Keuper Gas Storage Project

Preliminary Environmental Information Report – Air Quality

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ACRONYMS AND ABBREVIATIONS

Acronym	Description
AQIA	Air Quality Impact Assessment
AQMA	Air Quality Management Area
AQS	Air Quality Standards
C_6H_6	Benzene
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CO	Carbon Monoxide
DCO	Development Consent Order
DEFRA	Department of Environment, Food and Rural Affairs
DEMP	Decommissioning Environmental Management Plan
EC	European Commission
EGF	Enclosed Ground Flare
EIA	Environmental Impact Assessment
ERM	Environmental Resources Management

Acronym	Description
ES	Environmental Statement
ESRD	Environmental Sustainable Resource Development
EU	European Union
KGSL	Keuper Gas Storage Limited
KGSP	Keuper Gas Storage Project
MC	Material Change
NECD	National Emission Reduction Commitments Directive
NECR	National Emissions Ceilings Regulations
NH_3	Ammonia
NMVOC	Non-Methane Volatile Organic Compounds
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NRMM	Non-Road Mobile Machinery
Pb	Lead
PC	Process Contribution
PEC	Modelled Environmental Concentration
PEIR	Preliminary Environmental Information Report
PM_{10}	Particulate Matter
$PM_{2.5}$	Particulate Matter
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxide
SSSI	Site of Specific Scientific Interest

8. AIR QUALITY

8.1 INTRODUCTION

8.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) assesses the effects of the Proposed Development with respect to air quality. The chapter provides: the policy context for air quality; consultation feedback on the Proposed Development; the assessment methodology and criteria; the baseline conditions currently existing within the Site and in the surrounding area; the mitigation measures the Proposed Development is committed to implementing; and an assessment of likely significant effects with these measures adopted.

8.1.1.2 This chapter is supported by **Chapter 2, Proposed Development Description**, **Appendix 8A, Air Quality Modelling**, Dispersion Modelling (Sections 8.5 and 8.5.4), and Dust Assessment (Sections 8.5 and 8.5.3).

8.2 LEGISLATION, POLICY AND GUIDANCE

8.2.1.1 This assessment considers key legislation, planning policy and guidance that are relevant to the Proposed Development and air quality. For further details regarding planning policy and the general legislative context of the Proposed Development, please refer to **Chapter 5, Policy and Legislative Context.**

8.2.2 LEGISLATION

8.2.2.1 The following legislation is relevant to the Proposed Development.

National Emissions Ceilings Regulations 2018 (NECR)

8.2.2.2 The revised NECR (2016/2284/EU), which entered into force on 31 December 2016, sets new emission reduction commitments for each Member State for the total emissions of Oxides of Nitrogen (NO_x), SO_x, Non-Methane Volatile Organic Compounds (NMVOC), Ammonia (NH_3) and Particulate Matter ($PM_{2.5}$) in 2020 and 2030. The new Directive repeals and replaces Directive 2001/81/EC to ensure that the emission ceilings for 2010 set in that Directive shall continue to apply until 2020. In 2018, NECD was transposed into UK law as the National Emissions Ceilings Regulations (NECR).

The Air Quality Directive 2008

8.2.2.3 The European Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008[1], sets legally binding Europe-wide limit values for the protection of public health and sensitive habitats. The

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050 Last Assessed: 21 July 2025

Air Quality Standards Regulations 2010 (as amended)[2] have been adopted into UK law and implement the limit values required by the Air Quality Directive 2008 (EU Directive 2008/50/EC).

8.2.2.4 The Air Quality (England) Regulations 2000 are an essential component of the UK's efforts to manage and improve air quality across England. They were established to implement European Union directives (Air Quality Directive 2008) on air quality into national law, focusing specifically on reducing pollution and protecting human health and the environment. The main purpose of these regulations is to maintain and enhance air quality by setting legally binding objectives for levels of specific pollutants. These pollutants include Sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM_{10}), lead (Pb), carbon monoxide (CO), and benzene (C_6H_6), among others.

The Environment Act 2021

8.2.2.5 Part IV of the Environment Act 2021[3] also requires local authorities to periodically 'Review and Assess' the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any air quality objectives prescribed in regulations (Air Quality Standards Regulations 2010) are being achieved or are likely to be achieved in the future. Where any of the prescribed air quality objectives are not likely to be achieved, the authority concerned must designate that part an Air Quality Management Area (AQMA).

8.2.2.6 The local authority has a duty to draw up an Air Quality Action Plan setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them. The Department of Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their Review and Assessment work. This guidance referred to in this chapter as Local Air Quality Management Technical Guidance (TG22) was used where appropriate in the assessment.

Regulation (EU) 2016/1628 (as amended)

8.2.2.7 Regulation (EU) 2016/1628 sets out pollutant emission limits for engines of different power ranges and applications for non-road mobile machinery (NRMM) with the aim of gradually reducing emissions and phasing out equipment with the most polluting engines.

[2] The Air Quality Standards Regulations 2010 https://www.legislation.gov.uk/uksi/2010/1001/contents/made, Last Assessed: 21 July 2025
[3] Environment Act 2021 https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted Last Assessed: 21 July 2025

Air Quality Standards

8.2.2.8 The protection of sensitive human receptors is regulated through the following:

- Air Quality Standards (AQSs) imposed in UK law transposed from EU standards[4]; and
- Environmental Assessment Levels set out by the Environment Agency[5].

8.2.2.9 AQSs relevant to this assessment are set out in **Table 8.1**.

8.2.2.10 The protection of sensitive ecological receptors is regulated through the following:

- AQSs imposed in UK law transposed from EU standards; and
- Targets for protected conservation areas are set out by the Environment Agency.

