable even through conditions'.* This paragraph is written in the context of

[6] Department for Business, Energy and Industrial Strategy (2022). Draft Overarching National Policy Statement for Energy. EN-1. (online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf (Accessed 25 May 2022).
[7] Department for Energy and Climate Change, (2011). Overarching National Policy Statement for Energy (EN-1). (online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf (Accessed 24 August 2022).

Policy	Policy context
	environmental discharges but the same principle is anticipated to apply to legislative and regulatory safety requirements. Section 4.11 relates to safety but is limited in scope to the Control of Major Accident Hazard Regulations 2015 and the Planning (Hazardous Substances) Regulations 2015. Neither of which apply to the Proposed Development.
National Planning Policy Framework, July 2021[8]	Paragraph 97 states that Planning policies and decisions should promote public safety. Annex 2 highlights that the Health and Safety Executive (HSE) will apply consultation distances to Major Hazard pipelines to mitigate consequences to public safety.
Local planning policy[9]	
Cheshire West and Chester Local Plan (Part two) (2015)[10]	Policy DM33 covers the creation or extension of hazardous infrastructure. It states it will be supported where it does not significantly restrict future development or increase the risk to public safety. The embedded measures in **Section 16.7** describe how Land Use Planning (LUP) considerations have been incorporated within the Project.
Halton Delivery and Allocations Local Plan (2022)[11]	Policy CS23 aims to minimise the risk to public safety. The embedded measures in **Section 16.7** describe how LUP considerations have been incorporated within the Project.

[8] Department for Housing, Communities and Local Government (2021). National Planning Policy Framework. (online) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf (Accessed 24 August 2022).
[9] The Project has six host authorities and the local plans for each has been reviewed, and where there were specific policy requirements, these were listed in this table. The relevant plans for Cheshire East, St Helens, Trafford and Warrington were also reviewed and are listed in detail in **Appendix 4A**.
[10] Cheshire West and Cheshire Council, 2015. Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies.
[11] Halton Borough Council, 2022. Halton Delivery and Allocations Local Plan.

Technical guidance

16.2.4 A summary of the technical guidance for Major Accidents and Disasters is given in **Table 16.3**.

Table 16.3 Technical guidance relevant to the MA&D assessment

Technical guidance document	Context
Health and Safety Executive, Reducing Risks Protecting People (R2P2)(2001)[12]	R2P2 describes the Health and Safety Executive (HSE) decision making process and presents the protocols and procedures followed in decision making in relation to the protection of human life in the UK. The tolerability criteria for risk to people, including the aversion for large numbers of casualties resulting from single incidents, have been referenced in setting the criteria for assessing the significance of effects on people (see **Appendix 16A**).
European Commission, Environmental Impact Assessment of Projects, Guidance on the Preparation of the Environmental Impact Assessment Report(2017)[13]	Guidance on how to develop good quality environmental impact assessment report to ensure appropriate information is available for decision making purposes. The guidance provided by the European Commission states the purpose of the inclusion of MA&D is to ensure that adequate focus is given to the provisions for events leading to significant risk, with an objective of building resilience in a development against such effects.
DETR, Guidance on the interpretation of Major Accidents to the Environment for the purposes of Control of Major Accident	Guidance on what would constitute a major accident to the environment (from the perspective of COMAH regulations).

[12] Health and Safety Executive (2001). Reducing Risks Protecting People. HSE's Decision Making Process. (Online) available at: https://www.hse.gov.uk/risk/theory/r2p2.pdf (accessed June 2022).
[13] European Commission (2017). Environmental Impact Assessment of Projects, Guidance on the Preparation of the Environmental Impact Assessment Report. (Online) Available at: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf (Accessed June 2022).

Technical guidance document	Context
Hazards (COMAH) Regulations (1999)[14]	
Chemical and Downstream Oil Industries Forum (CDOIF), Guideline – Environmental risk tolerability for COMAH establishments (2016)[15]	Guidelines on the assessment and tolerability of Major Accidents to the environment (established in relation to COMAH establishments) produced by a joint industry and regulator forum in the UK.
IEMA, Major Accidents and Disasters in EIA: An IEMA Primer (2020)[16]	Example project methodologies for assessment of MA&D in EIA including guidance on approach and terminology.

[14] Department of the Environment, Transport and the Region (1999). Guidance on the Interpretation of Major Accidents to the environment for the purposes of COMAH Regulations. (Online) Available at: https://www.sepa.org.uk/media/219153/detr-guidance-1999.pdf (Accessed June 2022).
[15] Chemical and Downstream Oil Industries Forum (2016). Guideline – Environmental risk tolerability for COMAH establishments. (Online) Available at: https://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf (Accessed June 2022).
[16] IEMA (2020). Major Accidents and Disasters in EIA: An IEMA Primer. (online) Available at: https://www.iema.net/document-download/48557 (Accessed 25 May 2022).

16.3 Consultation and Engagement

Overview

16.3.1 The assessment has been informed by consultation responses and ongoing statutory and technical engagement. An overview of the approach to consultation is provided in **Section 3.4** of **Chapter 3: Approach to preparing the PEIR**.

Scoping opinion

16.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 08 March 2022. A summary of the relevant responses received in the Scoping Opinion in relation to Major Accidents and Disasters and confirmation of how these have been addressed within the assessment to date is presented in **Table 16.4**.

16.3.3 The information provided in the PEIR is preliminary and not all of the Scoping Opinion comments have been addressed at this stage, however all comments will be addressed within the ES.

Table 16.4 Summary of EIA Scoping Opinion responses for MA&D

Consultee	Consideration	How addressed in this PEIR
PINS	The Scoping Report states that the risk of accidents during maintenance of the Proposed Development would be managed through good design and procedural controls. In view of the nature and characteristics of the Proposed Development, the Inspectorate is content that accidents during maintenance are not likely to lead to significant effects on the environment and agrees this matter can be scoped out of the ES.	This item is listed in **Table 16.15** and is not considered further in the assessment.
PINS	The Scoping Report states that all construction activities would be managed in compliance with the Construction (Design and Management) (CDM) Regulations 2015 and through the CoCP. In view of the nature and characteristics of the Proposed Development, the Inspectorate is content that physical accidents during construction are not likely to lead to significant effects on the environment and agrees this matter can be scoped out of the ES.	This item is listed in **Table 16.15** and is not considered further in the assessment.

Consultee	Consideration	How addressed in this PEIR
PINS	The Applicant proposes to scope out the assessment of construction phase traffic accidents from the Major Accidents and Disasters ES Chapter. The assessment would instead be presented in the Traffic and Transport ES Chapter. The Inspectorate is content with this approach but advises the Applicant to provide clear cross-referencing in the Major Accidents and Disasters ES aspect chapter to where the assessment is located.	This item is listed in **Table 16.15** and is not considered further in the assessment. The assessment of construction phase traffic is presented in **Chapter 12: Traffic and Transport**.
PINS	The Inspectorate has considered the nature and characteristics of the Proposed Development and the distance from the nearest airport (stated in the Scoping Report to be “>5km at the nearest point”). On this basis, the Inspectorate is content that the impacts of the Proposed Development on aviation or impacts from aircraft crashes are not likely to result in significant effects. These matters can be scoped out of the ES.	This item is listed in **Table 16.15** and is not considered further in the assessment.
PINS	The Scoping Report seeks to scope out impacts from construction leaks and spills from the Major Accidents and Disasters ES Chapter. The Inspectorate notes that these matters will be considered elsewhere in the ES and is satisfied that they can be scoped out of the Major Accidents and Disasters ES Chapter.	
PINS	The Scoping Report explains that structural collapse will be prevented through the proper design of the assets and construction practices in compliance with CDM and the Building Regulations. Considering this together with the nature and characteristics of the Proposed Development and that ground stability issues are required to be addressed, the	This item is listed in **Table 16.15** and is not considered further in the assessment.

Consultee	Consideration	How addressed in this PEIR
	Inspectorate is content that further consideration of structural collapse of Proposed Development assets can be scoped out.	
PINS	• Loss of utility supply; • Cyber attack; • Terrorism; • Widespread public disorder; • Biological threats; • Lightning hazards; • Seismic hazards; and • Space weather. Based on the reasoning and evidence presented in the Scoping Report, the Inspectorate is content that risks to or from the Proposed Development from these matters are not likely to result in significant effects. These matters can be scoped out of the assessment.	These items are listed in **Table 16.15** and are not considered further in the assessment.
PINS	The Applicant proposes to scope out the assessments of dam breach/ reservoir failure and flood risk from the Major Accidents and Disasters ES Chapter. The assessment would instead be presented in the Water Environment ES Chapter. The Inspectorate is content with this approach but advises the Applicant to provide clear cross-referencing in the Major Accidents and Disasters ES aspect chapter to where the assessments are located.	Presented in **Chapter 7: Water Environment** and **Appendix 7B**
PINS	The Scoping Report states that extreme weather would be managed through good design to accommodate all foreseeable design loads which will account for the effects of climate change. However, paragraph 16.4.26 acknowledges that climate change is expected to alter the	Potential extreme weather events and the potential for significant effects on receptor populations are considered within the Climate Change Resilience (CCR) assessment. The

Consultee	Consideration	How addressed in this PEIR
	prevalence of extreme weather conditions. The Inspectorate considers it does not have sufficient evidence that the Proposed Development would not be vulnerable to extreme weather such that a significant effect can be excluded with certainty. Therefore, the Inspectorate is not in a position to agree to scope this matter out from the assessment. Any impacts from extreme weather which may result in significant effects in terms of major accidents and disasters should be assessed in the ES.	CCR assessment is included within **Chapter 18: Climate Change Resilience**.
PINS	The Scoping Report seeks to scope out risks to the Proposed Development from accidents at nuclear facilities, noting that the Proposed Development is outside of the Detailed Emergency Planning Zone and Outline Planning Zone of any Nuclear Licensed Site. However, in view of the scoping consultation response from the Office for Nuclear Regulation (ONR) (which states that the Proposed Development is within the 12km consultation zone for the nuclear site at Capenhurst), the Inspectorate does not agree to scope this matter out of the ES. The ES should assess impacts from accidents at nuclear facilities (both on and from the Proposed Development) where significant effects are likely.	See response to ONR below, further engagement with URENCO UK Ltd is planned prior to the ES and this is described in **Table 16.5.**
PINS	The Scoping Report states “it is anticipated” that transport networks including road and rail infrastructure would be crossed using trenchless techniques. The pipeline at a crossing point would be designed such that it would be protected from any rail or road accidents. Pipeline crossings would be undertaken in compliance with the CDM Regulations and in accordance with methodologies agreed with the relevant	At the time of writing, there are 124 crossings of the Road/Railway elements of the transport network (and 130 waterway crossings (encompassing river, canal and streams). All canals, railways, as well as the major roads and rivers are to be crossed using trenchless techniques.

Consultee	Consideration	How addressed in this PEIR
	stakeholder (highways authority/rail network). Regarding construction, the Inspectorate notes that the use of trenchless techniques for crossings is anticipated but not confirmed at this stage. For any crossings not subject to trenchless techniques, the ES should assess any impacts on and from the transport network from the risk of major accidents and disasters during construction which are likely to result in significant effects. For crossings subject to trenchless techniques, the Inspectorate is content that impacts on the transport network and from the transport network are not likely to result in significant effects in terms of major accidents and disasters and agrees that this matter can be scoped out. Regarding operation, as the pipeline would be a buried feature, the Inspectorate considers that impacts on the transport network and from the transport network are not likely to result in significant effects in terms of major accidents and disasters and agrees that this matter can be scoped out. The Scoping Report states *"it is anticipated"* that major rivers and canals would be crossed using trenchless techniques. It is stated that impacts on and from waterways would be managed through the proper design and construction of waterway crossings, that construction works would be undertaken in compliance with the CDM Regulations and in accordance with methodologies agreed with the relevant stakeholder (notably the Environment Agency). Regarding construction, the Inspectorate notes that the use of trenchless techniques for crossings is anticipated but not confirmed at this stage. For any	Currently 71 minor roads and lanes, 30 minor rivers and brooks and 74 streams/ ditches are to be crossed with open cut trenches. Impacts upon the transport network including Public Rights of Way as a receptor will be assessed in **Chapter 11: Traffic and Transport**. Potential major accidents which could occur during open trench construction are assessed in **Section 16.10**.

Consultee	Consideration	How addressed in this PEIR
	crossings not subject to trenchless techniques, the ES should assess any impacts on and from waterways during construction which are likely to result in significant effects in terms of major accidents and disasters. For crossings subject to trenchless techniques, the Inspectorate is content that impacts on and from waterways are not likely to result in significant effects in terms of major accidents and disasters and agrees that this matter can be scoped out. Regarding operation, as the pipeline would be a sealed and buried feature, the Inspectorate considers that impacts on waterways and from waterways are not likely to result in significant effects in terms of major accidents and disasters and agrees that this matter can be scoped out.	
PINS	The Scoping Report states that UXO hazard across the study area is mostly low (but with some area of moderate risk) and there are well developed construction industry practices that would be applied. The CEMP would include risk assessment to identify the potential for UXO hazard and mitigate, where necessary, the potential impacts. The Inspectorate is content to scope out further assessment for areas of low risk, but considers that the ES should give further consideration to the potential for likely significant effects to arise on human or ecological receptors in areas identified as having moderate risk.	A specific sub-section on Unexploded Ordnance (UXO) hazards which assesses the potential risk to human and ecological receptors has been included in the intrusive works assessment in **Section 16.10**.
PINS	A number of the applicable study areas are explained to have been defined "based on professional judgement". The Inspectorate acknowledges the lack of established guidance in this regard but advises that the ES should explain the reasoning and/ or evidence used to determine these distances rather than just referring to professional judgement.	The Study Areas are defined in **Section 16.4**, most of the distances refer to established guidance documents. Specific justifications have been developed for those which are based on judgment.

