The Keadby 3 Low Carbon Gas Power Station Project

PINS Ref: EN010114

The Keadby 3 Low-Carbon Gas Power Station Order

Land at and in the vicinity of the Keadby Power Station site, Trentside, Keadby, North Lincolnshire

Preliminary Environmental Information (PEI) Report Volume II - Appendix 8A: Air Quality – Construction Phase

The Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Applicant: SSE Generation Limited

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1.0 INTRODUCTION

1.1 Overview

1.1.1 This Technical Appendix supplements **Chapter 8**: Air Quality, Dust and Odour (PEI Volume I) and describes the additional details for the construction dust assessment, and dispersion modelling of road traffic emissions from the Proposed Development during the construction phase.

1.1.2 Emissions to air from the Proposed Development have the potential to adversely affect human health and sensitive ecosystems. This Technical Appendix identifies and proposes measures to address the potential impacts and effects of the Proposed Development on air quality during enabling works, construction (including enabling works), commissioning, and decommissioning. Emissions associated with the construction phase could give rise to potential localised air quality effects from traffic and dust generation, which have the potential to affect human health and sensitive ecosystems and, if not appropriately managed.

1.1.3 Emissions to air from the Proposed Development during operation, comprising emissions from the combustion plant and the carbon capture plant and additional operational road traffic, are covered in **Appendix 8B** – Operational Assessment (PEI Report Volume II).

1.1.4 The magnitude of air quality impacts at sensitive human receptors has been quantified for pollutants emitted from construction activities associated with the Proposed Development. The impact of emissions on sensitive ecological receptors has been considered in the context of relevant critical loads or critical levels for designated nature sites.

2.0 SCOPE

2.1 Construction phase emissions

2.1.1 The assessment has considered the impact of emissions during the construction, commissioning, and decommissioning of the Proposed Development on local air quality. The assessment considers impacts from the year in which the construction works for the Proposed Development are anticipated to be at a maximum, 2031.

2.1.2 The assessment comprises a review of the impacts of dust emissions from the various activities associated with the construction phase of the Proposed Development during planned construction works on site and the impacts associated with the emissions from construction traffic. Impacts on sensitive human and ecological receptors in the vicinity of the Proposed Development have been assessed.

Cumulative impacts

2.1.3 Cumulative impacts from existing sources of pollution in the area are accounted for in the adoption of site-specific background pollutant concentrations from archived and published sources. It is recognised, however, that there is a potential impact on local air quality from emission sources which were not present at the time of the survey.

2.1.4 The full list of short-listed cumulative schemes to be considered for the Proposed Development will not be available until the stage where final Environmental Statement (ES) is being produced, as detailed within **Chapter 19:** Cumulative and Combined Effects (PEI Report Volume I). The assessment for the final ES will therefore consider these schemes where relevant.

2.1.5 The purpose of the construction dust assessment is to determine the potential risk of dust impacts occurring at sensitive receptors due to construction related activities. Furthermore, the assessment is undertaken in order to identify the scale of mitigation and control measures required to avoid such potential impacts, and to ensure that there will be no significant impacts at sensitive receptors beyond the Proposed Development Site boundary. These measures are then secured within the Construction and Environmental Management Plan (CEMP); full details on the CEMP are provided within **Chapter 5:** Construction Programme and Management (PEI Report Volume I)

2.1.6 Other schemes within the vicinity of the Proposed Development are required to ensure that there will be no significant effects on sensitive receptors due to their own construction related activities, with mitigation and control measures secured in a similar manner.

2.1.7 There is therefore no formal assessment of cumulative impacts arising from construction dust as part of this PEI Report.

2.1.8 The traffic data used in this assessment includes predicted traffic growth on modelled roads between the current baseline and the future year baselines. The methodology to determine the growth in traffic on the local road network is described in **Chapter 10:** Traffic and Transportation (PEI Report Volume I). The predicted growth included in the traffic data ensures that the air quality assessment of road traffic emissions is inherently cumulative.

2.1.9 There is therefore no separate assessment of cumulative impacts of construction traffic as part of this PEI Report.