8.2.2.11 Air quality impacts on ecology are not anticipated, and therefore site-specific Critical Loads have not yet been identified in the PEIR but will be considered if it becomes necessary.

TABLE 8.1 – AIR QUALITY STANDARDS

Pollutant	Averaging Period	Assessment Criterion (µg/m^3)
Human Health (Air Quality Standard)		
PM_{10}	Annual mean	40
	24-hour mean (not to be exceeded more than 35 times per year)	50
$PM_{2.5}$	Annual mean	20
NO_2	Annual mean	40
	1-hour mean (not to be exceeded more than 18 times per year)	200
Ecological Receptors (Critical Level)		
NO_x	Annual Mean	30
	Daily Mean	75/200*

[4] Defra (2025) National air quality objectives and European Directive limit and target values for the protection of human health Available at; Air_Quality_Objectives_Update_20230403.pdf Accessed: 22/07/25

[5] Environment Agency (2016). Air emissions risk assessment for your environmental permit. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit Last Accessed: 17/07/25

Pollutant	Averaging Period	Assessment Criterion (µg/m³)
*The EA H1 guidance for air emissions risk assessments for environmental permits advises that for detailed assessments where ozone is below the AOT40 critical level and sulphur dioxide is below the lower critical level of 10 µg/m³, a higher AQS of 200 µg/m³ should be used compared to the recommended 75 µg/m³.		

8.2.3 NATIONAL POLICY

Air Quality Strategy: Framework for Local Authority Delivery (2023)

8.2.3.1 This Strategy sets out a framework to enable local authorities to deliver for their communities and contribute to England's long-term air quality goals, including the new targets for fine particulate matter ($PM_{2.5}$). It fulfils the statutory requirement of the Environment Act 1995 as amended by the Environment Act 2021 to publish an Air Quality Strategy setting out air quality standards, objectives, and measures for improving ambient air quality every 5 years.

National Policy Statements (2023)

8.2.3.2 The energy National Policy Statements (NPSs), EN-1–EN-6, outline the government's policy for delivering major energy infrastructure. The NPSs that are of relevance to the Proposed Development are:

- The Overarching NPS for Energy (EN-1) (2023): Details of specific policies within EN-1 and EN-4 that are considered relevant to air quality are set out in **Table 8.2**, below.

TABLE 8.2 – DESCRIPTION OF WHERE THE ASSESSMENT MEETS THE REQUIREMENTS OF NPSS EN-1 AND EN-4

Requirement of NPS	Consideration within Chapter
EN-1, paragraph 5.2.1 states: "*Energy infrastructure development can have adverse effects on air quality. The construction, operation and decommissioning phases can involve emissions to air which could lead to adverse impacts on health, on protected species and habitats, or on the wider countryside and species. Air emissions include particulate matter (for example dust) up to a diameter of ten microns (PM_{10}) and up to a diameter of 2.5 microns ($PM_{2.5}$) as well as gases such as sulphur dioxide, carbon monoxide and nitrogen oxides (NO_x).*"	Gaseous emissions associated with Proposed Development's construction, operation and maintenance, and decommissioning have been assessed in Section 8.8.
EN-1, paragraph 5.2.2 and 5.2.3 states: "*Legal limits for pollutants in ambient air are set out in the Air Quality Standards Regulations 2010 and for England, national objectives set out in the Air Quality (England) Regulations 2000 reiterated in the Air Quality Strategy, or for Wales, the Air Quality (Wales) Regulations 2000 and the Clean Air Plan for Wales. In addition, two fine particulate matter ($PM_{2.5}$) targets were set under the Environment Act 2021 for England – an annual mean concentration target and a population exposure target. Internationally agreed emissions commitments are set in the National Emission Ceilings Regulations 2018 and establish limits for total UK emissions of key pollutants.* *For many air pollutants there is not a threshold below which there is no health impact so it is important that energy infrastructure schemes consider not just how a scheme may impact statutory air quality limits, objectives or targets but also measures to mitigate all emissions in order to minimise human exposure to air pollution, especially for those who are more susceptible to the impacts of poor air quality.*"	Air Quality Standards relevant to the Proposed Development are outlined in **Table 8.1**.

Requirement of NPS	Consideration within Chapter
EN-1, paragraph 5.2.4 states: "*In addition, a particular effect of air emissions from some energy infrastructure may be eutrophication, which is the excessive enrichment of nutrients in the environment. Eutrophication from air pollution results mainly from emissions of NO_x and ammonia. The main emissions from energy infrastructure are from generating stations. Eutrophication can affect plant growth and functioning, altering the competitive balance of species and thereby damaging biodiversity. In aquatic ecosystems it can cause changes to algal composition and lead to algal blooms, which remove oxygen from the water, adversely affecting plants and fish. The effects on ecosystems can be short term or irreversible and can have a large impact on ecosystem services such as pollination, aesthetic services and water supply.*"	Due to the nature of the Proposed Development, NO_x emissions and by association any potential for eutrophication is expected only from emergency flaring emissions and construction traffic emissions. The emergency flaring emissions have been assessed in Section 8.8. Eutrophication is a long-term effect. Since emergency flaring is a non-routine event, only short-term impacts are assessed and any contributions to eutrophication are scoped out of further assessment. Construction traffic emissions are also considered in Section 8.8.
EN-1, paragraph 5.2.7 states: "*Proximity to emission sources can have significant impacts on sensitive receptor sites for air quality, such as education or healthcare sites, residential use or sensitive or protected ecosystems. Projects near a sensitive receptor site for air quality should only be proposed in exceptional circumstances if no viable alternative site is available. In these instances, substantial mitigation of any expected emissions will be required".*	The only relevant emission source associated with the Proposed Development is the emergency flare. Emergency flaring emissions have been assessed in Section 8.8, with due consideration of both sensitive human receptors and habitats.
EN-1, paragraph 5.2.8 states: "*Where the project is likely to have adverse effects on air quality the applicant should undertake an assessment of the impacts of the proposed project as part of the ES.".*	Impacts on air quality are assessed in Section 8.8 and will be considered further in the ES.