Consultee	Consideration	How addressed in this PEIR
Cheshire East Council	Page 390 - It is not clear if the assessment includes hazardous pipelines and hazardous installations under HSE control, and other infrastructure such as that covered by national grid	These sites have been identified within the baseline in **Section 16.6**, and will be included within the assessment for the effects on peoples under the category of 'External Major Accident Hazard sites' for the construction phase and the potential to damage pipelines when crossing them is included within 'Intrusive works such as excavation' in **Section 16.10** .
Cheshire West and Chester Council	The table includes COMAH establishments but does not refer to pipelines covered by HSE. There are several of these pipelines, especially in the Ellesmere Port / Stanlow area. There are also national grid cables and overhead lines that should be taken into consideration.	All service crossings have been identified by the Project design team. These pipelines have not been listed by name but are included within the PEIR baseline described in **Section 16.6**. The potential for an accident when crossing these pipelines is assessed in 'Intrusive works' and the potential for these pipelines to impact the Project workforce is considered under 'External Major Accident Hazard Sites' in **Section 16.10.**
Cheshire West and Chester Council	Page 394, para 16.4.16 Identifies that there are 17 low density residential areas partly or entirely encompassed within the study area. Does this include the residential Gypsy and Traveller site near Ellesmere Port?	This site will be assessed within the PEIR as per any other residential area.
Cheshire West and Chester Council	This identifies that the pipeline will be notified as a Major Accident Hazard pipeline, which is likely to have a consultation distance and appropriate land use planning restrictions applied by	This distance will be advised by the HSE in line with its LUP methodology. The Project cannot control or

Consultee	Consideration	How addressed in this PEIR
	the HSE and which would prevent inappropriate future development in the vicinity of the pipeline. What would this distance be? We require this information to be able to assess the potential impacts, particularly impacts on the delivery of Local Plan requirements and allocations.	pre-empt the distance determined at this stage. The consultation distance will be split into zones with differing restrictions on future development, which means that the most onerous restrictions will be limited to the closest area to the pipeline, as described in the HSE methodology[17]. It is noted that for a comparable 42 inch 70 barg natural gas main, CRR082[18] gives a maximum hazard distance of 422 m and a risk level for the maximum consultation distance of approximately 300 m.
Cheshire West and Chester Council	Within the table it states that Cheshire is known for its salt caverns, which have been used for storage of both liquid and gas hydrocarbon fuels and that the project will be routed to avoid these where practicable, but the potential to impact on storage caverns will be assessed in the EIA. The salt caverns are also used for other types of storage, including storage of documents (at Deepstore) and storage of hazardous waste (at Minosus). The impact on all types of existing storage and the potential for future storage should be taken into account, along with the potential for impacts on salt extraction to create future caverns.	The potential for impacts on all subsurface structures and caverns has been included within the assessment in **Section 16.10**. The impact on the creation of future potential salt caverns will not be considered within the assessment unless the effects represent a Major Accident or Disaster or where a Project has already been consented (future baseline).

[17] Health and Safety Executive. (2022). Land use planning - HSE's land use planning methodology. (Online) available at: https://www.hse.gov.uk/landuseplanning/methodology.htm (accessed 26 May 2022).
[18] HSE (1994). Risks from Hazardous Pipelines in the United Kingdom. Contract Research Report 82. (online) Available at: https://www.hse.gov.uk/research/crr_pdf/1994/crr94082.pdf (Accessed 6 January 2022).

Consultee	Consideration	How addressed in this PEIR
HSE	It would appear that the location of Control Room(s), Construction Compound(s) and the like are yet to be fixed, consequently HSE is currently not in a position to provide an indication of its' statutory Land Use Planning advice. However as a general point HSE will not advise against a proposed development, providing the proposed development does not introduce populations, either permanent or temporary, into any of HSE's public safety consultation zones, unrelated to the proposed development, which are assigned to individual Major Accident Hazard Installation(s) and/or Major Accident Hazard Pipeline(s)	This PEIR assesses the risk to populations within the Project from external sources of Major Hazard, and reviews the proposed construction compound locations, which are adjacent to the HAGIs (as described in **Chapter 2: The Project**).
HSE	The Applicant notes at Para 16.3.3 (**EIA Scoping Report**) that the proposed Hydrogen Pipeline development will be subject to the Pipelines Safety Regulations 1996; consequently HSE will need to be consulted/notified under these regulations.	This is acknowledged for the purpose of EIA and forms part of the embedded measures for the Project. This notification is planned for a later stage of the design when routes and designs are finalised.
HSE	Although it is implied on pages 3A30 & 3A31 (EIA Scoping Report) that the proposed development will not be subject to the Control of Major Accident Hazards Regulations 2015 (COMAH), the Applicant/Developer is still subject to the Health and Safety at Work Act 1974, along with all regulations made under the Act (most notably The Management of Health and Safety Regulations 1992).	The Project will not be subject to the COMAH Regulations. The Applicants obligations under the HSWA and related regulations are acknowledged. The key regulatory requirements are listed in **Table 16.1**. These obligations form the basis of the embedded measures described in **Table 16.12**.

Consultee	Consideration	How addressed in this PEIR
INOVYN	INOVYN Enterprises Limited owns and operates a significant number of various brine, water, chemical and compressed air pipelines, power and instrumentation cables and other services and infrastructure within and in close proximity to the Proposed Order Limits. Particularly in land areas around Northwich, Lostock Gralam to Lach Dennis and between Lostock Gralam and Runcorn. These services are within land owned by INOVYN Enterprises Limited, INOVYN ChlorVinyls Limited and within land owned by other parties for which INOVYN have easement rights. In addition, the Proposed Order Limits affect a number of third party occupiers of INOVYN land at both Runcorn and Northwich, some of whom operate COMAH controlled chemical and storage facilities. It is likely that many INOVYN services and infrastructure are at a shallower depth than the proposed hydrogen pipeline, necessitating crossing under our services and infrastructure. For each of these crossings the necessary protection must be incorporated into the design and the environmental impacts assessed. A safe working method must be agreed with INOVYN and an allowance for an INOVYN supervision representative to be on site at the time.	The safe crossing of utility systems is assessed in 'Construction of the Pipeline' in **Section 16.10**. The Applicant is in discussion with INOVYN with regard to its land holdings and infrastructure assets.
ONR	At this stage, we have no objection to the proposed development subject to the developer liaising with URENCO UK Limited in relation to the potential external hazards the proposed development poses to the nuclear site at Capenhurst and vice versa.	As stated in the Scoping Report, the limit of potential effects from a major accident occurring within the Project is anticipated to be limited to within 1 km. The Capenhurst facility is more than 7 km to the west and therefore a direct effect on that site is not considered likely or credible.

Consultee	Consideration	How addressed in this PEIR
		The Project is engaging with the site license holder to confirm whether there are any concerns surrounding the Project. Further engagement is described in **Table 16.5** .
Trafford Metropolitan Borough Council (TMBC)	The ES will need to include an assessment of any risk posed to existing and future residents in the vicinity of the proposed pipeline and HAGI's during the construction, operation and maintenance phases of the project.	This PEIR includes an assessment of construction and operational phase accidents which have been agreed as within scope for the EIA. Some scenarios have already been agreed with PINS as low risk (i.e., not significant) and will therefore be excluded from the scope of the assessment. These include accidents during maintenance and some types of construction hazard (which predominantly affect workers). The PEIR presents a description of the potential accident scenarios (see **Section 16.10**) which could occur and the measures in place to prevent and mitigate them (see **Section 16.7**).
TMBC	Given the proximity of the site to MAH sites and pipelines, the ES should include an assessment of the potential risk these sites may pose to the construction, operation and maintenance phases of the proposed development, including the risk of harm to persons working on its construction, operation and maintenance. The HSE will need to be consulted on the Scoping Opinion and on the application for a DCO.	The risk of an accident at one of these sites affecting the Project construction workforce is considered under 'External Major Accident Hazard Sites' in Section 16.10. The impacts on the operational workforce was scoped out as most of the Project locations are not normally occupied.

Technical engagement

16.3.4 Technical engagement with consultees in relation to MA&D is ongoing. A summary of the technical engagement undertaken to date is outlined in **Table 16.5**.

Table 16.5 Technical engagement on the MA&D assessment

Consultee	Consideration	How addressed in this PEIR
HSE	An initial meeting between the Applicant and HSE was held in February 2022 to align the expectations of both parties and set out the terms of cooperation on pipeline safety.	It is anticipated that continued technical engagement may shape the description of embedded mitigation presented in the ES.
TMBC	An initial meeting was undertaken to discuss the New Carrington Masterplan and preferred routes to the Partington HAGI.	N/A
URENCO UK Ltd	ONR requested that the Applicant consult with URENCO UK Ltd to confirm that URENCO do not have any objections to the Project as the Project falls within the ONR consultation distance (12 km) for the URENCO Licensed Site in Capenhurst.	A letter has been sent to URENCO UK Ltd on 29 July 2022 to confirm whether URENCO agree with the scoping phase assessment. The preliminary assessment in this PEIR has assessed that there are no significant effects on the basis of the significant distance between the two facilities. The Project is ~3 km outside the Capenhurst Works Outline Consultation Zone (OCZ) which is 5km, and the URENCO site is approximately 7 km outside of the Study Area.

Planned future engagement

16.3.5 It is proposed to engage with the emergency services on issues relating to security. As security issues have been agreed in the Scoping Opinion as being out of scope for the EIA, and security matters are inappropriate to publish publicly, it is not proposed to present detailed accounts of any engagement within the ES.

16.3.6 It is proposed to undertake technical engagement with the HSE on the future LUP restrictions for Hydrogen Major Accident Hazard Pipelines (MAHP).

16.3.7 Local authorities in their role as a Hazardous Substance Authority (HSA) may need to be consulted by the Applicant in relation to sites holding Hazardous

Substance Consent (HSC), where the Project is within the consultation distance of those sites.

16.3.8 Appropriate stakeholders such as the Department for Business, Energy and Industrial Strategy (BEIS) may need to be consulted in relation to operational and security requirements.

16.4 Study Area

Spatial scope

16.4.1 The Study Areas used for the MA&D assessment are based upon applying buffer distances relative to the Preliminary Order Limits, which may be revised as the Project design process progresses. These distances have been developed using professional judgement, where there is no specific regulatory guidance or standardised methodology.

16.4.2 Different Study Areas have been applied depending on the nature of the factor which is under consideration. Each factor has been grouped into either an external source of MA&D (where the Project is a receptor), or where the Project is a source of Major Accident to receptors.

16.4.3 The buffer distances applied remain unchanged from those presented in Scoping Report, but as the order limits have been revised, the Study Area has changed accordingly.

16.4.4 Two figures have been produced to represent graphically the Study Areas. **Figure 16.1** has been produced to represent the External MA&D Study Areas described in paragraphs 16.4.5 and 16.4.6. **Figure 16.2** has been produced to show the Receptor Study Area described in paragraph 16.4.7.

External Major Accident Study Areas

16.4.5 The buffer zones used to create the Study Area for external sources of Major Accidents are given in **Table 16.6**.

Table 16.6 External Major Accident Study Areas

Source of External Major Accident	Buffer Distance	Justification
Aerodromes	10 km	Based on HSE research.[19]
COMAH Establishments	3 km	Based upon professional judgement of the types of hazards which could be present at these establishments and typical HSE LUP restrictions
Major Accident Hazard Pipelines	1 km	Based upon HSE research.[18]
Fuel storage or retail facilities (where not COMAH establishments)	1 km	Based on professional judgement. It is anticipated the consequences from a worst-case fire at a fuel retail facility would not exceed 1km, due to the nature of the urban environment, limited inventories of fuel and safeguards required in order to operate a licensed fuel retail facility.
Other utilities (pipelines, electrical, communications etc.)	Various	Where a pipeline crossing is required or within the HAGI search areas.

Disaster Study Areas

16.4.6 The buffer zones used to create the Study Area for Disasters are given in **Table 16.7**.

Table 16.7 Disaster Study Area

Source of Disaster	Buffer Distance	Justification
Natural features which may lead to a risk e.g. flooding, wildfire or subsidence	1 km	It is anticipated that the most severe effects will be limited to close proximity to the Project e.g. ground or water-based hazards. An area of 1 km is based on professional judgement of the typical extent of these effects.

[19] HSE (2019). Update of aircraft crash rates used by HSE in assessing hazards from chemical, process and other major hazard installations. Research Report 1140. (Online) available at: https://www.hse.gov.uk/research/rrpdf/rr1140.pdf (Accessed June 2022).

Receptor Study Areas

16.4.7 The buffer zones used to create the Study Area for Receptors are given in **Table 16.8**.

Table 16.8 Receptor Study Area

Project Phase	Buffer Distance	Justification
Receptors during construction	500 m	Based upon typical construction hazards
Receptors during operation (including commissioning)	1 km	Based upon the HSE Research Report[18] which supports PSR.

Temporal scope

16.4.8 The temporal scope of the assessment of MA&D is consistent with the period over which the Project would be carried out and therefore covers the construction and operational phases.

16.4.9 No specific major accidents during the decommissioning phase were scoped into the MA&D assessment. Some similar hazards may be present when compared to the construction phase, but are expected to be much lesser due to the scale of the works required, including minimal intrusive works being required. There will be some additional activities required to support decommissioning prior to demolition such as venting and purging of the pipeline network, but these are considered to be comparable to the hazards of operating and maintaining the pipeline. Effects from the decommissioning phase are therefore not considered further.

16.5 Data gathering methodology

Desk study

16.5.1 A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 16.9**.

Table 16.9 Data sources used to inform the MA&D assessment

Source	Date	Summary
MAGIC mapping website[20]	25 May 2022	Locations of potential receptors.

[20] Defra (2021). Magic Maps. (Online) Available at: https://magic.defra.gov.uk/ (Accessed June 2022).

Source	Date	Summary
Natural England	25 May 2022	Access to evidence database[21] for details on Designated Land and Water Sites and for Scarce Habitats and Species.
Historic England	25 May 2022	Listed Buildings and Scheduled Monuments[22].
Environment Agency	25 May 2022	River Catchment Planning database for waterbodies[23].
COMAH Information Portal[24]	25 May 2022	Locations of any COMAH establishments and their inventories.
HSE Planning Advice Web App[25]	25 May 2022	Locations of Major Hazard sites and/ or pipelines within consultation distance from the Preliminary Order Limits.
National Risk Register of Civil Emergencies[26]	25 May 2022	Baseline information related to potential types of MA&D.
Google Earth[27] and Google Maps[28]	25 May 2022	Location of buildings close to the Preliminary Order Limits, including schools and hospitals.