Sources of information

2.1.10 The information that has been used within this assessment includes:

- Details on the site layout provided by the Applicant;
- Ordnance Survey mapping;
- Construction Traffic Data taken from **Chapter 10**: Traffic and Transportation (PEI Report Volume I); and,
- Baseline air quality data from project specific monitoring, published sources and Local Authorities.

3.0 METHODOLOGY

3.1 Overview

3.1.1 This section describes the approach that has been taken to the assessment of emissions associated with the construction phase of the Proposed Development. This is broken down into the following sub-sections:

- Qualitative assessment of construction dust; and
- Modelling of construction phase road traffic emissions on local roads.

3.1.2 Non-Road Mobile Machinery is considered within **Chapter 8:** Air Quality (PEI Report Volume I).

3.2 Construction dust assessment

3.2.1 The following three potential activities have been screened as potentially significant, based on the nature of construction activities proposed:

- Earthworks (soil stripping, spoil movement and stockpiling);
- Construction (including on-site concrete batching); and
- Trackout (HGV movements on unpaved roads and offsite mud on the highway).

3.2.2 At this preliminary stage, it is predicted that only minor site clearance works would be required as part of the Preliminary Works activities associated with the construction of the Proposed Development. For the purposes of this assessment, the closest assessment category is 'Demolition' and for this reason, that term is used throughout the remainder of the report and that activity is screened in.

3.2.3 Further details of anticipated constriction activities are available within **Chapter 5:** Construction Programme and Management (PEI Report Volume I).

Magnitude Definitions

3.2.4 The potential magnitude of dust emissions is categorised as detailed in Table 1.

Table 1: Example definitions of the magnitude of construction/ demolition activities

Magnitude	Demolition	Earthworks	Construction	Trackout
Large	Total building volume >50,000m^3, potentially dust construction material (e.g. concrete), on-site crushing and screening,	Site area >1ha potentially dusty soil type (e.g. clay). >10 heavy earth moving vehicles at once, bunds >8m high, total material moved	Total building volume >100,000 m^3, on-site concrete batching, sandblasting	>50 HDV (>3.5 tonne) peak outward movements per day, potentially dusty surface material (e.g. high clay

Magnitude	Demolition	Earthworks	Construction	Trackout
	demolition activities >20m above ground level	>100,000 tonnes		content), unpaved road length >100m
Medium	Total building volume 20,000 – 50,000 m^3, potentially dusty construction material, demolition activities 10 to 20 metres above ground level	Site area 0.25 – 1 ha, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles at once, bunds 4-8 metres high, total material moved 20,000 – 100,000 tonnes	Total building volume 25,000 – 100,000m^3, potentially dusty materials e.g. concrete, on-site concrete batching	10 – 50 HDV (>3.5 tonne) peak outward movements per day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 – 100 metres
Small	Total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 metres above ground level, demolition during wetter months	Site area <0.25 ha, large grain soil type (e.g. sand), <5 heavy earth moving vehicles at once, bunds <4 metres high, total material moved <20,000 tonnes	Total building volume <25,000m^3, low dust potential construction materials. e.g. metal/timber	<10 HDV (>3.5 tonnes) peak outward movements per day, surface material low dust potential, unpaved road length <50 metres

Receptor sensitivity definitions

3.2.5 The assessment of construction dust has been made with respect to the receptor and area sensitivity definitions as outlined in Table 2 to Table 5 below. Sensitivity definitions have been made with reference to the Institute of Air Quality Management (IAQM) guidance; receptors beyond 100m are defined as low sensitivity; ecological receptors (including statutory designations, and non-statutory ecological receptors of location importance such as county wildlife sites, national and local nature reserves) have been included as there are a number of ecological sites within the designated 50m screening distance.

Table 2: Receptor sensitivity to construction/ demolition dust effects

Potential dust effect	Human perception of dust soiling effects	PM_{10} Health effects	Ecological effects
High sensitivity	Enjoy a high level of amenity; appearance/ aesthetics/ value of property would be diminished by soiling; receptor expected to be present continuously/	Public present for 8 hours per day or more, e.g. residential, schools, car homes	Locations with an international or national designation and the designated features may be affected by dust soiling.
Moderate sensitivity	Enjoy a reasonable level of amenity; appearance/ aesthetics/ value of property could be diminished by soiling; receptor not expected to be present continuously/	Only workforce present (no residential or high sensitivity receptors) 8-hours per day or more	Locations where there is a particularly important plant species, where dust sensitivity is uncertain or unknown or locations with a national designation where the features may be affected by dust deposition
Low sensitivity	Enjoyment of amenity not reasonably expected; appearance/ aesthetics/ value of property not diminished by soiling; receptors are transient / present for limited period of time; e.g. playing fields, farmland, footpaths, short term car parks*	Transient human exposure, e.g. footpaths, playing fields and parks.	Locations with a local designation which may be affected by dust deposition.