Requirement of NPS	Consideration within Chapter
EN-1, paragraph 5.2.9 states: "*The ES should describe:* • *existing air quality concentrations and the relative change in air quality from existing levels;* • *any significant air quality effects, mitigation action taken and any residual effects, distinguishing between the project stages and taking account of any significant emissions from any road traffic generated by the project.".* • *the predicted absolute emissions, concentration change and absolute concentrations as a result of the proposed project, after mitigation methods have been applied; and* • *any potential eutrophication impacts*	Existing air quality levels are presented in Section8.6. The relative change in air quality due to the Proposed Development is presented in Section 8.8. Mitigation measures are described in Section 8.7. Air quality impacts are assessed in Section 8.9 Due to the nature of the project NOx emissions and by association possible eutrophication is expected only from emergency flaring emissions and construction traffic emissions. The emergency flaring emissions have been assessed in Section 8.8.1. Eutrophication is a long-term effect. As emergency flaring is a non-routine event, only short-term impacts are assessed and any contributions to eutrophication are scoped out. Construction traffic emissions are also considered in Section 8.8.
EN-1, paragraph 5.2.11 states: "*Defra publishes future national projections of air quality based on estimates of future levels of emissions, traffic, and vehicle fleet. Projections are updated as the evidence base changes and the applicant should ensure these are current at the point of an application. The applicant's assessment should be consistent with this but may include more detailed modelling and*	As a worst case, existing rather than future air quality levels are presented in Section 8.6.3, the relative change in air quality due to the Proposed Development are presented in Section 8.8

Requirement of NPS	Consideration within Chapter
evaluation to demonstrate local and national impacts. If an applicant believes they have robust additional supporting evidence, to the extent they could affect the conclusions of the assessment, they should include this in their representations to the Examining Authority along with the source".	
EN-1, paragraph 5.2.12 states: "*Where a proposed development is likely to lead to a breach of any relevant statutory air quality limits, objectives or targets, or affect the ability of a noncompliant area to achieve compliance within the timescales set out in the most recent relevant air quality plan/strategy at the time of the decision, the applicant should work with the relevant authorities to secure appropriate mitigation measures to ensure that those statutory limits, objectives or targets are not breached.".*	This is considered in the programme design, through mitigation committed to by the Applicant and by following applicable guidance as mentioned in Section 8.2.5 and is unlikely to breach any standards.
EN-1, paragraph 5.2.13 states: "*The Secretary of State should consider whether mitigation measures are needed both for operational and construction emissions over and above any which may form part of the project application. A construction management plan may help codify mitigation at this stage. In doing so the Secretary of State should have regard to the Air Quality Strategy in England, or the Clean Air Plan for Wales in Wales, or any successors to these and should consider relevant advice within Local Air Quality Management guidance and $PM_{2.5}$ targets guidance".*	Where effects are potentially significant mitigation measures are provided as described in Section 8.7 and in the CEMP.
EN-1, paragraph 5.2.14 states: "*The mitigations identified in Section 5.14 on traffic and transport impacts will help mitigate the effects of air emissions from transport."*	Mitigation measures are described in Section 8.7.

Requirement of NPS	Consideration within Chapter
EN-4, paragraph 2.9.22 states: "*The most significant emissions are likely to come from gas reception facilities where flaring of gas is used to deal with a continuous stream of low volume waste gas from the processing. There may also be emissions from underground gas storage"* and **EN-4, paragraph 2.9.24** states: "*The ES should include an assessment of the effects of gas emissions on air quality in accordance with Section 5.2 of EN-1 and on greenhouse gas emissions in accordance with Section 5.3 of EN-1.".*	Air quality impacts are assessed in Section 8.8, in accordance with Section 5.2 of EN-1, as detailed in the rows above. Greenhouse gas emissions are considered in **Chapter 17, Climate Change and Greenhouse Gas Emissions**.

The National Planning Policy Framework (NPPF) (2023)

8.2.3.3 The National Planning Policy Framework (NPPF), last updated in December 2023, sets out the Government's planning policies for England, and how they are expected to be applied.

8.2.3.4 Chapter 15 para 180 of the NPPF notes that planning decisions should be made to:

> *"Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans …"*

8.2.3.5 In dealing specifically with air quality, the NPPF states, para 184, that:

> *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

8.2.4 LOCAL PLANNING POLICY

Cheshire West and Chester Council

8.2.4.2 Most of the Site Boundary is within the Borough of Cheshire West and Chester. The Proposed Development is not located within an AQMA. Cheshire West and Chester Council has four AQMAs in the borough. In three areas (Chester, Ellesmere Port and Frodsham) the main source of air emissions is NO_2 from road traffic. In Thornton-le-Moors the main pollutant of interest is SO_2 from industrial sources.