[21] Natural England (2021). Access to Evidence. (Online) available at: http://publications.naturalengland.org.uk/ (accessed June 2022)
[22] Historic England (2021). Search the list. (Online) available at: https://historicengland.org.uk/listing/the-list/ (accessed May 2022)
[23] Environment Agency (2021). Catchment Data Explorer. (Online) available at: https://environment.data.gov.uk/catchment-planning/ (accessed May 2022)
[24] HSE (2021). COMAH 2015 Public Information. (Online) available at: https://notifications.hse.gov.uk/COMAH2015/Search.aspx (accessed May 2022)
[25] HSE (2021). Planning Advice WebApp. (Online) Available at: https://pa.hsl.gov.uk/ (accessed May 2022)
[26] Cabinet Office (2020). National Risk Register of Civil Emergencies. (Online) available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952959/6.6920_CO_CCS_s_National_Risk_Register_2020_11-1-21-FINAL.pdf (accessed May 2022)
[27] Google (2021) Google Earth. (Online) Available at: https://earth.google.com/web/ (accessed May 2022)
[28] Google (2021). Google Maps. (Online) Available at: https://www.google.com/maps (accessed May 2022)

Source	Date	Summary
Office for Nuclear Regulation[29]	25 May 2022	List of Nuclear Licensed Sites in the UK.

Survey work

16.5.2 No specific surveys have been undertaken for MA&D.

Data limitations

16.5.3 There are no data limitations which have adversely affected this preliminary assessment of MA&D.

16.6 Overall Baseline

Current baseline

16.6.1 A Study Area has been defined as the Preliminary Order Limits, with wider areas applied for COMAH and Nuclear Licensed Sites as described in **Section 16.4**, paragraphs 16.4.1 to 16.4.3. The Study Area will be refined as the project design and construction approach is developed further. However, for the Environmental Statement (ES), it is intended to identify effects that are relevant to the Project within those search areas.

Sources of Potential Major Accidents

16.6.2 An initial search to identify establishments subject to the Control of Major Accident Hazards Regulations 2015[30] within 3 km of the Study Area has been undertaken using information from the HSE COMAH Information Portal[24]. Under the regulations, sites are classified into one of two tiers depending on the inventories of substances that they store. The list of identified COMAH establishments is given in **Table 16.10** as they have notified to the HSE. The 3 km study area is shown on **Figure 16.1**.

16.6.3 The spatial extent which has been used in this section to identify the baseline sources is preliminary and will be further refined with a more detailed Study Area in future environmental reporting, during which specific pipeline routes will be defined.

[29] Office for Nuclear Regulation (2022). ONR - Sites/Facilities that we regulate. (online) Available at: https://www.onr.org.uk/regulated-sites.htm (accessed May 2022).
[30] UK Government (2015). Control of Major Hazard Regulations 2015. (online) Available at: https://www.legislation.gov.uk/uksi/2015/483/contents (Accessed August 2022).

Table 16.10 COMAH establishments within 3 km of Study Area

Establishment Name	Operator Name	Postcode	Upper/Lower Tier
Chester	Encirc Limited	CH2 4LF	Lower Tier
Ince Marshes[31]	CF Fertilisers UK Limited	CH2 4LB	Upper Tier
INOVYN	INOVYN ChlorVinyls Limited	WA7 4HZ	Upper Tier
Runcorn	Packed Chlorine Limited	WA7 4HZ	Upper Tier
Runcorn	Mexichem UK Limited	WA7 4LN	Upper Tier
Runcorn MCP	Runcorn MCP Limited	WA7 4HZ	Upper Tier
Sulphuric Acid Plant - Runcorn	INEOS Enterprises Group Limited	WA7 4LT	Upper Tier
Runcorn	Vynova Runcorn Limited	WA7 4HZ	Upper Tier
Ellesmere Port	Argent Energy Holdings Limited	CH65 4EQ	Upper Tier
Ellesmere Port	Veolia ES (UK) Limited	CH65 4EQ	Upper Tier
Ellesmere Port	Innospec Limited	CH65 4EY	Upper Tier
Ellesmere Port	Avanti Gas Limited	CH2 4RA	Upper Tier
Stanlow	Essar Oil (UK) Limited	CH65 4HB	Upper Tier
Stanlow - Tanker Loading Depot	Stanlow Terminals Limited	CH65 4BD	Lower Tier
Runcorn	Syntor Fine Chemicals Limited	WA7 1SR	Lower Tier
Northwich	Nalco Manufacturing Limited	CW8 3AA	Upper Tier
Stublach Gas Storage Site	Storengy UK Limited	CW9 7SE	Upper Tier
Winsford	Warehouse One Distribution Limited	CW7 3BE	Upper Tier
Byley - Middlewich	H W Coates Limited	CW10 9NT	Upper Tier

[31] It has been reported in the news media that CF Fertilisers are to close their plant in Ince, if the establishment is removed from the HSE Portal, it will be removed from this list prior to ES.

Establishment Name	Operator Name	Postcode	Upper/Lower Tier
Holford Brine Field	Holford Gas Storage Limited	CW10 9NE	Upper Tier
Holford H165 Gas Storage Cavity	Cadent Gas Limited	CW9 7ST	Upper Tier
Wincham	Thor Specialities (UK) Limited	CW9 6GB	Upper Tier
Cadishead	Univar Solutions UK Limited	M44 5AL	Upper Tier
Carrington	Air Products (BR) Limited	M31 4TG	Lower Tier
Carrington	Basell Polyolefins UK Limited	M31 4AJ	Upper Tier
Irlam	Libra Speciality Chemicals Limited	M44 5LF	Upper Tier
Irlam	Multisol Limited	M44 5EG	Lower Tier
Irlam	Air Liquide UK Limited	M44 5BA	Lower Tier
Baronet Works	Solvay Interox Limited	WA4 6HA	Upper Tier
Warrington	Unilever UK Limited	WA5 1AQ	Lower Tier
Widnes	Emerald Kalama Chemical Limited	WA8 0RF	Upper Tier
Widnes	ICoNiChem Widnes Limited	WA8 0RU	Upper Tier
St Helens	Sutton & Son (St. Helens) Limited	WA9 5BW	Upper Tier

16.6.4 In addition to the COMAH establishments identified in **Table 16.10**, there may be other non-COMAH establishments which operate under an HSC. These sites may present hazards which could be a source of major accidents, and the location and nature of these sites will be considered following consultation with the HSE.

16.6.5 There are various MAHP which are regulated under the Pipeline Safety Regulations 1996[5].

16.6.6 Following an inspection of the list of sites and facilities regulated by the ONR[29], details of the closest sites to the Project are presented in **Table 16.11**. The spatial footprint of the Project, as currently defined, is entirely outside of the assigned emergency planning zones for the URENCO facility. Therefore, it is considered that the Project cannot credibly be significantly affected by a Major Accident at that facility.

Table 16.11 Sites regulated by ONR

Establishment Name	Operator Name	Postcode	Distance from Project
Capenhurst Works	URENCO UK Ltd	CH1 6ER	7.5km

16.6.7 The risk of encountering Unexploded Ordnance (UXO) in the Project is considered generally to be low. The Zetica UXO maps[32] indicate that the majority of the Study Area is considered to be low risk, with three areas of moderate risk relating to the St Helens, Manchester and Runcorn-Warrington urban areas inside the Preliminary Order Limits. There are well developed industry working practices and published good practice guidance for dealing with UXO hazard in construction such as CIRIA C681[33], which will enable safe construction.

Sources of Disasters

16.6.8 Most disasters were agreed with the PINS in its Scoping Opinion to be out of scope for the EIA. This section cross-refers to those which are considered within the PEIR. Reference can be made to the Scoping Report and Scoping Opinion for those which were agreed as not significant.

16.6.9 Extreme weather such as intense precipitation, extreme temperatures (high and low) and high winds are possible throughout the duration of the Project, but presents the greatest risk during the construction phase, when there is a significant construction workforce as a receptor. Monitoring of extreme weather will be undertaken using predictive information provided by the Met Office, which typically includes the provision of advanced warnings of hazardous weather. The impacts of extreme weather as a result of climate change are assessed in **Chapter 18: Climate Change Resilience**.

16.6.10 Flooding is a potential disaster, which may affect areas of the Preliminary Order Limits. This will be assessed elsewhere in a Flood Risk Assessment (FRA), the scope for which is detailed in **Chapter 7: Water Environment**.

Population and human health

16.6.11 There are numerous low density residential areas partially or entirely encompassed within the Study Area. A high-level review of the existing land-use within the Study Area indicates that the area is generally sparsely populated and consists mostly of agricultural land, with some small urban areas. The urban areas are generally to the south of St Helens and through Warrington and Runcorn. Within urban areas, the pipeline and spur corridors are generally routed through industrial areas, but in some sections the pipeline is routed through or close to residential areas.

[32] Zetica (2021). UXO Risk Maps. (Online) Available at: https://zeticauxo.com/downloads-and-resources/risk-maps/ (Accessed November 2021)
[33] CIRIA (2009). Unexploded ordnance (UXO). A guide for the construction industry (C681). CIRIA; London UK.

16.6.12 Various vulnerable (public) receptors have been identified within the Study Area which include both education centres (e.g., colleges, schools) and medical/care facilities (e.g., hospitals, care homes). Following further evolution of the project design, a refined list of receptors which could be vulnerable to a Major Accident will be provided in the ES.

16.6.13 Further details on the current baseline with respect to human population characteristics are given in **Chapter 15: People and Communities** and include data for populations within the Study Area.

Biodiversity

16.6.14 There are eight internationally designated land/water sites present in the north-west region, including four Special Areas of Conservation (SAC), three Ramsar sites and one Special Protection Area (SPA). However, due to the route corridor selection process, none of these designated sites are within the Preliminary Order Limits.

16.6.15 The only designated site within the Study Area is the Mersey Estuary, which is designated as a Ramsar wetland, a Site of Special Scientific Interest (SSSI) and an SPA. The Mersey Estuary is designated primarily for bird populations and the intertidal habitats which support them. This receptor is 830 m to the west of the Project at the nearest point and the receptor itself extends over more than 50 km²

16.6.16 Further details on the current baseline for biodiversity are given in **Chapter 5: Biodiversity**.

Land, soil, and water

16.6.17 Specific details on the land, soil, and water receptors in the surrounding area are given in **Chapter 7: Water Environment**, **Chapter 12: Ground Conditions**, and **Chapter 13: Agriculture and Soil Resources**.

16.6.18 A high-level summary of those receptors which could be affected by a Major Accident arising from the Project has been included within this chapter.

16.6.19 There are five groundwater bodies present within the Study Area. In most cases, the superficial groundwater bodies are present at a relatively shallow depth. The specific groundwater bodies are:

- Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers.
- Manchester and East Cheshire Permo-Triassic Sandstone Aquifers.
- Sankey and Glaze Carboniferous Aquifers.
- Weaver and Dane Quaternary Sand and Gravel Aquifers.
- Wirral and West Chester Permo-Triassic Sandstone Aquifers.

Material assets, cultural heritage, and the landscape

16.6.20 A review of the Preliminary Order Limits, cross referenced against Historic England's database for Listed Buildings and Scheduled Monuments has identified

the Grade I Listed Buildings, Grade II* buildings and Scheduled Monuments within the Study Area. Further information on the historic environment baseline context is given in **Chapter 6: Historic Environment**.

Future baseline

16.6.21 This section describes a number of factors which may influence the baseline conditions over the time the Project is due to be constructed and then operated. This includes changes which are anticipated as a result of climate change, natural changes and those driven by human populations.

Climate change

16.6.22 Climate change is predicted to lead to an increase in peak rainfall intensities and potential flood flows over time. The latest guidance on climate change allowances to be applied in England was last updated in October 2021[34] and provides guidance on the potential enhanced rainfall intensity, with wetter winters and drier summers. Climate change is expected to alter the prevalence of extreme weather conditions which could, if unmitigated, lead to a disaster. Any impact of climate change will be dealt with through **Chapter 18: Climate Change Resilience**.

Technological development

16.6.23 It is anticipated that there may be technological improvement over the lifetime of the Project; this could include improved control systems and use of remote maintenance or inspection tools. These are likely to reduce the risk posed to the environment (human and non-human receptors); however, they may also introduce new hazards that would need to be managed at the appropriate time. There are unlikely to be significant changes in the operations of the Project, which would change the nature of the accidents that could occur.

Land use change

16.6.24 Changing land use may mean that the surrounding environment could become more agricultural, industrial, residential or recreational in use. Changing ecological baselines resulting from the land use and climate change factors may also impact the local ecology and associated environmental designations of the land. As the surrounding environment changes, so do the receptors which could be affected. If land adjacent to the Project were to receive a higher level of ecological protection such as a designation, or a larger or more sensitive human population, then the sensitivity of receptors could increase. It is not expected that this will drastically change due to the application of local planning policy and the use of agricultural land.

16.6.25 The Project will be notified to HSE as an MAHP, which is likely to have a consultation distance and appropriate LUP restrictions applied by the HSE, and

[34] Environmental Agency (2021). Flood Risk Assessment - Climate Change Allowances. (Online) available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed June 2022)

which would assist in preventing inappropriate future development in the vicinity of the pipeline.

16.7 Embedded environmental measures

16.7.1 As part of the project design process, a number of embedded environmental measures are proposed to reduce the potential for impacts on MA&D. **Table 16.12** outlines how these embedded measures will influence the MA&D assessment.