3.2.6 Distances have been measured from source to receptor in bands of less than 20m, less than 50m, less than 100m and less than 350m for earthworks and construction. For trackout, the receptor distances have been measured from receptor to trackout route (up to 50m) and up to 500m from the site exit. These distances bands have been applied in Table 3 and Table 4. For sensitivity of an area to ecological impacts the distance bands are for less than 20m and less than 50m.

Table 3: Sensitivity of the area to dust soiling effects on people/ property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Moderate	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 4: Sensitivity of the area to human health impacts

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High (annual mean PM_{10} concentration <24µg/m^3)	>100	Medium	Low	Low	Low
	10-100	Low	Low	Low	Low
	1-10	Low	Low	Low	Low
Medium (annual mean PM_{10} concentration <24µg/m^3)	>10	Low	Low	Low	Low
	1-10	Low	Low	Low	Low
Low	≥1	Low	Low	Low	Low

Table 5: Sensitivity of the area to ecological impacts

Receptor sensitivity	Distance from source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Risk definitions

3.2.7 The potential risks from emissions from unmitigated demolition and construction activities have been defined with reference to the magnitude of the potential emission and the sensitivity of the highest receptor(s) within the effect area, as summarised in

3.2.8 Table 6 below.

Table 6: Classification of risk of unmitigated impacts

Area of Sensitivity to Activity	Magnitude		
	Large	Medium	Small
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	negligible
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

Magnitude assessment

3.2.9 For the purpose of this assessment, the Proposed Development site is considered to be a large emissions source for fugitive dust emissions from construction related activities, as defined in Table 1.

Receptor identification

3.2.10 Human health and ecological receptors have been identified within the Study Area and are shown in Table 7 (CDR = Construction Dust Receptor).

Table 7: Identification of receptors for construction dust assessment

ID	Receptor name	Receptor type	Approx. distance (m) from site boundary or exit	Approx. distance to construction route (m)	Within screening distance?	Receptor sensitivity to dust and particulate matter
CDR2	Hawthorn House	Residential	10	2,860	Yes	High
CDR3	76 Chapel Lane	Residential	30	3,015	Yes	High
CDR4a	Keadby Warping Drain	Ecological	5	3,380	Yes	Low
CDR4b	Keadby Warping Drain	Ecological	215	2,955	Yes	Low
CDR5	Keadby Boundary Drain	Ecological	0	2,465	Yes	Low
CDR6	Stainforth and Keadby Canal Corridor	Ecological	5	2,415	Yes	Low
CDR7	Keadby Wetland	Ecological	30	2,380	Yes	Low
CDR8	South Soak Drain	Ecological	30	2,335	Yes	Low
CDR9	Keadby Wet Grassland	Ecological	50	2,370	Yes	Low
CDR10	Keadby Power Station SNCI	Ecological	30	2,135	Yes	Low
CDR11	Trentside, Keadby	Commercial	5	3,065	Yes	Low
CDR12	Pilfrey Farm	Residential	205	30	Yes	High
CDR13	Hatfield Waste Drain	Ecological	0	15	Yes	Low
CDR14	North Engine Drain, Belton	Ecological	10	0	Yes	Low
CDR15	River Torne	Ecological	25	20	Yes	Low
CDR16	North Pilfrey Farm	Residential	180	1,450	Yes	High
CDR17	Ealand Warpings	Residential	210	1,150	Yes	High
CDR18	Humber Estuary	Ecological	0	0	Yes	Medium

Area sensitivity assessment

3.2.11 The receptor sensitivity to the effects of dust soiling and PM_{10} (human health) impacts has been determined for all activities, based on the closest distance from the identified receptors to those activities, as summarised in Table 8 below. The overall area sensitivity to dust soiling and PM_{10} (human health) is considered to be 'low', whilst the area sensitivity to ecological dust impacts is considered to be 'medium'.