8.2.4.3 The council's priorities to reduce air emissions include;

- The appointment by October of a delivery partner(s) for the roll out of public electric vehicle charging infrastructure and subsequent commencement of a borough wide public electric vehicle charging infrastructure installation programme in late Autumn 2024.
- The continued conversion of the Council transport fleet to Ultra Low Emission Vehicles in accordance with the Replacement Programme and the appointment of a delivery partner(s) for the roll out of electric vehicle charging infrastructure across private Council offices and depot sites.
- Progressing the development of the new Local Transport Plan (LTP4)[6].

8.2.5 GUIDANCE

8.2.5.1 This assessment references several pieces of guidance and methodology relevant to both. The Air Quality Impact Assessment (AQIA) has been undertaken with reference to applicable guidance documents (**Table 8.3**).

TABLE 8.3 – AIR QUALITY GUIDANCE

Guidance	Reference	Relevance	Geographic Coverage
Air emissions risk assessment for your environmental permit	Environment Agency (accessed May 2024)[7]	Provides guidance on assessing air quality impacts within the framework of a permit application.	England
Environmental permitting: air dispersion modelling reports	Environment Agency (accessed May 2024)[8]	States specifics that need to be considered in a dispersion modelling report.	England
Guidance on the assessment of the air quality effects of development on designated nature conservation sites prepared by the Institute of Air	IAQM, 2020[9]	Provides guidance with regards to air quality impacts on designated nature conservation sites.	UK

[6] Local Transport Plan – have your say | Cheshire West and Chester Council
[7] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[8] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports#estimate-model-uncertainty
[9] air-quality-impacts-on-nature-sites-2020.pdf (iaqm.co.uk)

Guidance	Reference	Relevance	Geographic Coverage
Quality Management			
Guidance on land-use planning and development control: Planning for air quality v1.2	IAQM, 2017[10]	Provides guidance with regards to assessing air quality impacts from traffic.	UK

8.3 CONSULTATION

8.3.1 EIA SCOPING

8.3.1.1 A request for a formal EIA Scoping Opinion was submitted on 22 April 2025 (**Appendix 1A, EIA Scoping Report**); a Scoping Opinion from the Planning Inspectorate was received on 5 June 2025 (included as **Appendix 1B, EIA Scoping Opinion**).

8.3.1.2 The Planning Inspectorate and other statutory responses within the Scoping Opinion which are considered relevant to Air Quality are provided in **Table 8.4**, which also sets out how and where they have been addressed in this chapter.

[10] air-quality-planning-guidance.pdf (iaqm.co.uk)

TABLE 8.4 – SCOPING OPINION

Issue	Planning Inspectorate Comments	Response/Action	Reference within this document
Construction Dust - associated with dust raising activities (earthworks, traffic on unpaved areas, construction works)	*"The Scoping Report states that the construction of the proposed development is unlikely to lead to new or different effects on air quality compared to the Consented Development, and that embedded mitigation would ensure that any dust impacts noted in the original ES for the Consented Development would be negligible or minor. The Inspectorate agrees that the proposed changes would not result in significantly different air quality impacts from those assessed in the original ES for the Consented Development and this matter can be scoped out of further assessment. However, the applicant's attention is also directed to the Defra advice (2024) '$PM_{2.5}$ Targets: Interim Planning Guidance'. The applicant should explain how $PM_{2.5}$ emissions have been considered in the updated ES."*	This comment has been addressed in Section 8.5 and Section 8.6.2.4.	This has been scoped out with no further assessment
Decommissioning activities	*"It is not entirely clear to the Inspectorate what specific matter relating to air quality and decommissioning is being scoped out in this row of Table C.1; however, given that decommissioning related traffic effects are described below and reference to embedded mitigation such as compliance with Institute of Air Quality Management (IAQM) guidance, it is assumed this is*	This comment has been addressed in Section 8.5.	This has been scoped out with no further assessment

Issue	Planning Inspectorate Comments	Response/Action	Reference within this document
	referring to dust emissions. Decommissioning activities are stated in Table C.1 to be generally the reverse of the construction sequence, involving similar types of equipment, and to be scoped out. On this basis, the Inspectorate agrees that the proposed changes would not result in significantly different air quality impacts from those assessed in the original ES for the Consented Development. Decommissioning phase dust emissions can be scoped out of the further assessment."		
Emissions from construction, operation, and decommissioning related traffic (including emissions of dust and exhaust gases)	*"These matters are proposed to be scoped out of further assessment on the basis that traffic associated with the construction, operation and decommissioning of the proposed development would be the same as the Consented Development and would have minimal anticipated impact on the local air quality. The Inspectorate agrees on the basis that the changes to the proposed development would remain below the threshold of significance in line with relevant guidance, that emissions from construction, operation, and decommissioning traffic can be scoped out of further assessment."*	This comment has been addressed in Section 8.5	This has been scoped out with no further assessment

8.3.2 OTHER CONSULTATION

8.3.2.1 No other consultation has taken place to date.

8.4 BASIS OF THE ASSESSMENT

8.4.1.1 **Chapter 2, Proposed Development Description** presents a summary of the currently available design information for the Proposed Development, and this has been used to inform this assessment.

8.4.1.2 Details regarding the proposed flare design are outlined in **Table 8.5**.

8.5 ASSESSMENT METHODOLOGY

8.5.1 SCOPE OF ASSESSMENT

8.5.1.1 Potential impacts on air quality as a result of the Proposed Development comprise:

- Emergency and maintenance flaring during operation.

8.5.1.2 The assumption at this stage of the Proposed Development is that there will be no routine combustion activities on-site during operation which will mean there is a reduction in CO_2 and NO_x emissions from the Consented Development.