Table 16.12 Summary of embedded environmental measures

Embedded measures	Compliance mechanism
All phases	
MAD-A-01: Health and Safety HSWA[1] combined with the MHSWR[3] () enshrine various principles as fundamental components of UK law. These include the requirement to undertake a written risk assessment of any activities and to ensure that the residual risk arising from those activities is reduced to ALARP, which is known as the ALARP principle. Finally, they codify the 'hierarchy of controls' which requires more effective risk controls which would eliminate the risk entirely to be used in preference to mitigation measures, such as Personal Protective Equipment (PPE).	The Applicant/ Contractor will adhere to regulatory requirements.
MAD-A-02: Project Route The route of the pipelines will be consulted upon with relevant stakeholders including National Highways, Network Rail, the HSE and appropriate local authorities to ensure that any transport networks, hazardous pipelines or other hazardous sites along the route are avoided entirely or crossed safely in accordance with industry standards.	The Applicant/ Contractor will apply good practice in design and construction.
MAD-A-03: Pipeline Regulations The Pipeline Safety Regulations 1996[5] (PSR)will apply to this Project.	Regulatory requirement secured by PSR
The Applicant will develop a Safety Management System (as defined in the regulations) or adopt the Project into the current processes to ensure that all Major Accident Hazards are identified, evaluated and reduced to ALARP, and that these processes are audited to ensure their effectiveness.	The Applicant/Contractor will adhere to regulatory requirements.
MAD-A-04: MAHP Notification The Applicant will notify the HSE that the Project will represent a new Major Accident Hazard Pipeline as defined in The Pipeline Safety Regulations 1996[5].	Regulatory requirement secured by PSR.

Embedded measures	Compliance mechanism
	The Applicant/Contractor will adhere to regulatory requirements.
MAD-A-05: Good Practice Design Gas transmission is a mature industry with some changes required to ensure suitability for hydrogen; the design requirements are generally well understood by industry. Good practice design standards such as those issued by the Institution of Gas Engineers and Managers (IGEM) or British Standards Institute (BSI) will be applied to the design of the pipelines, the HAGIs and all Project infrastructure, as appropriate. A good practice industry design standard will require a risk assessment of the pipeline to determine that the risk is ALARP and incorporates a minimum separation distance to occupied buildings and vulnerable receptors.	CoCP secured via DCO requirement The Applicant/ Contractor will apply good practice in design.
MAD-A-06: Design Safety Engineering The specific systems will go through an iterative design process, from the current phase through to a fully developed detailed design which will be used for construction. At each stage of the design process, there will be a consideration of the inherent hazards and how the risks arising from these hazards could be reduced. These hazards will be designed out where possible in accordance with good practice, applying the hierarchy of controls principle, which prioritises inherently safe design over control and mitigation measures. However, some of these hazards are an intrinsic part of a gas transmission network. As part of the design process, safety and environmental major accident hazards will be identified and assessed to ensure that adequate technical and administrative measures are in place to reduce the risk to ALARP. Specific design mitigation measures will be incorporated as the design progresses.	CoCP secured via DCO requirement The Applicant/ Contractor will apply good practice in design.
MAD-A-07: Land Use Planning The Project will ensure that any workforce populations for constructing or operating the Project are in a location that would not be ‘Advised Against’ as defined by the HSE LUP Methodology.	The Applicant will apply Good Practice in design.

Embedded measures	Compliance mechanism
Construction Phase	
MAD-C-01: COCP Any effects arising from disasters during the construction process will be identified and dealt with through appropriate risk assessment and mitigation (applying the hierarchy of controls) as required to comply with UK health and safety legislation and environmental legislation. A CoCP will be produced prior to commencement of construction which would detail measures to be implemented and regulated through relevant regulations such as CDM Regulations[2] to avoid or reduce impacts during the construction phase. The CoCP will require risk assessment of construction activities (including any necessary earthworks or demolition activities) and this assessment will cover and mitigate where necessary the potential impact of all major accidents or disasters including those affecting non-human receptors.	CoCP secured via DCO requirement
MAD-C-02: CDM The potential major accidents arising from construction activity include a spill from temporary fuel storage tanks, collapse of excavations, fire during construction or the collapse of a crane/ piling rig. All of the construction works will be managed in accordance with a CoCP and relevant regulations such as CDM Regulations[2]. Under the CDM Regulations, all structures must be designed so that they can be built and maintained safely, the designer must also 'design out' hazards where possible by applying the hierarchy of controls and produce a designers risk assessment to inform the construction contractors. The construction process must be managed to take account of the risks to people affected by the work, including the public. These include measures to manage fire risk, electrical hazards and structural integrity (including excavations) throughout the construction process.	CoCP secured via DCO requirement
MAD-C-03: Good Construction Practices Good construction practices will be adopted and included as requirements in the CoCP, which will describe how the construction practices will comply with the CDM regulations2 and incorporate Industry Good Practice standards, such as those published by the Construction Industry Research and Information Association (CIRIA).	CoCP secured via DCO requirement

Embedded measures	Compliance mechanism
MAD-C-04: UXO The Applicant will employ a specialist UXO contractor to provide detailed desk study incl. risk assessment, and advice on required risk mitigation such as briefings, site investigation or site clearance as required for areas of moderate UXO hazard.	CoCP secured via DCO requirement
Operational phase	
MAD-O-01: Lifting There are various regulations governing the use of work equipment such as the Lifting Operation and Lifting Equipment Regulations 1998[35] (LOLER) and Provision and Use of Work Equipment Regulations 1998[36] (PUWER). For example, for this Project, all lifting operations involving lifting equipment will be properly planned by a competent person, appropriately supervised and carried out in a safe manner in accordance with LOLER.	The Applicant/ Contractor will adhere to regulatory requirements.
MAD-O-02: DSEAR In order to comply with the requirements of the Dangerous Substances and Explosive Atmospheres Regulations 2002[4] (DSEAR), the Applicant will carry out an assessment of locations where flammable materials could be present, either by design or in event of a deviation from normal operations including for maintenance and ensure that sufficient mitigation is in place. Mitigation could include: minimising quantities of flammable materials, optimisation of operating conditions (e.g. flow rate/pressures), containment, inert gas blanketing, and controls over ignition sources including the use of ATEX rated equipment where necessary.	CoCP secured via DCO requirement The Applicant/ Contractor will adhere to regulatory requirements.
MAD-O-03: Land Use Planning Following the notification of a new MAHP by the Applicant, a consultation distance (demarcated into zones) will be implemented following the requirements of the HSE. This is to discourage encroaching development significantly increasing the risk from the Project. In addition to statutory LUP requirements, the Applicant will monitor for encroaching developments as part of their integrity management program.	Regulatory requirement secured by PSR The Applicant/ Contractor will adhere to regulatory requirements.

[35] UK Government (1998). The Lifting Operations and Lifting Equipment Regulations 1998. (Online) Available at: https://www.legislation.gov.uk/uksi/1998/2307/contents/made (Accessed June 2022).
[36] UK Government (1998). The Provision and Use of Work Equipment Regulations 1998. (Online) Available at: https://www.legislation.gov.uk/uksi/1998/2306/contents/made (Accessed June 2022)

Embedded measures	Compliance mechanism
MAD-O-4: Project Design The Project will comprise a route and design which the HSE 'does not advise against' granting consent on the basis of public safety, in line with its published methodologies and standard Land Use Planning Practices.	The Applicant/ Contractor will apply good practice in design.

16.8 Scope of the assessment

Potential receptors

16.8.1 The principal MA&D receptors that have been identified as being potentially subject to effects are summarised in **Table 16.13**.

Table 16.13 MA&D receptors subject to potential effects

Receptor	Reason for consideration
Project construction workforce	The Project Construction Workforce will be the most exposed human population during the construction phase.
Project operational workforce	These individuals will be responsible for maintenance and operation of the Project once operational.
Human populations (public) including: **Urban areas in the vicinity of St Helens, Warrington, Runcorn, and other population centres in the Study Area**	Potential releases from the Project could affect nearby human populations.
Groundwater bodies including: **Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone Aquifers** **Manchester and East Cheshire Permo-Triassic Sandstone Aquifers** **Sankey and Glaze Carboniferous Aquifers** **Weaver and Dane Quaternary Sand and Gravel Aquifers** **Wirral and West Chester Permo-Triassic Sandstone Aquifers**	Potential releases from hazardous third-party pipelines could affect groundwater bodies in the Study Area.
Designated Historic Environment receptors within the Study Area	Potential releases from the Project could affect nearby receptors.

Receptor	Reason for consideration
Ecological receptors within the Study Area	Potential releases from the Project could affect nearby receptors.

Likely significant effects

16.8.2 The effects on MA&D receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 16.14**.

Table 16.14 MA&D receptors scoped in for further assessment

Receptor	Likely significant effects
Project construction workforce	• Accident during intrusive construction works (including open trench crossings of transport network and watercourses). • Fire in a construction compound. • Impacts on mines/storage caverns during construction. • Accident during commissioning. • Land movement during construction. • External major accident hazard sites.
Project operational workforce	• Release of hydrogen from pipeline or HAGI/block valve. • Building fire at HAGI/block valve during operation. • Pipeline or HAGI/block valve damaged by land movement.
Human populations (public)	• Fire in a construction compound. • Impacts on mines/storage caverns during construction. • Release of hydrogen from pipeline or HAGI/block valve. • Building fire at HAGI/block valve during operation.
Ecological receptors (as listed in Table 16.13)	• Fire in a construction compound. • Release of hydrogen from pipeline or HAGI/block valve.

Receptor	Likely significant effects
	• Building fire at HAGI/block valve during operation.
Water receptors (as listed in Table 16.13)	• Accident during intrusive construction works (including open trench crossings of transport network and watercourses).
Historic Environment receptors (as listed in Table 16.13)	• Release of hydrogen from pipeline or HAGI/block valve. • Building fire at HAGI/block valve during operation.

Elements scoped out of further assessment

16.8.3 The receptors/effects detailed in **Table 16.15** have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant.

Table 16.15 Summary of effects scoped out of the MA&D assessment

Receptors/potential effects	Justification
Accidents during maintenance	Accidents during maintenance would be managed through good design of the assets and procedural controls in place under relevant regulatory regimes including MHSWR[3] which will reduce risk to ALARP, and PSR which makes requirements for the safe maintenance of pipelines.
Physical accidents during construction including dropped objects, excavation hazards and use of plant machinery	All construction activities would be managed in compliance with the CDM Regulations[2] and through the CoCP, which will require risk assessment of all activities to be undertaken and reduced to ALARP.
Construction works encountering UXO during intrusive construction works, where the risk is low[37]	The UXO hazard across the Study Area is mostly low with some areas of moderate hazard based upon historical bombing. There are well developed construction industry practices that will be applied and which have allowed the safe construction of numerous recent projects in low and moderate hazard areas. The CoCP will

[37] At the request of PINS, further information on construction techniques in areas of moderate UXO hazard will be provided.

Receptors/potential effects	Justification
	require that a specialist UXO contractor is retained for works in any areas of moderate risk.
Impacts of the Project on aviation	The physical separation of the Project from any aerodromes (>5 km at the nearest point) mitigates any effects and these are further mitigated through compliance with good practice such as the Airport Operators Association advice notes[38].
Impact on/ from transport networks	This will be managed through the proper design and construction of network crossings. Construction works would be undertaken in compliance with the CDM Regulations[2] and in accordance with methodologies, which will be agreed with the relevant stakeholder (highways authority/rail network).
Impact on/ from waterways	This would be managed through the proper design and construction of waterway crossings. Construction works would be undertaken in compliance with the CDM Regulations[2] and in accordance with methodologies, which will be agreed with the relevant stakeholder (notably the Environment Agency).
Leaks and spills during construction	This would be managed through compliance with construction good practice as described in the embedded measures included in **Chapter 12: Ground Conditions** and CoCP.
Structural collapse	Structural collapse will be prevented through the proper design of the assets and construction practices in compliance with CDM Regulations[2] and the Building Regulations[39].
Aircraft crash	The significant distance of the Project from an aerodrome and the relatively small footprint of the Project will therefore have a minimal impact on the risk of any such event.
External major accidents at nuclear facilities	The spatial extent of the Project elements do not overlap with the emergency planning zones of any Nuclear Licensed Sites, which indicates that

[38] AOA (2022). Operations & Safety, AOA. (online) Available at: https://www.aoa.org.uk/policy-campaigns/operations-safety/ (Accessed 30 July 2022).
[39] UK Government (2010). The Building Regulations 2010. (online) Available at: https://www.legislation.gov.uk/uksi/2010/2214/contents (Accessed August 2022).

Receptors/potential effects	Justification
	at an accident at those facilities would not pose significant risk to the Project.
Loss of utility supply	Any loss of supply would not have consequences that would be considered to be a major accident.
Cyber attack	A successful cyber attack is not expected to have consequences that would be considered to be a major accident.
Terrorism	The Project represents a low risk target with relatively small receptor populations, and therefore has a negligible impact on the wider risk of terrorism.
Widespread public disorder	The Project would have a negligible impact on the risk of widespread public disorder.
Biological threats	The Project would not significantly alter the risk of biological threats such as epidemic diseases or animal diseases.
Lightning	The majority of the pipeline infrastructure will be buried and therefore at negligible risk of a lightning strike. At the HAGIs, lightning is considered to be effectively mitigated through compliance with a design standards such as BS EN 62305[40] which will reduce the risk to ALARP. Suitable protection would be provided to construction phase structures and equipment through the CoCP.
Seismic hazards	The UK does not typically experience significant seismic activity. The design of the Project will account for any foreseeable loads e.g., due to seismic activity in line with British Standards. It is therefore considered there are no significant effects arising from seismic hazards.
Space weather	The potential harm arising from severe space weather is not considered to be significant enough to meet the threshold of a disaster.
Construction phase traffic accidents	This will be assessed **in Chapter 11: Traffic and Transport**.

[40] British Standards Institution (2011) BS EN 62305 Protection against lightning. British Standards Institution; London.

Receptors/potential effects	Justification
Extreme weather	This would be managed through good design of the Project to accommodate all foreseeable design loads which will account for the effects of climate change. The potential effects of climate change are described in **Chapter 18: Climate Change Resilience**.
Dam breach/reservoir failure	This will be assessed within the FRA as described in **Chapter 7: Water Environment.**
Flood risk	This will be assessed within the FRA as described in **Chapter 7: Water Environment**.

16.9 Methodology for PEIR assessment

Introduction

16.9.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 3: Approach to Preparing the PEIR**, and specifically in **Sections 3.7** to **3.10**. However, whilst this has informed the approach that has been used in this MA&D assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this MA&D assessment.