Table 8: Area sensitivity for receptors of construction dust

Activity	Potential impact	Receptor sensitivity and distance to activity	Area sensitivity
Demolition	Dust soiling	High sensitivity (<10 receptor) <20m	Low
	Health PM_{10}	High Sensitivity (<10 receptors) <20m	Low
	Ecology	Medium sensitivity (<10 receptor) <20m	Medium
Earthworks	Dust soiling	High sensitivity (<10 receptor) <20m	Low
	Health PM_{10}	High Sensitivity (<10 receptors) <20m	Low
	Ecology	Medium sensitivity (<10 receptor) <20m	Medium
Construction	Dust soiling	High sensitivity (<10 receptor) <20m	Low
	Health PM_{10}	High Sensitivity (<10 receptors) <20m	Low
	Ecology	Medium sensitivity (<10 receptor) <20m	High
Trackout	Dust soiling	High sensitivity (<10 receptor) <20m	Low
	Health PM_{10}	High Sensitivity (<10 receptors) <20m	Low
	Ecology	Mediumsensitivity (<10 receptor) <20m	Low

3.2.12 The risk of impacts from unmitigated activities has been determined through combination of the potential dust emission magnitude and the sensitivity of the area, for each activity to determine the level of mitigation that should be applied. The risk of impacts from unmitigated activities are summarised in Table 9 below.

Table 9: Risk of impacts from unmitigated activities

Activity	Demolition	Earthworks	Construction	Trackout
Dust Emission Magnitude	Medium	Large	Large	Medium
Risk of impacts from unmitigated activities				
Dust soiling (medium sensitivity)	Low Risk	Low Risk	Low Risk	Low Risk
Health PM_{10} (low sensitivity)	Low Risk	Low Risk	Low Risk	Low Risk

Activity	Demolition	Earthworks	Construction	Trackout
Ecology	Medium Risk	Medium Risk	Medium Risk	Low Risk

3.2.13 The risk assessment for construction dust indicates that there would be a low risk of unmitigated dust impacts on human health (PM_{10}) and dust soiling from unmitigated clearance works ("demolition"), earthworks, construction and track out activities. The assessment also shows that the impact of unmitigated construction activities on ecological sites is likely to be medium.

3.2.14 These risk classifications are solely used to select the appropriate schedule of mitigation measures, examples of which are set out in guidance published by the IAQM (IAQM, 2014). For all but the smallest of sites the use of the high-risk schedule of measures represents good working practice.

3.2.15 On consideration of the likely effectiveness of these measures, additional site-specific measures will be identified in the CEMP if required but at this stage the requirement for any such measures has not been identified.

3.2.16 It is considered that with the implementation of appropriate mitigation and control measures set out in the CEMP, the potential effect from fugitive emissions of construction dust would not be significant.

3.3 Construction traffic assessment

Introduction

3.3.1 For the construction traffic assessment, all affected roads have been assessed at a 'detailed level' of assessment. As detailed in IAQM Guidance (IAQM, 2017), a 'detailed level' assessment uses dispersion modelling to predict pollutant concentrations, taking into account additional variables. The detailed assessment of local air quality reported herein has used the Cambridge Environmental Research Consultants (CERC) Atmospheric Dispersion Modelling System (ADMS) Roads dispersion model (version 4.1.1) to predict road pollutant contributions at identified sensitive receptors.

3.3.2 Predictions have been made for the baseline year (2020 Base) and the peak construction year (2031) with the Proposed Development construction work (2031 Construction Peak) and without the Proposed Development construction work (2031 Base). On the basis of these predictions, the change in key pollutant concentrations (NO_2, PM_{10} and $PM_{2.5}$) associated with the Proposed Development have been established.

3.3.3 Predictions have been verified using a conservative verification factor based on professional experience of similar projects (as set out in paragraphs 3.3.26 to 3.3.30 of this Appendix) and applied to bring modelled concentrations more into line with monitored concentrations.