8.5.1.3 As process heating will be achieved via electric heaters for the Proposed Development this will also prove beneficial from an air quality perspective and reduce the significance of effects reported in the Consented Development ES.

8.5.1.4 From the perspective of air quality, any venting of hydrogen is not a consideration as hydrogen is essentially non-toxic at ambient concentrations[11]. Fugitive emissions are covered in **Chapter 17, Climate Change and Greenhouse Gas Emissions.**

8.5.2 ELEMENTS SCOPED OUT OF ASSESSMENT

8.5.2.1 See Section 8.5.3.

8.5.3 CONSTRUCTION DUST & TRAFFIC

8.5.3.1 An assessment was conducted in the Consented Development ES. Impacts noted in the Consented Development ES would be negligible or minor with the implementation of adequate mitigation measures.

8.5.3.2 The construction of the proposed development is unlikely to lead to new or different effects on air quality compared to the Consented Development under the condition that mitigation as identified for the Consented Development is implemented (see Section 8.7). This is

[11] https://www.energy.gov/eere/fuelcells/safe-use-hydrogen#:~:text=A%20number%20of%20hydrogen%27s%20properties,in%20case%20of%20a%20leak. Last Assessed: 21 July 2025

further reinforced by the confirmation that there will be no changes in construction traffic flows for the Proposed Development.

8.5.4 EMERGENCY AND MAINTENANCE FLARING

8.5.4.1 The Proposed Development will be equipped with two flares, an elevated flare and an enclosed ground flare (EGF) which will combust hydrogen at the flare tips, for the safe disposal of hydrogen during unplanned events or maintenance.

8.5.4.2 Combustion of hydrogen in air will produce emissions of nitrogen oxides (NO_x) and by association nitrogen dioxide (NO_2) which can have negative effects on human health and ecological receptors.

8.5.4.3 The details of the proposed flare design or capacity are available and outlined in **Table 8.5**, and **Chapter 2, Proposed Development Description**. The design of the flaring system will be such that it is capable of safely disposing of hydrogen without resulting in unacceptable impacts on air quality.

TABLE 8.5 – FLARE EMISSION PARAMETERS

Flare Design	Elevated Flare	EGF	EGF pilot
Internal diameter (m)	1.6 (flare tip)	5 (ground flare enclosure)	0.015 (pilot nozzle, assumption)
Emission height (m)	50 (flare tip)	15 (ground flare enclosure)	5 (pilot nozzle, assumption)
Total gas flow rate (Sm^3/s, at 293K)	352	2.34	0.0336
Maximum volume released per event (Sm^3, at 293K)	~633000	~1012900	~1058200
Number of events per year	Less than once per year,	Up to 15 per year	continuous
Duration of event	max. 30 min	max. 8 h	continuous
Composition of feed gas	H_2: 99.5%-vol H_2S: <28 ppmv Non-combustibles (N_2, H_2O, CO_2, etc): <0.5%-vol		
Max. NO_x emission rate (g/s)	Hourly basis: 62.1 Daily basis: 2.59 Annual basis: 0.0071	Hourly basis: 0.828 Daily basis: 0.276 Annual basis: 0.0113	Hourly basis: 0.0118 Daily basis: 0.0118 Annual basis: 0.0118

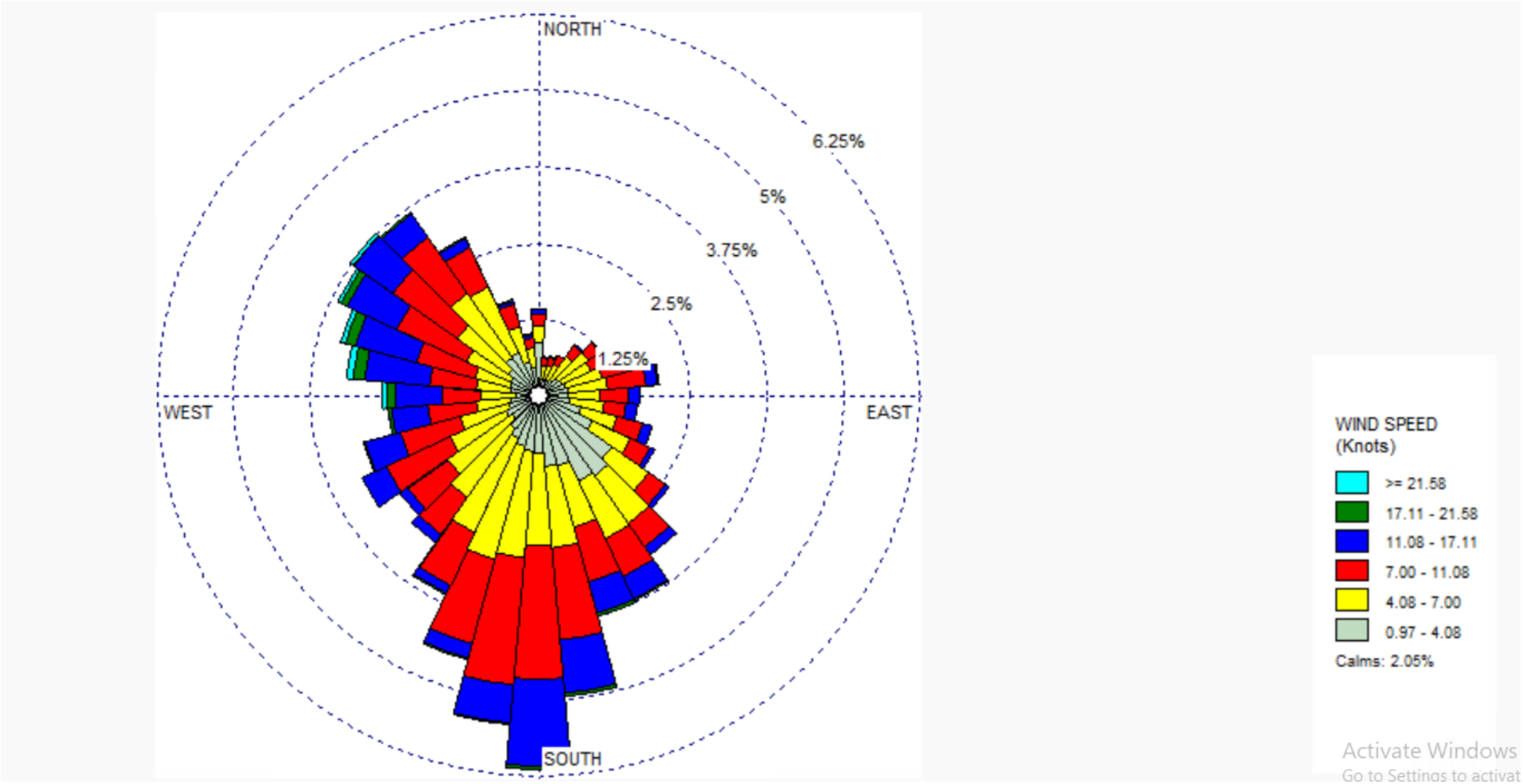
8.5.4.4 The AQIA utilises detailed dispersion modelling to predict the potential impacts on air quality as a result of emissions from the flare. The model Aermod View 13.0.0[12] has been used to assess these emissions. The results of the model are used to provide a comprehensive understanding of air quality impacts at sensitive receptors and whether these could lead to a significant effect. The input parameters used in the assessment of the model are identified in **Table 8.5** and **Table 8.6**.