General methodology approach

16.9.2 Other than a high-level primer document[16], There is no established guidance on the assessment of MA&D within the context of EIA in the UK. Two clear principles have emerged from existing EIA guidance.[13] These have been adopted in the methodology described below; firstly, the principle of proportionality and secondly, the established principle that only those effects likely to be significant need to be assessed within the EIA.

16.9.3 The approach described herein is aligned to the European guidance made available by the European Commission (EC). The context of the guidance for MA&D is that the scope covers those MA&Ds which could impede the Project's activities/objectives and may have adverse effects upon receptors. The focus of the assessment will therefore recognise significant risk arising from MA&D and which may lead to potential significant environmental effects, thereby building resilience into and reducing the vulnerability of the Project.

16.9.4 MA&D are by their nature, high consequence events (if they occur) and are 'unplanned' with the effects not part of the intended design, construction or operational intent. The assessment of significant effects for MA&D focuses on the risk, which is the combination of the severity of harm, sensitivity of the receptor and likelihood of occurrence.

16.9.5 Risk tolerability for MA&D in the UK is built on the principle of eliminating intolerable risks, and to ensure, particularly at engineering design stages, that any residual risks are further minimised where 'reasonably practicable'. This principle has been applied in the assessment here, with 'intolerable risk' interpreted as equivalent to a 'significant adverse effect'.

16.9.6 A significant adverse effect for MA&D is one which would result in the following consequences, with a likelihood that the effect is considered intolerable to general society, based on commonly accepted benchmarks for what is intolerable:

- Serious damage to human populations – This includes harm which would be considered substantial i.e., death(s), multiple serious injuries or a substantial number requiring medical attention.
- Serious damage to the environment – Loss or significant detriment to populations of species or organisms, designated sites, cultural heritage sites, contamination of drinking water supplies, ground or groundwater, or harm to environmental receptors in line with other UK major accident regulations.

16.9.7 A significant effect could include both immediate and delayed effects. An immediate effect would be one that is self-evident at the time of the event (e.g., fire damage, injury). A delayed effect is one which becomes evident only after time (e.g. loss of feeding resources for a particular species leading to a change in ecosystem dynamics).

16.9.8 The proposed methodology is qualitative as the design is at the planning stage. If consent is granted, the design will advance through detailed engineering design stages, additional risk assessments (qualitative and where necessary quantitative) will be undertaken as part of the normal pre-construction design process, to account for all relevant emerging and requirements.

16.9.9 The assessment approach will:

- Identify potential receptors;
- Identify potential MA&D arising from or affecting the Project;
- Assess whether any credible pathways exist (i.e., the link between an event and a receptor);
- Qualitatively assess the harm/ damage which could be caused to the receptor to:
  - Eliminate those effects which do not meet the minimum threshold of serious damage from a major accident/ disaster; and, if the threshold is met; or
  - Estimate the magnitude of accidents and disasters (if they were realised), at the receptor.
- Qualitatively assess the likelihood of the effect, considering the range of impacts which may be associated with the source/initiator of an accident/disaster and taking into account the measures embedded in the Project which would reduce their occurrence and/or severity; and
- Establish whether there are any significant (i.e., intolerable) effects from MA&D.

Assessment of effects

16.9.10 As noted above, a significant effect for MA&D focuses on risk. This differs from the way in which many other topics in the EIA context are addressed. Typically, other topics examine effects that are considered likely to occur and therefore such effects are unlikely to meet the thresholds required to be considered a major accident or a disaster.

16.9.11 This chapter considers the potential for MA&D which are reasonably foreseeable but unplanned events with the effects not part of the intended design, construction or operational intent. These are typically by their nature very infrequent but are important considerations so that resilience against them can be built into a project at planning stage, and to provide sufficient information for informed decisions to be made for planning purposes. Resilience is built by ensuring that high consequence events are eliminated or, where elimination is not possible, reduced to such an extent the chance of them occurring is so small that they can be deemed not to be significant.

16.9.12 Risk tolerability for people is well established in the UK. The primary reference for this is HSE's R2P2[12] .The CDOIF[15] and R2P2 criteria will be used for this assessment to provide a consistent basis for the study against common benchmarks for MA&D applied across the UK.

16.9.13 The following factors are important in defining the criteria:

- Magnitude of change – the consequence thresholds of MA&Ds are established from the following dimensions and intrinsically account for receptor sensitivity;
  - Severity of harm (a combination of extent and damage potential); and
  - Duration of harm (the recovery period) for non-human receptors or the numbers of people affected for human receptors.
- Likelihood of the event occurring.

16.9.14 These combine to provide a measure of risk (i.e. the combination of the serious damage arising from a potential event and its likelihood of occurrence). The fact that the Project is currently in the planning stage means that the estimates are necessarily qualitative and based on expert judgement informed by comparison against experience in similar industries and for similar developments, where possible and practical.

Magnitude of change

16.9.15 In order to distinguish between potential major accidents of differing severities, all potential MA&D are categorised into one of four magnitude of change categories: Low, Medium, High and Very High. Any scenario which does not meet the criteria of a Major Accident or Disaster is simply listed as 'Not MA&D'. Magnitude of change within the context of MA&D is assessed from both the severity of the harm, and either the duration over which the receptor experiences that harm or the number of people affected.

16.9.16 The criteria for severity of harm developed for a range of non-human receptor types were extracted directly from the CDOIF guidance and further receptor types

for human populations were established to align to HSE's R2P2[12]. The severity of harm criteria are given in **Appendix 16A**.

16.9.17 Four categories of harm severity are considered:

- **Not Significant**: This level of harm is below the minimum threshold determined for a major accident or disaster in the CDOIF guidance and in R2P2[12]; and
- **Severe**, **Major**, **Catastrophic**: These represent increasing levels of damage or harm to populations or environmental receptors.

16.9.18 For non-human receptor types, four categories of duration are considered: Short, Medium, Long and Very Long Term.

16.9.19 The combination of harm severity and harm duration for non-human receptors to determine magnitude of change is given in **Table 16.16**.

Table 16.16 Magnitude of change matrix – non-human receptors

Severity of Harm	**Very Large**	Not MA&D	High	Very High	Very High
	Large		Medium	High	Very High
	Severe		Low	Medium	High
	Not Significant	Not MA&D			
		Short	**Medium**	**Long**	**Very Long**
		Duration of harm			

16.9.20 For human receptors, the number of people affected is accounted for in assigning the magnitude of change; this ensures appropriate alignment to HSE R2P2[12] concepts. The combination of harm severity and people affected for human receptors to determine magnitude of change is given in **Table 16.17**.

Table 16.17 Magnitude of change matrix – Human receptors

Severity of Harm	Magnitude of change	Number of people affected
Very Large	Very High	**Very high**
	High	**Low to high**
Large	Medium	
Severe	Low	
Not Significant	Not MA&D	

16.9.21 Potential MA&D that have been assigned a magnitude of change are further assessed for significance, unless they are eliminated under any of the following cases:

- Although a source, pathway and receptor are present it is unrealistic to consider that major accident or disaster consequences could occur, even if theoretically credible;
- The magnitude of damage, when assessed without taking into account mitigation, does not meet the threshold for major accident or disaster;
- If the 'source' does not directly cause a major accident but influences the sequence of events leading to a major accident/ disaster being realised, the influence of the source is integrated into the event scenario assessment but is not assessed further as a standalone scenario. This includes:
  - Conditions such as snow and rain that make driving more dangerous, but do not directly cause accidents – these are considered as causal factors; and
  - Impairment of an embedded environmental measure such as damage to a secondary containment designed to contain hazardous spillages – this does not cause release, but if a spillage occurs while it is damaged the consequences are more likely to be major accident – these are considered in the assessment of likelihood.

Determination of significance

16.9.22 Guidance provided by the EC[13] highlights that the context for inclusion of MA&D in EIA is to ensure that adequate focus is given to the potentially significant risks facing a project with an objective of building resilience into a development against such effects. The threshold for what may be considered significant (i.e., what can be considered to be intolerable) therefore includes much less frequent effects than are addressed in many other topic chapters.

16.9.23 **Table 16.18** presents the magnitude of change and a qualitative likelihood scale to determine whether the risk is significant. In the assessment, a significant effect would represent a level of risk that would generally be considered intolerable.

16.9.24 The assessment applies expert judgement to evaluate the likelihood of each potential major accident or disaster occurring once the mitigation is applied. The likelihood and risk reported is that above the baseline (i.e., the incremental likelihood and risk). This is the risk that can be attributed to the development directly or indirectly.

16.9.25 While qualitatively stated, the definition and classifications used for likelihood are designed to be compliant with HSE's R2P2[12] for societal risk, and CDOIF[15] for environmental tolerability, if considered on a per effect basis rather than in terms of aggregated risk (i.e. the risk from all contributors to a receptor). Expert judgement has been used to establish the appropriate qualitative parameters for likelihood categorisation, with levels used ranging from 'Remote chance of occurring' through to 'Reasonable chance of occurring'. These then provide an allocation of likelihood against magnitude to determine risk significance, which in turn is an

approach that is consistent with major accident tolerability perceptions applied on all UK Major Hazards (COMAH) sites.

Table 16.18 Significance matrix – Major Accidents and Disasters

Magnitude of change	Likelihood (per receptor per effect)				
	Remote chance of occurring	Very small chance of occurring	Small chance of occurring	Chance of occurring	Reasonable chance of occurring
Very high	Not significant	Significant	Significant	Significant	Significant
High	Not significant	Not significant	Significant	Significant	Significant
Medium	Not significant	Not significant	Not significant	Significant	Significant
Low	Not significant	Not significant	Not significant	Not significant	Significant

16.10 Preliminary Assessment of Major Accidents and Disasters Effects

Construction phase

Intrusive works

16.10.1 As described in **Chapter 2: The Project**, the pipeline will be constructed in a linear fashion with work being completed sequentially to prepare the site, install the pipeline, inspect the pipeline and then reinstate the site.

16.10.2 Both open cut trenching and trenchless techniques will be used for the Project. In general, open-cut techniques will be preferred except where a specific crossing is required. Either approach carries the potential to strike subsurface obstacles, either during the initial excavation or the trenchless crossing.

16.10.3 This includes the potential to impact upon existing infrastructure such as gas pipelines, telephone lines or water/sewer pipes, causing structural instability of the transport/ waterway network or to impact unexploded ordnance. The embedded measures (**Table 16.12**) in place to manage the risk of each of these items are described below.

16.10.4 It is noted that Schedule 3 of the CDM regulations[2] identifies a number of construction activities which present particular risks. Only work near high voltage power lines is considered within this section. Most of these items are not applicable to the Project, including exposure to chemical/biological substances or ionising radiation, wells and underground earthworks, divers, workers in a compressed air atmosphere and the use of explosives. The remaining items were

covered by the construction hazards scoped out in **Table 16.15**, these include the use of heavy prefabricated components, falls from height, potential for engulfment/burial and the risk of drowning (flood risk).

Utility systems

16.10.5 The Project will need to cross a large number of utilities such as water, sewer, gas, telecommunications and electricity. An indicative list has been identified by the design team, which identifies approximately 1,150 service crossings.

16.10.6 The crossing of utility systems is well understood, and the good practice engineering design standards will specify an appropriate separation distance between the nature of the utility and the design of the pipeline at that location.

16.10.7 The design of the crossing will be agreed with the owner of the asset to be crossed, which will include details of the crossing technique, any asset protection measures and the agreed separation distance, as described in the embedded measures in **Table 16.12**.

16.10.8 Prior to the construction workers occupying a new area of site to prepare for pipeline installation, the utility survey will be reviewed by the appointed construction contractor so that any utility services (underground or overhead) are identified and that the appropriate precautions are used. In some cases, this will mean supervision by the asset owner and in others, it will mean reinforcement of the surface for crossings.

16.10.9 While the Project has a number of embedded measures (see **Section 16.7**) to prevent and mitigate the risk of striking underground services, there is still a small residual risk of a service strike occurring. In most cases, this would result in only financial loss and a delay to Project, in the worst case such as a gas transmission main, hazardous pipeline, or electrical distribution cable, then harm to the construction workers involved could occur. If it were a liquid pipeline, then there could be contamination of the groundwater.

Human receptors

16.10.10 The worst case for human receptors is considered to be causing damage to a gas transmission main leading to a fire in the vicinity of the excavation. The primary receptor will be the immediate construction workforce, with the potential for a small number of fatalities (approximately 1-5) and other injuries (major and minor) within the Project construction workforce. This would represent a **Medium MA&D** for the construction workforce.

16.10.11 There is limited potential for this to impact members of the public due to the segregation between the public and the works area.

Environmental receptors

16.10.12 The highest risk activity for ground and groundwater is when the Project crosses a number of liquid pipelines, which would be carrying hydrocarbon fuels or other chemicals. There are four pipeline networks which need to be crossed at multiple points, which include those operated by Exolum, INOVYN, SABIC and Shell.

16.10.13 Despite the embedded measures (see **Section 16.7**) to prevent service strikes, if a pipeline were to be damaged, then there could be a release of harmful substances to the ground with the potential to affect the groundwater.

16.10.14 As described in **Chapter 7: Water Environment**, there are five groundwater bodies within the Study Area.

16.10.15 There are three locations with a Source Protection Zone (SPZ) in the Study Area, meaning that the groundwater is extracted for drinking water; these are near the Higher Walton HAGI, Cuerdley and Rainhill. The most sensitive location is to the south of the Higher Walton HAGI. While both HAGI location options are outside of the SPZ, the pipeline itself runs through the SPZ and runs in close proximity (<50m) to several fuel pipelines. Both the West Corridor and the Solvay Spur may cross some of these pipelines within the Outer Zone of an SPZ.

16.10.16 When considering a release in this area, the worst-case consequence is contamination of the aquifer of a **Large** severity of extent. It is anticipated that this would lead to a **Long** duration of harm, this consequence would be considered a **High MA&D**.

16.10.17 Utilising the same parameters, an accident during crossing of a hazardous pipeline in any other location would represent a **Severe** severity of harm and a **Medium** duration of harm. This combination would represent a **Low MA&D**.

UXO hazard

16.10.18 The majority of the Study Area is designated by Zetica as low risk for UXO, and this has been scoped out of further assessment as agreed with PINS (**Table 16.4**).