3.3.4 A key element of the local construction phase detailed assessment is the rate of improvement in air quality over time as cleaner road vehicles enter the national vehicle fleet. Due to the current uncertainty in projected year-on-year improvements in UK vehicle fleet emissions and background pollutant concentrations, this assessment has

made use of the approach set out in the Highways England (HE) Design Manual for Roads and Bridges (DMRB) guidance (Highways England, 2019). Referred to as Gap Analysis, the method considers the Department of Environment, Food and Rural Affairs (Defra) advice on long-term trends related to roadside NO_2 concentrations. This advice suggests that there is a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in Defra's technical guidance and observed trends. This is due to discrepancies between measured NO_2 trends and pre-Euro 6/VI EFT projections, which were based on roadside measurements taken before Euro 6/VI vehicles entered the UK fleet, i.e. pre-2015 data. Consequently, Highways England developed a set of NO_2 projection factors to inform scheme air quality assessments and these projections are referred to as long-term trend (LTT).

3.3.5 The impact of the Proposed Development is based on modelled predictions of pollutant concentrations in the scenarios considered, taking account of the Gap Analysis approach, described above, and Defra Local Air Quality Management (LAQM) guidance and tools, including the current version of the NOx to NO_2 conversion approach and background maps. Predictions are also informed by two-way 24 hour annual average daily traffic flow data, sourced from **Chapter 10**: Traffic and Transportation (PEI Report Volume I), and hourly sequential meteorological data from a representative meteorological station.

3.3.6 Further details of the assessment methodology including the inputs used in the ADMS-Roads model (including meteorology data), model post-processing (e.g. NOx to NO_2 conversion) and the approach taken to model verification (including all monitoring locations used in the verification process) are presented in the following sub-sections.

3.3.7 Representative sensitive receptors (e.g. residential properties and ecological sites) have been selected for assessment within the local air quality assessment. These include those sensitive receptors located closest to the Study Area for construction effects.

3.3.8 The predicted air quality impacts of the Proposed Development are evaluated against relevant national, regional and local air quality planning policy. An evaluation of the significance of the local air quality assessment findings at sensitive receptors for human health has been undertaken in accordance with IAQM/ EPUK guidance (IAQM, 2017). It is considered that the determination of significance using the IAQM/EPUK guidance is more conservative for the assessment of the Proposed Development than the use of significance criteria provided in Highways England guidance, where a significant effect can only occur when there is an exceedance of an air quality standard in either future baseline or future construction phase scenarios.

3.3.9 The significance of the effects on European and nationally designated habitat sites, including the magnitude of change in NOx and nitrogen deposition, are considered as part of the Ecology and Nature Conservation assessment (see **Chapter 11**: Biodiversity and Nature Conservation (PEI Report Volume I).

Screening Criteria

3.3.10 The construction phase traffic assessment considers the impact of emissions associated with additional heavy duty vehicles (HDV – vehicles >3.5t in weight) and

light duty vehicles (LDV – vehicles <3.5t in weight) introduced to the local road network due to construction work associated with the Proposed Development, including those associated with the import and export of materials to and from site, and the commuting of contractors.

3.3.11 The screening of traffic data has been undertaken using both the approach set out in the DMRB guidance and the approach set out by IAQM guidance. The IAQM approach identifies a larger air quality Study Area and more stringent criteria for the identification of affected road links, and therefore this been applied to the assessment. The IAQM criteria is summarised in Table 10.

Table 10: Screening criteria for determining the Study Area

If the Development will:	Indicative Criteria to Proceed to an Air Quality Assessment
Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.

3.3.12 The construction traffic assessment considers those areas where a change in traffic above the criteria identified in Table 10 occurs in the immediate area around the Proposed Development. There is a single Air Quality Management Area (AQMA) declared within the overall study area, however it is not anticipated that it will be effected by the change in traffic flows due to the construction of the Proposed Development. Consequently, only roads with changes of more than 500 AADT in LDVs or 100 AADT in HDVs are considered to be within the construction Study Area. The study area is shown in **Figure 8A.3** (PEI Report Volume I).