TABLE 8.6 – MODEL APPROACH AND PARAMETERS

Parameter	Approach	Notes
Dispersion model	Aermod View 13.0.0	
Model Domain	10 km x 10 km	Multi-tier grid
Receptor Grid resolution	20 m (0-2.5 km) 100 m (2.5-10 km)	The assessment considers both sensitive human receptors and habitats
Buildings	Not included	No buildings within exclusion zone
Terrain	Not required	There are no sustained gradients of >1:10 in the vicinity of the Site and therefore terrain was not included
Meteorological Data	5 years, 2020-2024, from Rostherne with missing data taken from Manchester	Hourly-sequential data.
Surface Characteristics	Surface roughness: 0.072 m Bowen Ratio: 0.75 Albedo: 0.28-1.00	Representative of mixed industrial and agricultural land use

[12] AERMOD Modeling System - A steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD is an industry-recognised model in accordance with international guidelines and considers information on the emission points, local meteorological data, and local land use characteristics and terrain. https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod

FIGURE 8.1 – WIND ROSE 2020-2024



8.5.4.5 As flaring is typically a short-term event (be it during an emergency or during planned maintenance), only short-term impacts are considered.

8.5.4.6 The IAQM planning guidance[13] sets out descriptors for evaluating a predicted impact at individual human receptor locations; these criteria are presented in **Table 8.7**. These criteria have been used for assessing impacts of emissions of the flares. The potential significance of the modelled emissions from the Site are assessed by comparison with applicable standards on the basis of the:

- Process Contribution (PC); and
- Modelled Environmental Concentration (PEC), the PEC being the Process Contribution (PC) added to the baseline.

TABLE 8.7 – IMPACT DESCRIPTOR

	% Change in Concentration relative to Air Quality Assessment Level (AQAL)			
Short Term PC	**<10%**	**10-20%**	**20-50%**	**>50%**
(not dependent on baseline)	Negligible	Minor	Moderate	Substantial

8.5.5 STUDY AREA

8.5.5.1 The key sensitive ecological receptors within 10 km of the Proposed Development include Little Budworth Common SSSI, Oak Mere SSSI, Plumley Lime Beds SSSI, Witton Lime Beds SSSI, Pettypool Brook Valley SSSI, Wimboldsley Wood SSSI, Tabley Mere SSSI, Sandbach Flashes SSSI, Abbots Moss SSSI, and Wettenhall and Darnhall Woods SSSI.

8.5.5.2 The nearest air quality sensitive receptors to the Proposed Development include the various farms within the project development as well as the nearby residential properties (see **Figure 8.2**).

[13] https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

Site Boundary
Site Bounday 10km Buffer
Human Receptors
Hospital
Kindergarten
School
Residential

0 0.51 1.02 1.53 2.04 2.55
Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: YV
DATE: 10/09/2025	APPROVED:

Figure 8.2
Nearest Human Receptors

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PROJECTION: British National Grid

Path: \\UKSPRDGISFS01\Data\London\Projects\0755727 - Keuper Hydrogen\Map\0755727 - Keuper Hydrogen - PEIR.aprx\0755727 - PEIR - C8 - Nearest Human Receptors - A01

8.5.6 BASELINE SURVEY METHODOLOGY

8.5.6.1 A desk study was undertaken to obtain an understanding of the baseline air quality conditions in the Study Area, and to determine if any AQMAs are within or adjacent to the Study Area.

8.6 BASELINE

8.6.1 BASELINE DATA SOURCES

8.6.1.1 The baseline has been derived from publicly available sources. The available baseline information has been considered to derive a single value for each pollutant to be used in the assessment. These are shown in Section 8.6.2.3 and 8.6.2.4.