16.10.19 There are only short sections of the route and infrastructure which are in areas of moderate risk, these areas are the Runcorn Spur, sections of the North Corridor close to Higher Walton HAGI and north of M62, and the St Helens Spur.

16.10.20 As the Zetica maps are intended as a high-level pre-screen, for these areas, a detailed desk study will be undertaken prior to construction in line with industry good practice. This detailed desk study will assess the likelihood of UXO being present and any required mitigations which may include UXO awareness training, site investigation, e.g. magnetometry, site pre-clearance or Explosive Ordnance Disposal (EOD) engineer site supervision.

16.10.21 Prior to the occupation of new area of site, the UXO survey will be reviewed by the appointed construction contractor to ensure that any appropriate precautions given in the desk study are employed. It is anticipated that UXO will be considered as part of the risk assessment and management processes required under the CDM Regulations[2]. All construction activities will be managed in compliance with the CDM Regulations and through the CoCP, which will the risk of all activities to be reduced to ALARP.

16.10.22 While the Project has a number of embedded measures (see **Section 16.7**) to prevent and mitigate the risk of encountering, there is still a small residual risk. In the worst case, this could lead to harm to the construction workers involved. Whilst there is the potential for a fatal accident, the CIRIA guidance[33] states that there have been no fatalities in the UK due to UXO since the Second World War.

Therefore, the most likely case is anticipated to be 1-5 severe injuries amongst the construction workforce. This would represent a **Low MA&D** for the Project construction workforce.

16.10.23 If UXO was encountered and exploded either accidentally during construction, or deliberately detonated as part of a planned clearance undertaken by an EOD engineer, then this could have localised effects on any ecological receptors e.g. plants or animals in the vicinity of the explosion. However, when this potential localised harm is considered against the harm criteria given in **Appendix 16A**, namely, lethal effects to >1% of the national population of any animal species or 5% of ground cover for any plant species, the effects are considered to be Not Significant and therefore it is assessed as **Not MA&D.**

Transport Network crossings

16.10.24 The Planning Inspectorate has requested that the impact of open cut crossings on the Transport Network are considered within the EIA. It is proposed that all railways and major roads are crossed using trenchless techniques but there are approximately 70 minor roads to be crossed using trenches, as well as various Public Rights of Way (PRoW).

16.10.25 Both road and railway crossings are well understood from the natural gas industry and will be addressed through the design of the pipeline. good engineering practices will be adopted for the whole pipeline system, and this includes utilisation of relevant design standards such as IGEM/TD/1[41] which includes a specific section on the design of road/railway crossings. In addition, pipeline crossings of railways and major roads are subject to approval by the relevant network authority.

16.10.26 All construction activities would be managed in compliance with the CDM Regulations[2] and through the CoCP, which will require risk assessment of all activities to be undertaken and reduced to ALARP. This risk assessment will require additional measures for the transport network crossings to prevent unauthorised access to construction sites by the public, which could lead to harm.

16.10.27 The crossings will require either road closures with diversions, or partial closures with active traffic management. These measures will be agreed with the relevant highways authority and are described by **Chapter 11** and **Appendix 11A**. These measures will allow the users of the transport network to be adequately segregated from the construction process.

16.10.28 As the users of the transport network would be segregated from the construction activities, there would be no additional risk of major accidents to them from the construction of the Project. As there is no potential Major Accident scenario, there are no significant effects.

16.10.29 Impacts upon the transport network as a receptor are assessed in **Chapter 11**.

Waterway crossings

16.10.30 As part of the Scoping Opinion, PINS has requested that the impact of open cut crossings of waterways are considered within the EIA (see **Section 16.3**). All major and navigable rivers are to be crossed using trenchless techniques.

16.10.31 Two techniques are described in **Chapter 2: The Project** for trenched crossing of small water courses, damming and fluming. These techniques are both well established for construction of utilities within the UK. The crossing of each watercourse will be subject to permits and consents issued by the appropriate environmental regulator and this process is described in **Chapter 7: Water Environment**.

16.10.32 All construction activities would be managed in compliance with the CDM Regulations[2] and through the CoCP, which will require risk assessment of all activities to be undertaken and reduced to ALARP. This risk assessment will require additional measures for open-cut watercourse crossings to prevent flooding of the excavations and potential drowning of construction workers in the event of dam failure.

16.10.33 The pipeline itself would be buried beneath the watercourse and therefore not located within the surface water body. The design of the pipeline in such locations will ensure that it is protected from foreseeable forces including sedimentation, scour or dredging. These are well understood from the natural gas industry and will be addressed through the design of the pipeline. good engineering design practices will be adopted for the whole pipeline system, including utilisation of design standards such as IGEM/TD/1[41] which has a specific section on the design of waterway crossings.

16.10.34 The dam/ flume will be designed with a specific safety tolerance for water flow, to prevent the potential for it to be overwhelmed. The works will also take place in summer when water flows are much lower.

16.10.35 All works in the vicinity of watercourses will be subject to additional risk assessment and measures where required. In the worst case, if a construction worker were to be within the trench when the dam failed, there is potential for a fatality in the construction workforce.

16.10.36 A single worker fatality would represent a **Medium MA&D** for the Project construction workforce.

16.10.37 Impacts upon the watercourses as a receptor are described in **Chapter 7: Water Environment**.

Summary

16.10.38 There is the potential for an accident to occur with any construction activity, while construction accidents generally are scoped out for the MA&D assessment. Some activities or locations carry additional risk of an accident occurring such as works in proximity to utility services, areas with a higher risk of UXO presence, or crossings of waterways. In the worst case, an accident in these locations would be a **Medium MA&D** magnitude of change affecting the Project construction workforce. When crossing hazardous liquid pipelines, there is the potential to cause damage to that pipeline leading to a release into the ground with the

[41] Institution of Gas Engineers and Managers (2021). IGEM/TD/1 Edition 6: Steel pipelines for high pressure gas transmission. IGEM; Kegworth, UK.

potential to contaminate the groundwater, in the worst case this could be a **Large MA&D**.

16.10.39 The CDM regulations[2] govern all UK construction activity and embedded measures secured in the CoCP start with CDM compliance and develop this to ensure compliance with all good practice. This approach will require that the risk in these locations is reduced to ALARP. All other embedded measures will be driven by this risk assessment process.

16.10.40 On the basis of the embedded measures (see **Section 16.7**), it is considered that a Major Accident associated with Intrusive works affecting the Project construction workforce has only a **Small chance of occurring**. As there are only a small number of liquid pipeline crossings, the likelihood of a major accident is reduced and is considered to only have a **Very small chance of occurring**. In line with the significance matrix given in **Table 16.18**, the risk of these potential major accidents is **Not Significant**.

Fire in a construction compound

16.10.41 Construction compounds for the Project are located adjacent to the HAGIs and will include temporary welfare facilities and vehicle fuelling facilities established in order to facilitate construction are required as part of the Project. These locations of these are described in **Chapter 2**. There is the potential for a fire in the construction compounds which could cause serious harm to the Project construction workforce.

16.10.42 Potential causes of fire include electrical faults, human error during hot works or vehicle/plant failure. The compounds themselves are relatively small with limited combustible inventory, other than a small storage tank of fuel for construction vehicles and plant. This tank will be stored in a dedicated area within a storage bund.

16.10.43 All UK construction activity is undertaken under MHSWR[3] and the CDM regulations[2] which require that the risk associated with those activities is identified and reduced to ALARP. The Project will use the CoCP to ensure compliance with the regulations. The Project will require the Principal Contractor to assess the risk of fire (and all other foreseeable hazards) within the construction compounds and put in place suitable measures as may be required to reduce the risk to ALARP. This is likely to include evacuation routes, fire alarms, active management of waste, firefighting equipment and ignition control measures such as exclusion of certain activities including hot works from specific areas and not allowing smoking on-site. There will also be safe systems of work identified to control any construction activities which need to happen within the construction compounds.

16.10.44 The embedded measures as described above will ensure that the Project complies with HSWA and MHSWR, including incorporating the hierarchy of controls and duly considers applicable guidance such as HSG168[42].

[42] HSE (2022). HSG168: Fire safety in construction. (online) Available at: https://www.hse.gov.uk/pubns/priced/hsg168.pdf (Accessed 21 June 2022).

16.10.45 Despite the embedded measures, there is still the potential for a fire to occur and lead to serious or fatal injuries to the construction workers, which is considered to be a **Low MA&D**.

16.10.46 The embedded measures described above ensure that fires in the construction compound have only a **Small chance of occurring**, which is therefore **Not significant.**

Impacts on mines and salt caverns during construction of the pipeline

16.10.47 The Project will represent linear buried infrastructure and may have the potential to affect existing subterranean infrastructure. In particular, salt caverns and coal mines have been identified within the Study Area and are considered below.

Salt caverns

16.10.48 Cheshire is known for salt caverns, which have been used for storage of both liquid and gas hydrocarbon fuels, additionally there are other caverns which are used for the storage of other items such as paper records.

16.10.49 The Project routing including all current options has been selected to avoid any interaction with subterranean features. However, it should be noted that the salt caverns for hydrocarbon storage are typically at a depth of ~500 m below ground level (bgl), with the Deepstore document storage at a higher level of ~150 m bgl. The pipeline will be buried in most locations to a cover depth of ~1.2 m, meaning a total excavation depth of several metres. In some locations, such as trenchless road/river crossings, a deeper level may be required but at no point would the pipeline credibly impact or enter the salt layer affecting underground storage caverns.

16.10.50 The Project intends to connect to one of these underground salt caverns for the purpose of hydrogen storage to buffer the network, however, this facility does not form part of this application and will be subject to a separate application for consent. For clarity, this Project terminates at the HSF HAGI where the future HSF operator will be able to make a connection to the network at ground level and route to its storage caverns.

16.10.51 Due to the physical separation between the pipeline and the storage caverns, there is not considered to any credible major accident scenario where the Project impacts the storage caverns.

16.10.52 It should be noted that the potential for the Project to affect pipelines associated with storage caverns is covered above under the ‘Intrusive works’ sub-heading and the potential for storage caverns to impact on the Project construction workforce is considered below under ‘External Major Accident Hazard Sites’.

Coal mines

16.10.53 Lancashire and Merseyside have historic coal mining activity. St Helens and the surrounding areas are located in Merseyside, although they are included within the Lancashire reporting area for the Coal Authority maps. The maps indicate that areas of the North Corridor located between the Clock Tower HAGI and end-users in St Helens are defined as High Development Risk Areas and with Past or

Possible Previous Shallow Coal Working Areas. It should however be noted that these areas have been significantly developed into urban areas such as Lea Green, Green Bank, Sutton Heath and Ravenhead.

16.10.54 Historic coal mines present a hazard as the anticipated geology of the ground may be altered through the creation of artificial voids, which may be supported by historic structures of varying quality. As there are no active mines within the Study Area, there is no potential to cause harm to mine workers. However, in the absence of the good practice design measures embedded into the Project, there would be a risk of collapsing these historic workings and causing harm to the construction workforce or other people in the vicinity.

16.10.55 There are previous shallow workings in the vicinity of the pipeline route, including within areas of Lea Green, Sutton Heath and Thatto Heath in St Helens, but these areas have already been redeveloped into residential areas so the construction of the pipeline at relatively shallow depths (limited to several metres) is unlikely to impact subterranean features. It should also be noted that significant sections in the St Helens Spur and St Helens section of the North Corridor will run within existing road infrastructure, which will already have been developed and stabilised where required.

16.10.56 The design of the pipeline and the route selection have and will continue to be informed by ground investigation studies and the Ground Conditions Desk Study as described in **Chapter 12: Ground Conditions**. Significant ground hazards will be identified to ensure that the structural design of the pipeline in that location is suitable for those hazards or ensure that the pipeline is routed around them.

16.10.57 If the embedded measures were to fail and a significant collapse occurred during the pipeline construction then there could be a significant loss of life amongst the Project construction workforce. This theoretical worst case would be a **Medium MA&D**.

16.10.58 A major accident of such severity is without precedent in the UK construction industry. On the basis of these embedded measures, including the structural design of the pipeline, design of the excavations and project route selection, there is considered to be only a **Remote chance of occurring.**

16.10.59 On the basis of **Table 16.18,** effects (risk) arising from the risk of historic coal mining is **Not Significant**.

Accidents during commissioning

16.10.60 It is proposed that the pipeline would be constructed in 2025 and 2026 with the commissioning taking place before the operation of the pipeline commences in 2027 or 2028.

16.10.61 Following the construction of the pipeline, there would be a period of initial testing called pre-commissioning. This period is used to confirm that the pipeline has been correctly installed and has not been damaged during the construction phase prior to flammable gases being introduced.

16.10.62 As described in **Chapter 2: The Project**, the pre-commissioning phase would encompass a hydrostatic pressure test, followed by inspection via PIG in-line

inspection tools to confirm there are no unacceptable defects. These final tests and inspections would be in addition to the non-destructive testing and inspection completed during the construction process to test the correct construction (such as welds).

16.10.63 If a pipe failure were to occur during the hydrostatic pressure test, then there would be a sudden release of pressure resulting in a high-pressure jet of water. As the pipeline would be buried along the full length, unless the failure occurred at a HAGI, it is unlikely to affect any of the Project construction workforce. As the leak would be water, it is not considered that there is any wider environmental consequence.

16.10.64 The in-line inspection for the commissioning would be undertaken using a non-hazardous gas as the motive fluid for pushing the pig along the pipeline. Therefore, if there were a release, it is not considered to represent a major accident as it would only have financial consequences.

16.10.65 Following the in-line inspection for, the pipeline would be tested to ensure that the pipeline is moisture free prior to the introduction of first hydrogen gas.

16.10.66 The appointed contractor will develop Safe Systems of Work and dedicated commissioning procedures including any necessary exclusion zones for the pressure testing at the HAGIs. These procedures will be developed in line with the CDM Regulations[2] and will include a risk assessment of all activities to ensure that any residual risk is reduced to ALARP.

16.10.67 Any accidents which occur during the final stages of commissioning before the system is operating on a commercial basis, but after hydrogen gas has been introduced is covered under release of hydrogen from pipelines or HAGIs.