Modelled scenarios

3.3.13 A quantitative assessment of the impact of exhaust emissions from additional road traffic has been undertaken for the following scenarios:

- 2020 Baseline Scenario (for model verification process) (2020 Base);
- 2031 Future Baseline Scenario (for Long Term Trends Calculations) (2031 Future Base);
- 2031 Future Construction Year Base + Committed Development Scenario (2031 Base); and
- 2031 Future Construction Year Base + Committed + Peak Construction Scenario (2031 Construction Peak).

Model inputs

3.3.14 The general model conditions will be used in the assessment of road traffic emissions are summarised in Table 11. Other more detailed data used to model the dispersion of emissions is considered below.

Table 11: General ADMS roads model conditions

Variable	Input
Surface Roughness at source	0.5m
Minimum Monin-Obukhov length for stable conditions	10m
Receptors	Selected discrete receptors
Receptor location	X,Y co-ordinates determined by GIS. The height of residential receptors will be set at 1.5m. Ecological receptors are set at 0m
Emissions	NOx, PM_{10}, $PM_{2.5}$
Emission Factors	Emission Factor Toolkit version 9.0 for 2020 for all scenarios
Meteorological Data	1 year of hourly sequential data, Doncaster Robin Hood Airport Meteorological Station (2019)
Emission Profiles	None used – emissions averaged across a 24 hour period
Terrain Types	Flat terrain
Model Output	Long-term annual mean NOx concentration ($\mu g/m^3$) Long-term annual mean PM_{10} concentration ($\mu g/m^3$) Long-term annual mean $PM_{2.5}$ concentration ($\mu g/m^3$)

Traffic data

3.3.15 The traffic data used in this assessment has been prepared by AECOM and takes the form of Annual Average Daily Traffic (AADT).

3.3.16 The future construction base year is 2031. The construction base year is the period where the number of construction vehicles accessing the Site will peak, and is assumed to be a worst-case for assessing potential effects due to construction traffic.

3.3.17 All future scenarios consider traffic generated from other committed developments within the Study Area. The exact cumulative developments to include in the traffic data has not yet been finalised, and traffic data and predicted concentrations may require updating once this has been agreed. AADT traffic flows are presented in Table 12.

Table 12: Road traffic data used in the assessment

Road/Link ID	2020 Base			2031 Base			2031 Construction Peak		
	Total AADT	HDV	Avg. Speed (km/hr)	Total AADT	HDV	Avg. Speed (km/hr)	Total AADT	HDV	Avg. Speed (km/hr)
A18 (West of Construction Site Access)	8132	707	88	9179	798	88	10081	918	88
A161 (between A18 and M180 Jct 2)	5622	704	77	6346	795	77	7080	915	77
A18 Station Rd (West of Keadby Bridge)	14896	962	53	16813	1086	53	17147	1086	53
B1392 (North of Main Site Entrance)	1650	142	51	1862	160	51	1862	160	51
B1392 (South of Main Site Entrance)	2661	271	34	3003	306	34	3003	306	34
A18 (East of Construction Site Access)	8132	707	88	9179	798	88	9513	798	88

Emissions data

3.3.18 The magnitude of road traffic emissions for the baseline and with development scenarios have been calculated from traffic flow data using the Defra's current emission factor database tool EFT 9.0 (Defra, 2020). The uncertainty in future emission rates is considered by use of Highways England's DMRB Gap Analysis. The assessment considers the construction phase impact of road traffic emissions at receptors adjacent to roads in the vicinity of the Proposed Development.

Modelled domain – discrete receptors

3.3.19 In line with guidance and standard practice, representative worst-case receptors located within 200m of road links in the study area are considered in this assessment. For human health receptors, receptor locations represent the nearest façade of a residential property, school or medical facility to the road links considered. For ecology receptors, they represent the nearest part of each designated area to the road links, with additional receptor points set in a transect with increasing distance from the road links, to demonstrate the spatial variation in predicted impacts across each designated site.

3.3.20 This report has considered receptors that appear within 200m of the road network of this study area that have AADT flows reported for them in **Chapter 10**: Traffic and Transportation (PEI Report Volume I). Consequently, discrete receptors have been identified irrespective of the change in AADT flow between base year and future year scenarios for a road.

3.3.21 The receptors for which the impact of road traffic emissions will be predicted are listed in Table 13 and Table 14 (TR = Traffic Receptor, TE = Traffic Ecology).