8.6.1.2 The short-term average has been derived from multiplying the long-term background by two, as per Environment Agency guidance[14].

8.6.1.3 Estimated Background Air Pollution Maps (base year 2018) have been used to inform current and future local baseline levels[15].

8.6.2 EXISTING BASELINE CONDITIONS

8.6.2.1 The Councils of Cheshire West and Chester, along with Cheshire East, conduct air quality monitoring using diffusion tubes and automatic monitoring stations. These systems monitor the following pollutants $PM_{2.5}$, PM_{10}, NO_2, SO_2[16].

8.6.2.2 The Proposed Development is not located within an Air Quality Management Area (AQMA)[17]. Cheshire West and Chester Council has four AQMAs in the borough. In three areas (Chester, Ellesmere Port and Frodsham) the main source of air emissions is NO_2 from road traffic. In Thornton-le-Moors the main pollutant of interest is SO_2 from industrial sources.

8.6.2.3 UK DEFRA 2023 background maps for the Site Boundary show:

- Annual mean PM_{10} levels below 13 µg/m^3 (UK air quality standard is 40 µg/m^3);
- Annual mean NO_x levels below 10 µg/m^3 (UK air quality standard is 30 µg/m^3);
- Annual mean NO_2 levels below 10 µg/m^3 (UK air quality standard is 40 µg/m^3); and
- Dust baseline is not monitored, but similar to PM is expected to be well below nuisance thresholds.

8.6.2.4 The closest automatic monitoring location to the Site is Middlewich, which is approximately 5 km from the Proposed Development. The

[14] Air emissions risk assessment for your environmental permit - GOV.UK, Last Accessed in 18 July 2025
[15] Background Mapping data for local authorities - DEFRA UK Air - GOV.UK, Last Accessed in 18 July 2025
[16] Air quality annual status report 2024
[17] Air quality annual status report 2024

pollutant monitored in Middlewich is $PM_{2.5}$ and monitoring started on the 13 of November 2024[18].

- Annual mean $PM_{2.5}$ levels are about 8.18 µg/m^3 (UK air quality standard is 20 µg/m^3).
- There are no AQMAs in close proximity to the Site. The nearest sensitive receptors include schools, hospitals, and residential properties. Dust generation during the construction phase of the project is expected to be short-term. With the application of suitable mitigation measures the impacts on these sensitive receptors is anticipated to be negligible. Therefore, no significant changes in $PM_{2.5}$ concentrations are expected.

8.6.3 FUTURE BASELINE CONDITIONS

8.6.3.1 Baseline air quality conditions within the Study Area are expected to remain unchanged or slightly improve in the future; background pollutant concentrations are expected to decrease, for reasons such as changes/ advancements in technology and expected reductions in vehicle emissions. As such, current background concentrations (i.e. the existing baseline conditions) are considered to be the worst-case.

8.7 MITIGATION

8.7.1 OVERVIEW

8.7.1.1 The Proposed Development is committed to the implementation of measures to mitigate impacts that could lead to significant effects in relation to air quality. This includes mitigation that is integral to the design of the Proposed Development, including for legislative compliance, as well as good practice mitigation measures that the Proposed Development is committed to adopting during, operation and maintenance, and decommissioning (for further general context see Section 5.4.2, **Chapter 4, EIA Methodology and Consultation**).

8.7.1.2 The following subsections describe the mitigation measures for each phase of the Proposed Development and the mechanisms for securing these measures.

8.7.1.3 The significance of the effects reported in Section 8.8 takes into account adoption of these measures in full.

8.7.2 CONSTRUCTION

8.7.2.1 As stated in Paragraph 8.5.3, the construction of the Proposed Development is unlikely to lead to new or different effects on air quality compared to the Consented Development under the condition that mitigation as identified for the Consented Development is

[18] Automatic Urban and Rural Network (AURN) - DEFRA UK Air - GOV.UK

implemented. In the following paragraphs these mitigation measures are re-iterated.

8.7.2.2 In advance of construction, an updated Construction Environmental Management Plan (CEMP) will be prepared by the relevant contractors for approval by Cheshire West and Chester Council, with input as necessary from relevant statutory bodies.

8.7.2.3 The CEMP for the Consented Development included an Air Quality Management Plan which will be updated for the Proposed Development to incorporate the changes to the Site infrastructure as part of the Material Change.

8.7.2.4 The CEMPs will reflect any conditions, requirements and obligations including those set out in the draft DCO amendment order submitted as part of the Application. The construction contractors and all subcontractors will be required to comply with the measures and procedures contained in the updated CEMP. An updated CEMP which provides the framework and required content for the detailed CEMPs will be produced and an Updated Outline CEMP will be produced for the ES.

8.7.2.5 With regard to air quality, the CEMP is expected to include a Dust Management Plan (DMP) and / or Air Quality Management Plan (AQMP), which will detail mitigation measures derived from IAQM guidance. The mitigation measures proposed for air quality during construction are consistent with the Consented Development ES in Section 10.6 and with the Consented Development CEMP.

8.7.3 OPERATION AND MAINTENANCE

8.7.3.1 During operation and maintenance of the Proposed Development, all rotating and packaged equipment will be electrically driven. There will be no on-site power generation using combustion technology. Process heating will be achieved via electric heaters. Heating, cooling, or steam to support utility systems will be electrically generated. Therefore, this will reduce CO_x and NO_x emissions from the Consented Development and no mitigation is required for routine combustion sources.