16.10.68 On the basis of the approach to commissioning, there are no potential major accident scenarios and therefore the effects arising from major accidents are **Not Significant**.

Construction works affected by land movement

16.10.69 It was agreed with PINS in their Scoping Opinion[43] that the risk arising from seismic hazards, structural collapse of completed assets or temporary works are not significant and did not need to be considered further within the assessment. This section covers the underlying risk of land movement presenting a hazard to the Project construction workforce.

16.10.70 The geological nature of the Study Area is described in more detail in **Chapter 12: Ground Conditions**. The Study Area is predominantly flat rural and agricultural

[43] PINS (2022). Scoping Opinion Proposed HyNet North West Hydrogen Pipeline Project Case Reference: EN060006. (online) Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN060006/EN060006-000019-EN060006%20-%20Scoping%20Opinion.pdf (Accessed 25 August 2022).

areas. As described in a paper by the British Geological Society (BGS)[44], almost all fatal landslides in the UK occurred in a coastal environment and the fatalities were generally due to falling rock. These conditions are significantly different to those within the Study Area.

16.10.71 The design of the Project will be informed by ground investigations, initially a desk study followed by site investigation as required to ensure that the structural design of the pipeline and any temporary works are suitable for the location that they are in. Under the CDM Regulations[2], all structures must be designed so that they can be built and maintained safely, the designer must also 'design out' hazards where possible, by applying the hierarchy of controls and will produce a designer's risk assessment to inform the construction contractors.

16.10.72 The construction process must be managed to take account of the risks to people affected by the work, including the public. These measures must be documented in a CDM Design Risk Register. This ensures that the risk of such effects occurring is extremely low and will be reduced to ALARP. This process will be managed by the construction contractor.

16.10.73 It is not considered that there is any real risk of a major accident scenario relating land movement affecting the Project construction workforce.

External Major Accident Hazard Sites

Introduction

16.10.74 The construction phase will have a number of independent work crews undertaking different tasks such as pipe laying or trenchless crossings of road, rail and watercourses.

16.10.75 Typically, the pipeline construction will move sequentially along the pipeline route with different teams undertaking tasks sequentially including site preparation, pipelaying, welding, inspection and reinstatement. These teams will move along the corridor and in most locations will advance 500-1,000 m per day, although this will be reduced in urban areas. The typical working crew in any location will be approximately 30 individuals.

16.10.76 The construction of the HAGIs will take place over a period of 6-12 months, with block valve stations taking approximately 4 months. This will limit the exposure of any construction workforce, from several days up to 12 months.

16.10.77 Most of the HAGIs are located within LUP restrictions of some kind, which is logical given the intent to group hazardous infrastructure to prevent the unnecessary sterilisation of land. However, both Block Valve Stations, Clock Face HAGI and St Helens HAGI are not within any LUP consultation zones.

[44] Gibson, A., Culshaw, M., Dashwood, C. and Pennington, C., (2012). Landslide management in the UK—the problem of managing hazards in a 'low-risk' environment. Landslides, 10(5), pp.599-610.

Pipelines

16.10.78 A number of the HAGIs will be situated within the consultation distance of other pipelines. In particular, Rocksavage, Central Hub HAGI, Warburton, and Higher Walton Option 2 are all located within the inner zones of consultation distances for other pipelines. Others such as Partington are likely to be within the outer or middle pipeline consultation zones.

16.10.79 At other locations, the pipeline will be constructed in the vicinity of, and where necessary, cross other MAHPs. The potential for an accident to occur during construction at a crossing point is assessed under 'Intrusive Works'.

16.10.80 Where the Project may run parallel to other pipelines, a minimum separation distance will be derived by use of good practice engineering design standards. The risk will also be limited by the nature of the pipeline construction, which will move along the corridor, such that the construction workforce will only be exposed to risk from adjacent pipelines for a short period. Pipeline consultation distances are typically 50-300 m and the pipeline construction is expected to progress at a rate of 500-1,000 m per day in rural areas.

COMAH and other sites

16.10.81 As identified in the **Section 16.6**, there are a number of COMAH establishments in the vicinity of the pipeline route. The pipeline route itself will fall inside the consultation distances for a number of these sites. It should be noted that the Project is intended to deliver hydrogen to a number of industrial users including a number of COMAH establishments in order to support the decarbonisation of industry. Therefore, by the nature of the Project, it will enter several COMAH establishments. The hydrogen will also be produced at an Upper Tier COMAH establishment at Stanlow and stored at another near Middlewich.

16.10.82 The Hydrogen Storage Facility is within the Inner Zone of the Consultation Distance for various facilities including the existing gas storage cavern infrastructure and some of the pipelines which supply it.

16.10.83 The Hydrogen Production Plant (HPP) HAGI at Stanlow sits entirely within the Inner Zone of the Stanlow Refinery complex.

16.10.84 The Carrington HAGI sits within the middle and outer zones of adjacent COMAH establishments and Higher Walton HAGI (both options) are within the outer zone of sites holding hazardous substances as well.

16.10.85 Where the Project may run within the consultation zones of a COMAH establishment, the risk will be limited by the nature of the pipeline construction which will move along the corridor such that the construction workforce will only be exposed to risk from any particular site for a very short period. COMAH consultation distances are typically 50-1,000 m and the pipeline construction is expected to progress at a rate of 500-1,000 m per day in rural areas.

Nuclear sites

16.10.86 Some parts of the Project are located within the wider consultation zone for the URENCO UK Ltd Nuclear Licensed Site at Capenhurst, which is set by the ONR at

12 km. The HPP HAGI and a section of the West Corridor are within this consultation distance.

16.10.87 While the URENCO site may have a credible accident scenario which could affect the Project, it is noted that there is the town of Ellesmere Port, as well as the villages of Great Sutton, Whitby, and Wolverham, and the Cheshire Oaks shopping centre directly between then HPP HAGI and the URENCO Nuclear Enrichment Plant. This means that the temporary addition of ~30 construction personnel at a distance of more than 7km is unlikely to materially alter the risk of this scenario when the town of Ellesmere Port alone has a population of >60,000 (based upon the 2011 census).

16.10.88 It should also be noted that the Project falls entirely outside of the Detailed Emergency Planning Zone and outer consultation zone for the Urenco Capenhurst works.

16.10.89 It is proposed to consult with URENCO UK Ltd, as to whether they have any material concerns in relation to the Project.

Summary

16.10.90 It is proposed to treat the individual construction teams as individual receptors as they will be significantly geographically separated throughout in line with the HSE LUP Methodology[19]. The HAGIs during construction are anticipated to be Development Type 1.1 under this methodology as a normal workplace, due to the construction population. As a sensitivity level 1 type development, the HSE methodology would indicate it is suitable to be developed in any of the inner, middle or outer zones.

16.10.91 If an accident were to occur, depending on the nature of the accident, it could lead to a small number of fatalities (fewer than 10) within the construction workforce. This potential MA&D represents a **Medium MA&D** based on **Table 16.17**.

16.10.92 Each worksite will be risk-assessed in line with the CDM Regulations[2] and will be segregated from neighbouring industrial activities wherever possible. Each construction worksite will have designated escape routes and muster points that will account for the surrounding environment and hazards. The nature of the development is suitable for the location within which it is located, in line with the HSE LUP methodology. On that basis, the likelihood of an MA&D occurring is considered to be a **Very small chance of Occurring**.

16.10.93 In line with the significance matrix given in **Table 16.18**, a **Medium MA&D** with a **Very small chance of occurring** is **Not Significant**.

Operational phase

Release of hydrogen from pipelines or HAGIs

16.10.94 Whilst good engineering practices ensure that releases from pipelines are an extremely rare occurrence, they can still occur and lead to accidents. The risk of these releases is well understood in current natural gas infrastructure, but the introduction of hydrogen transmission systems such as the Project, will change

this risk profile. It is anticipated that the same processes by which the risk of natural gas infrastructure is reduced to ALARP and therefore is tolerated for the benefits it brings, are equally suitable for hydrogen infrastructure.

16.10.95 Hydrogen (just like natural gas) is a flammable gas that has the potential to be burnt to provide heat and energy for homes, vehicles and industrial processes. However, combustion at the wrong time or wrong place can potentially lead to either a fire or an explosion with the potential to fatally injure people or damage habitats, and to damage built infrastructure.

16.10.96 There are some properties of hydrogen which are different to natural gas:

- Hydrogen has a lower 'Minimum Ignition Energy' and the flammable range is wider, this means that an accidental release is more likely to become ignited.
- Hydrogen is less dense than air and natural gas, which means it will naturally rise and disperse faster than natural gas.
- Hydrogen flame speeds are faster than natural gas, which means that explosions with hydrogen will be more powerful than a comparable cloud of natural gas.
- Hydrogen has a lower heating value than methane so a hydrogen fire will generate less thermal radiation than a comparable release of natural gas.

16.10.97 Hydrogen industry at this scale is relatively new, and therefore there are ongoing research programmes and planned tests intended to enhance the understanding of the potential risks of hydrogen explosions and how they should be modelled for networks at this scale. Where there are uncertainties, the assessment must apply the precautionary principle as defined by the HSE (R2P2)[12]. This may lead to a degree of conservatism and uncertainty in the assessment of these scenarios. The principle stated in R2P2 is that where there is greater uncertainty, more conservative assumptions should be made to overcome this uncertainty. It is anticipated that these uncertainties will be reduced over the coming months and years as the large-scale hydrogen distribution industry becomes more established. It is expected that this will in turn allow a more representative risk assessment of hydrogen projects, which are greater in scale than the current UK operated hydrogen pipelines.

16.10.98 The main hydrogen infrastructure is described in **Chapter 2: The Project**. The pipeline is generally buried across its full length with any control systems, valves or associated equipment located above ground at one of the HAGIs or block valves. The HAGIs will have a variety of supporting equipment including isolation valves, pig launcher/receivers, pressure reducers and gas meters. The HAGIs may also have various supporting equipment including potential for power generation and control systems. This scenario is intended to cover a release of hydrogen from all equipment associated with either the pipeline or HAGI.

Hydrogen release consequences

16.10.99 While hydrogen is different to natural gas, the potential hazards will be subject to iterative risk assessment throughout the design process. A release of hydrogen has a range of possible outcomes, with scenarios ranging from a very small flange

leak within a HAGI where strict ignition controls are in place, to a scenario where a third party were to damage the pipeline causing a very large release of hydrogen. The first scenario would likely cause no harm and be detected during regular inspections. The latter scenario would likely lead to a very large fire and potential explosion, with the potential to lead to multiple fatalities. In this worst case, the damage may extend a significant distance from the pipeline.

16.10.100 As there is a wide range of consequences, the scenarios could be assessed to fall anywhere between **Not MA&D** for a case involving none or minor injuries and **Very High MA&D** where there are multiple fatalities including members of the public following major pipeline damage. Detailed engineering studies undertaken as part of the design process will evaluate and reduce as low as reasonably practicable the risk from all potential releases but for the purposes of EIA, a number of representative scenarios will be considered. Large and rupture cases from the pipeline, large and rupture cases from the HAGIs and small releases from either.

16.10.101 The theoretical worst case is the rupture of the pipeline or of HAGI pipework in the West Corridor or South Corridor, where if ignition is delayed, there could be an explosion, which could affect one of the residential areas. The most severe effects would be experienced near to the pipeline, but there is potential for impacts such as broken glass or noise over a much larger area. If this event were to occur in the 'worst location', there is potential for a very high number of people to be affected by a very large severity of harm leading to a **Very High MA&D**. It is worth noting that this theoretical worst case is without historical precedent, as no pipeline accident in history has been so severe.

16.10.102 Large releases (smaller than a rupture) from the pipeline or HAGIs are also possible. These are typically caused by events such as third-party interference such as an excavator digging into the pipeline. At the HAGIs, the compound will protect the pipework from most third-party interference. However there is still potential for damage to the pipeline or HAGI pipework and in this scenario, there would a significant release which could become ignited and lead to multiple fatalities. This is considered to be a **High MA&D**.

16.10.103 Therefore, the worst-case severity for large and rupture releases from either the pipeline or a HAGI is considered to be between **High MA&D** and **Very High MA&D**.

16.10.104 While still very unlikely, the most likely releases from the pipeline or HAGI are via small holes or damage to the infrastructure resulting from causes such as corrosion or impact damage. If one of these was ignited, it would likely lead to a small isolated fire. If a person was in the immediate vicinity, such as a Cadent employee in the HAGI, then this person could suffer severe or fatal injuries. This scenario is assessed to be at worst a **Medium MA&D**.

Embedded measures

16.10.105 In line with UK Health and Safety legislation, the Project will ensure that the risk of harm to people due to a release is reduced to ALARP. This will consider all stages in the hierarchy of controls from intrinsically safer options to mitigation measures.

16.10.106 The first major stage of the Project is design. The Project will be designed in line with good engineering practice and a specific design standard will be adopted for the whole pipeline system, such as IGEM/TD/1[41] which has been developed to include a hydrogen specific supplement[45]. The design standard will require a risk-based approach to design requiring additional measures in higher risk areas such as re-routing, thicker pipe walls and impact protection. These standards also allow minimum proximity distances to be identified between the pipeline and occupied buildings or transport network crossings.

16.10.107 This ongoing design risk assessment will be informed by specific studies such as Quantified Risk Assessment (QRA), which will take place during the design stages of the Project. This assessment will consider all potential release sources and identify higher risk areas along the pipeline network where additional mitigation may be required. This assessment will need to encompass conservative assumptions to bridge any uncertainties relating to the modelling of hydrogen explosion hazards.

16.10.108 The Applicant will develop a pipeline integrity management system, which will encompass all the necessary actions to maintain the integrity of the pipeline system. This will include regular inspection and maintenance, examination and monitoring, provision of information on utility surveys, and surveillance for encroaching development.

16.10.109 In order to mitigate the potential for third parties to damage the pipeline e.g. during excavations, the Applicant will make details of the pipeline route available on request, as is currently undertaken for the Applicant's natural gas transmission system.