Table 13: Modelled human health receptors

Receptor ID	x	y	Description
TR1	480758	409985	Pilfrey Farm, A18
TR2	482615	409594	Residential Property on Crowle Bank Road
TR3	483281	409791	Residential Property on Kelsey Lane
TR4	483863	410649	Residential Property on Old School Lane, Keadby
TR5	483724	410668	Residential Property on Station Road, Keadby
TR6	483691	410790	Residential Property on Station Road, Keadby
TR7	483548	411238	Residential Property on Station Road, Keadby
TR8	483511	411611	Blackfriars Cottage (former Trentvale Prep School, Keadby)

Receptor ID	x	y	Description
TR9	483527	411804	Residential Property on Trent Side, Keadby
TR10	478181	409792	Little Hurst Cottages, A161
TR11	478347	409479	Hirstwood Farm, A161
TR12	478457	409228	Residential property at Mosswood Court, A161

Table 14: Modelled ecological receptors

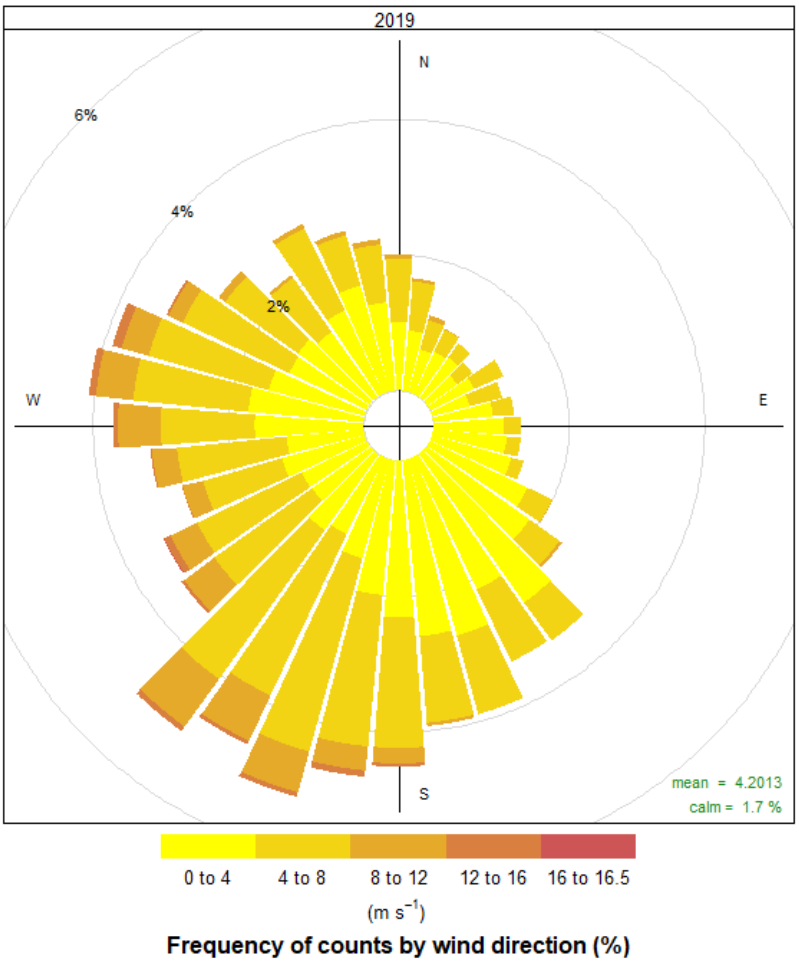
Receptor ID	x	y	Designated site
TE1	479055	410252	Hatfield Waste Drain LWS - North of A18
TE2	478651	410338	Hatfield Waste Drain LWS - South of A18
TE3	479110	410221	North Engine Drain, Belton LWS
TE4	479108	410198	River Torne LWS
TE5	480922	409925	Three Rivers LWS - South
TE6	480957	409898	South Engine Drain, Belton LWS
TE7	483532	411259	Three Rivers LWS - North
TE8	483434	411422	Stainforth and Keadby Canal Corridor LWS
TE9	483338	411379	Keadby Wetland LWS
TE10a	483561	411266	Humber Estuary SSSI SAC
TE10b	483582	411274	Humber Estuary SSSI SAC
TE10c	483603	411282	Humber Estuary SSSI SAC
TE10d	483624	411290	Humber Estuary SSSI SAC
TE10e	483644	411298	Humber Estuary SSSI SAC
TE10f	483665	411306	Humber Estuary SSSI SAC
TE10g	483686	411314	Humber Estuary SSSI SAC
TE10h	483706	411322	Humber Estuary SSSI SAC
TE10i	483727	411330	Humber Estuary SSSI SAC
TE10j	483748	411338	Humber Estuary SSSI SAC
TE11a	484102	410665	Humber Estuary SSSI SAC
TE11b	484098	410688	Humber Estuary SSSI SAC
TE11c	484094	410710	Humber Estuary SSSI SAC