8.7.3.2 As noted in Paragraph 8.4.1.2, a flare system consisting of an elevated flare and enclosed ground flare (EGF) will be installed on-site. The system, as noted, will be sufficient to safely dispose of excess hydrogen, including avoiding unacceptable impacts on air quality.

8.7.3.3 As noted in Paragraph 8.8, modelled impacts from flaring are negligible, hence no further mitigation is considered necessary.

8.7.4 DECOMMISSIONING

8.7.4.1 As stated at Section 8.5, in the context of air quality, no aspects of decommissioning of the Proposed Development are anticipated to be

materially different to those previously assessed through the Consented Development. The significance of effects are anticipated to be no more than reported for construction and activities will involve similar types and numbers of vehicles and equipment. The impacts from these activities will be mitigated in line with relevant IAQM guidance and mitigation measures will be included in a Decommissioning Environmental Management Plan (DEMP).

8.7.4.2 A Decommissioning Plan including a DEMP will be prepared at the cessation of operations at the Site, in line with relevant legislation at that time. The DEMP will outline the potential environmental effects associated with decommissioning and site closure/ restoration, and detail appropriate management and mitigation measures.

8.8 ASSESSMENT OF EFFECTS

8.8.1 OPERATION AND MAINTENANCE

Flaring

8.8.1.2 As noted in Section 8.5, there will be no routine emissions to air resulting from the operation of the Proposed Development, only maintenance and emergency flaring.

8.8.1.3 Flaring emissions (see **Table 8.5**) were modelled using AERMOD (see **Table 8.6**). Flare emissions were calculated using the Alberta Environmental Sustainable Resource Development (ESRD) method, based on feed gas composition (see **Table 8.5**). SO_2 emissions were deemed negligible based on the feed gas composition and therefore not assessed. Feed gas flow rate and temperature were also considered in the calculations.

8.8.1.4 The results of this model for the maximum off-site concentration as shown in **Table 8.8**. As flaring is a non-routine event, only short-term impacts are assessed against the relevant 1-hour standard for human health and 24-hour standard for ecology.

TABLE 8.8 – MODEL RESULTS FLARING

Parameter	Averaging period	AQS	Baseline	PC	PEC	PC	PEC	Magnitude
		µg/m^3	µg/m^3	µg/m^3	µg/m^3	%AQS	%AQS	-
NO_2 (Human)	1-hour*	200	20	3.41	23.4	1.7%	12%	Negligible at nearest sensitive receptors (see contour plots)
NO_x (Ecology)	24-hmax	200	20	1.06	21.1	0.53%	11%	Unlikely to make a significant contribution and no further assessment required.
*not to be exceeded more than 18 times a year								

NO_2 Hourly Process Contribution

8.8.1.5 **Figure 8.3** presents a contour plot for the hourly PC of NO_2. As can be seen from this plot, impacts are predicted to be Negligible (PC <10%, green on **Figure 8.3**) anywhere outside the fenceline of the Proposed Development.

NO_2 24 hour Process Contribution

8.8.1.6 **Figure 8.4** presents a contour plot for the 24-hour PC of NO_x. As can be seen from this plot, impacts (PC <10%, green on **Figure 8.4**) are unlikely to make a significant contribution at any protected habitat.

Summary of Potential flaring impacts

8.8.1.7 Based on the above, and the fact that flaring will be a non-routine activity, the effects on human receptors of the Proposed Development from maintenance and emergency flaring are considered to be **Negligible (Not Significant)** and there is no need for further assessment.

Site Boundary
Site Bounday 10km Buffer
Special Areas Of Conservation
Sites of Special Scientific Interest_Ply

NO_2 Hourly 19 Highest (µg/m^3)

< 20
< 40
< 100
> 100

Note:
AQS 200 µg/m^3
Baseline 20 µg/m^3

0 0.5 1 1.5 2 2.5
Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: YV
DATE: 10/09/2025	APPROVED:

Figure 8.3
NO_2 Hourly Process Contribution

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Site Boundary
Site Bounday 10km Buffer
Special Areas Of Conservation
Sites of Special Scientific Interest_Ply

NO_x 24 Hour Maximum ($\mu g/m^3$)

< 7.5
< 15
< 75
> 75

Note:
AQS 75 $\mu g/m^3$
Baseline 20 $\mu g/m^3$

0 0.5 1 1.5 2 2.5
Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A3	DRAWN: MC
PROJECT: 0755727	CHECKED: YV
DATE: 10/09/2025	APPROVED:

Figure 8.4
NO_x 24-hour Process Contribution

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8.9 SUMMARY OF INDIRECT EFFECTS

8.9.1.1 There are no indirect effects associated with air quality as a result of the Proposed Development.

8.10 SUMMARY OF CUMULATIVE EFFECTS

8.10.1.1 The cumulative effects of impacts from the Proposed Development together with impacts from other planned projects or developments on the same resources and/or receptors are assessed in **Chapter 18, Cumulative Effects Assessment**.

8.10.1.2 The ES will summarise the conclusions of the Cumulative Effects Assessment (CEA) that are relevant to air quality.

8.11 SUMMARY AND CONCLUSIONS

8.11.1.1 As stated at Section 8.5.1, potential impacts on air quality as a result of the Proposed Development comprise:

- Emergency and maintenance flaring during operation and maintenance.

8.11.1.2 The assessment concludes the following:

- Operation and maintenance effects due to flaring on sensitive human and ecological receptors are predicted to be Negligible (Not Significant) and therefore no further mitigation is required.

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AERMOD Modeling System - A steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD is an industry-recognised model in accordance with international guidelines and considers information on the emission points, local meteorological data, and local land use characteristics and terrain.

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