16.10.110 The Project itself will be regulated under the PSR[46] and will be a MAHP, under those regulations. These regulations require the pipeline to be actively regulated by the HSE, with the operator bound to notify them at least 6 months prior to construction. With construction anticipated to start in late 2024, it is anticipated that this notification will be made in 2023 or 2024.

16.10.111 As the operator of an MAHP under PSR, the Applicant is required to prepare a Major Accident Prevention Document (MAPD). The MAPD requires the Applicant to demonstrate that a suitable Safety Management System is in place to ensure the risk of a Major Accident is reduced to ALARP.

16.10.112 Future development in the vicinity of the pipelines would increase the risk if a receptor population that did not exist when the pipeline was built is subsequently permitted by a planning permission[47]. HSE is a statutory consultee under this legislation. HSE uses the information provided under the PSR preconstruction notification to assign a consultation distance around each MAHP, the consultation

[45] IGEM (2021). High Pressure Hydrogen Pipelines. IGEM/TD/1 Edition 6 Supplement 2 Communication 1849. IGEM, Kegworth.
[46] UK Government (1996). The Pipelines Safety Regulations 1996. (Online) Available at: https://www.legislation.gov.uk/uksi/1996/825/contents/made (Accessed June 2022).
[47] UK Government (2015). The Town and Country Planning (Development Management Procedure) (England) Order 2015. (online) Available at: https://www.legislation.gov.uk/uksi/2015/595/contents (Accessed August 2022).

distance is subdivided in to three zones with sequentially increasing planning restrictions applying in each zone, with the greatest restrictions applied in the inner zone.

Likelihood

16.10.113 None of the potential accident scenarios described are likely to occur over the lifetime of the Project, and there are tens of thousands of kilometres of gas transmission pipelines across the country, which operate safely each year as well as a small number of hydrogen smaller scale pipelines between industry.

16.10.114 The embedded measures within the Project which are described above and in **Table 16.12**, encompass an overriding commitment to design safety and to ensure that all risks are reduced to ALARP in line with the PSR[5] and MHSWR[3] regulations, and good engineering practice.

16.10.115 The theoretical worst case described above as a full rupture is particularly unlikely. The HSE has produced a research report[48] which summarises the pipeline failure rates and causes which are used for its risk assessment in relation to land use planning. The HSE report states that the vast majority of pipeline ruptures are related to ground movement. The structural design of the pipeline will be suitable for the ground conditions encountered and the integrity management system will provide a mechanism to ensure this is maintained throughout the life of the pipeline. The HSE report also shows that large holes within the pipeline are the rarest category of release. On the basis of the embedded measures within the Project secured by the Pipeline Safety regulatory regime, it is considered that this case has only a **Remote chance of occurring**.

16.10.116 The HSE report[48] indicates that for a pipeline of this size, corrosion holes are unlikely due to the thickness of the pipeline material and the major cause of very small and small holes is due to third party activity. On the basis of the embedded measures within the Project secured by the pipeline safety regulatory regime, it is considered that this case has only a **Very small chance of occurring.**

16.10.117 Most of the HAGIs have limited equipment and are located within secure compounds, which reduces the likelihood of releases as a result of third-party activity. However, given the current uncertainties in the assessment of hydrogen explosions described above (paragraph 16.10.97), a large release from or rupture of pipework at the HAGIs leading to the worst-case consequences described above is assessed to have between a **Very small chance of occurring** and a **Remote chance of occurring**.

16.10.118 Very small and small holes in the equipment at the HAGIs typically have two major causes, impact damage and corrosion. The HAGIs are located within secure compounds which reduces the potential for third-parties causing damage to the pipework or equipment. Corrosion holes are considered unlikely due to the thickness of the pipe materials. On the basis of the embedded measures within the

[48] HSE (2015). Update of pipeline failure rates for land use planning assessments. HSE Research Report 1035. (online) Available at: https://www.hse.gov.uk/research/rrpdf/rr1035.pdf (Accessed 28 July 2022).

Project including the integrity management system, it is considered that this case has only a **Very small chance of occurring.**

Summary

16.10.119 While there are a variety of potential major accident scenarios, the EIA assessment is based upon the risk of various representative cases which are described in **Table 16.19**. While the releases from the pipeline and the very small and small releases from the HAGI are not considered to be significant, because of the ongoing industry and academic development in the assessment of hydrogen explosion hazards, for PEIR, it has been determined that the risk from the HAGIs is potentially significant, at this time pending further works.

16.10.120 However, it should be considered that there are currently hydrogen pipelines in operation at a smaller scale in the UK and the USA. The Project, through the Development Consent Order will be issued to the Health and Safety Executive for review as a Statutory Consultee. If the project does not satisfy the Statutory Consultees the Project would not reach construction, with the Project likely abolished or substantially redesigned.

Table 16.19 Summary of representative hydrogen release scenarios significance

Representative Scenario	Magnitude of change	Likelihood	Significance
Rupture or large release from pipeline	High to Very High	Remote	Not significant
Rupture or large release from pipework at HAGI	High to Very High	Very small/Remote	Potentially significant
Very small and small releases from pipeline or pipework at HAGI	Medium	Very small	Not significant

Building fires at HAGIs

16.10.121 There are currently 10 HAGIs and two Block Valve stations proposed where the pipeline is above ground for short distances within secure compounds. These compounds represent the only permanently visible infrastructure associated with the Project.

16.10.122 While the final design for each of these locations is subject to further refinement, there could permanent buildings constructed to support the future operations, particularly at the larger HAGIs such as HPP and HSF. These buildings may house storage, office or welfare facilities for employees, but some may house instrumentation or electrical equipment.

16.10.123 Any buildings which form part of the Project will be subject to a detailed fire risk assessment under the Regulatory Reform (Fire Safety) Order 2005[49], and will be constructed in line with the Building Regulations, particularly Part B and Approved Document B which relate to fire risk.

16.10.124 Additionally, there may be some kiosks or cabinets to provide weather protection to electrical equipment, but these will generally not be designed for people to enter and will be operated from outside.

16.10.125 It is not considered credible that a fire at one of these buildings could escalate and affect the integrity of the pipeline. If a minor electrical fire occurred in the kitchen or office of a building, the worst case is considered to be significant injuries to a worker who may be present. On this basis, it is not considered to be a credible MA&D.

Pipeline or HAGIs affected by land movement

16.10.126 As described above, there is relatively little risk of significant land movement hazards.

16.10.127 The placement of gas distribution infrastructure across the Study Area is well understood from the natural gas industry and will be addressed through the design of the pipeline and HAGIs. good engineering practices will be adopted for the whole pipeline system, and this includes utilisation of relevant design standards such as IGEM/TD/1[41] which includes specific sections on subsidence and landslides.

16.10.128 The design of the HAGIs will be undertaken by suitably qualified and experienced personnel including civil and structural engineers. The design will account for the expected ground conditions and design loads, i.e. any potential instability will be shored up. This will also account for the effects of climate change and will be ensured through compliance with good practice in structural design including compliance with the Eurocodes and any relevant BSI published documents. As part of the Application, compliance with the Building Regulations 2010 will also be provided, in particular, Part A of Schedule 1 and Approved Document A which relate to structure.

16.10.129 The design of the Project will be informed by ground investigations, initially a desk study followed by site investigation, as required to ensure that the structural design of the Project is suitable for its proposed location. Under the CDM Regulations[2], all structures must be designed so that they can be built and maintained safely, the designer must also ‘design out’ hazards where possible, by applying the hierarchy of controls and will produce a designer’s risk assessment to inform the construction contractors.

16.10.130 This will ensure appropriate design of the Project and effectively mitigate the risk of land movement causing serious damage to a pipeline or HAGI.

[49] UK Government (2005). The Regulatory Reform (Fire Safety) Order 2005. (online) Available at: https://www.legislation.gov.uk/uksi/2005/1541/contents (Accessed August 2022).

16.11 Preliminary significance conclusions

16.11.1 A summary of the results of the preliminary MA&D assessment is provided in **Table 16.20**.

Table 16.20 Preliminary summary of significance of effects

Receptor and summary of predicted effects	Magnitude of change[1]	Likelihood	Significance[2]	Summary rationale[3]
Construction Phase				
Intrusive construction works affecting Project construction workforce	Medium (Low for UXO)	Small chance	Not Significant	MAD-A-01, MAD-A-02, MAD-A-03, MAD-A-05, MAD-A-06, MAD-C-01, MAD-C-02, MAD-C-03, MAD-C-04
Intrusive construction works affecting Groundwater	Low (High for Higher Walton HAGI area)	Very small chance	Not Significant	MAD-A-01, MAD-A-02, MAD-A-05, MAD-C-01, MAD-C-02, MAD-C-03
Intrusive construction works affecting Ecological receptors	Not MA&D	N/A	Not Significant	N/A
Fire in a construction compound impacting the Project	Low	Small chance	Not Significant	MAD-A-01, MAD-C-01, MAD-C-02, MAD-C-03

Receptor and summary of predicted effects	Magnitude of change[1]	Likelihood	Significance[2]	Summary rationale[3]
Construction Workforce				
Land movement affecting Project Construction Workforce	No Credible MA&D	N/A	Not Significant	N/A
Construction of the pipeline impacting mines and storage caverns	Medium (No credible MA&D for storage caverns)	Remote chance	Not Significant	MAD-A-01, MAD-A-02, MAD-A-05, MAD-A-06, MAD-C-01, MAD-C-02, MAD-C-03
Accidents during commissioning	No Credible MA&D	N/A	Not Significant	N/A
External Major Accident hazard sites	Medium	Very small chance	Not Significant	MAD-A-01, MAD-A-02, MAD-C-01, MAD-C-02
Operation Phase				
Rupture or large release from the pipeline	High to Very High	Remote	Not significant	MAD-A-01, MAD-A-02, MAD-A-03, MAD-A-04, MAD-A-05, MAD-A-06, MAD-A-07, MAD-O-02, MAD-O-03
Rupture or large release from	High to Very High	Very small/Remote	Potentially significant[4]	

Receptor and summary of predicted effects	Magnitude of change[1]	Likelihood	Significance[2]	Summary rationale[3]
pipework at a HAGI				
Very small and small releases from pipeline or pipework at a HAGI	Medium	Very small	Not significant	
Building fires at HAGIs	No Credible MA&D	N/A	Not Significant	N/A
Pipeline or HAGIs affected by land movement	No Credible MA&D	N/A	Not Significant	N/A

1. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 16.9** and is defined as low, medium, high and very high.
2. The significance of the environmental effects is based on the combination of the magnitude of change and the likelihood of occurrence, subject to the evaluation methodology outlined in **Section 16.9**.
3. See **Table 16.12**
4. It should be considered that there are currently hydrogen pipelines in operation at a smaller scale in the UK and the USA. The Project, through the Development Consent Order will be issued to the Health and Safety Executive for review as a Statutory Consultee. If the project does not satisfy the Statutory Consultees the Project would not reach construction, with the Project likely abolished or substantially redesigned.

16.12 Further work to be undertaken

16.12.1 The information provided in this PEIR is preliminary, the final assessment of likely significant effects will be reported in the ES and may have some differences to the PEIR. This section describes the further work to be undertaken to support the MA&D assessment presented in the ES.

Baseline

16.12.2 The current baseline will be updated with any additional information identified during site surveys undertaken by other EIA technical topics, or due to revised information available such as new external Major Accident Hazard sites.

16.12.3 The baseline will also be updated to reflect any changes in the Study Area.

16.12.4 The baseline will be reviewed to identify any changes in receptors or receptor populations for the ES.

Assessment

16.12.5 As described in the assessment above, there is ongoing industry and academic development with regards to the assessment of hydrogen explosion hazards, which affect the whole large scale hydrogen distribution industry. The HSE decision making methodology[12] includes a section with advice and requirements for handling uncertainty and defines the precautionary principle. HSEs position is that any assessment should give due consideration to any uncertainty to ensure that any risk assessment undertaken is based on conservative assumptions. The principle in paragraph 93, is that where there is greater uncertainty, more conservative assumptions should be made to overcome this uncertainty. It is anticipated that these uncertainties will be reduced over the coming months and years as the large-scale hydrogen distribution industry becomes more established. It is expected that this will in turn allow a more representative risk assessment of hydrogen projects.

16.12.6 For the PEIR, due to the ongoing industry and academic development with regards to the assessment of hydrogen explosion hazards, it is not possible to categorically rule out the potential for a significant effect. The embedded measures, particularly the design engineering processes, have the aim to reduce the risk of all potential major accidents to ALARP. The preliminary assessment of this scenario is based on the precautionary principle, and considers that the Project is still at an early stage of design and there are ongoing industry and academic trials in the assessment of hydrogen explosion hazards. This has led to the preliminary assessment conclusion that there is potential for a significant effect arising from the release of hydrogen from the HAGIs, but that it may not be significant following further development of the Project design.

16.12.7 The embedded measures should ensure that for each potential accident scenario and in each location, the risk will be reduced to ALARP (which would not be a significant effect). It is anticipated that following further refinement of the design, more detailed description of how the design of the Project has embedded risk reductions in the Project will be available at ES.

16.12.8 To determine whether the risk and therefore the effects are significant at ES, further description of how the embedded measures, particularly MAD-A-05 and MAD-A-06 have achieved their design intent will be presented within the ES. This will include specific examples of engineered risk reduction measures and operational approaches to ensure that the risk is appropriately managed. This will describe how all major accident risks are reduced to a level which a) can be tolerated and b) represents ALARP.

16.12.9 Further assessment is also required to determine whether there is any potential for significant effects outside of the 1km study area.

16.12.10 The potential for releases of hydrogen from the operational pipeline or HAGIs to affect specific identified ecological or historic environment receptors will be included within the ES. Given then distance between the pipeline and designated receptors in this category, it is not anticipated that there will be any significant effects.

16.12.11 A Cumulative Effects Assessment (CEA) will be undertaken for the Project which will consider the combined impacts with other developments on the same single receptor or resource (inter-project effects) and reported in the ES. The detailed method to be followed in identifying and assessing potential cumulative effects is set out in **Section 3.9** of **Chapter 3: Approach to Preparing the PEIR**.

Environmental measures

16.12.12 While no further environmental measures are anticipated to be required, further detail on the implementation of the embedded measures already described are likely to be presented within the ES.

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