Receptor ID	x	y	Designated site
TE11d	484090	410732	Humber Estuary SSSI SAC
TE11e	484086	410754	Humber Estuary SSSI SAC
TE11f	484082	410776	Humber Estuary SSSI SAC
TE11g	484078	410799	Humber Estuary SSSI SAC
TE11h	484073	410821	Humber Estuary SSSI SAC
TE11i	484069	410843	Humber Estuary SSSI SAC
TE11j	484065	410865	Humber Estuary SSSI SAC
TE12	478707	410333	Hatfield Chase Ditch SSSI
TE13a	479020	410284	Crowle Borrow Pits SSSI
TE13b	479024	410305	Crowle Borrow Pits SSSI
TE13c	479028	410325	Crowle Borrow Pits SSSI
TE13d	479032	410346	Crowle Borrow Pits SSSI
TE13e	479036	410366	Crowle Borrow Pits SSSI
TE13f	479040	410386	Crowle Borrow Pits SSSI
TE13g	479044	410407	Crowle Borrow Pits SSSI
TE13h	479048	410427	Crowle Borrow Pits SSSI
TE13i	479052	410447	Crowle Borrow Pits SSSI
TE13j	479056	410468	Crowle Borrow Pits SSSI

Meteorological data

3.3.22 The model runs carried out for the Proposed Development used hourly sequential data from Doncaster Robin Hood Airport for the year 2019, consistent with the year chosen to verify the performance of the model against measured NO_2 concentrations. This meteorological site is located approximately 19km southwest of the Study Area. A wind rose for this site is presented in **Figure 1**.

Figure 1: Doncaster Robin Hood Airport - 2019 Windrose



Produced using R Openair (Carslaw et al, 2012)

Background concentrations

3.3.23 Annual average background concentrations were taken from Defra's 2018 baseline 1x1 km background maps and adjusted using Defra's adjustment tool removing emissions from road traffic for motorways and primary or trunk A roads. The data used in the assessment is presented for the centre of each 1x1 km grid square in Table 15. The Defra background concentrations have also been compared against Local Authority background monitoring, which has suggested no uplift is required.

Table 15: Defra modelled background concentrations

Grid Ref. of Centre Point	2018 Background concentrations (µg/m^3)				2018 Background concentrations (µg/m^3)			
	NOx	NO_2	PM_{10}	$PM_{2.5}$	NOx	NO_2	PM_{10}	$PM_{2.5}$
480500, 409500	11.6	8.9	16.4	9.0	8.1	6.4	15.2	8.0

Grid Ref. of Centre Point	2018 Background concentrations (µg/m^3)				2018 Background concentrations (µg/m^3)			
	NOx	NO_2	PM_{10}	$PM_{2.5}$	NOx	NO_2	PM_{10}	$PM_{2.5}$
482500, 409500	11.6	8.9	16.4	9.0	8.1	6.4	15.2	8.0
483500, 409500	12.2	9.3	16.1	9.0	8.5	6.7	14.9	8.0
483500, 410500	12.7	9.7	15.7	9.0	9.1	7.1	14.4	7.9
483500, 411500	12.2	9.3	15.0	8.7	8.7	6.8	13.7	7.6
478500, 409500	11.9	9.1	16.6	9.1	8.1	6.4	15.4	8.2
479500, 410500	12.0	9.2	16.2	8.9	8.6	6.7	15.0	8.0
478500, 410500	11.7	9.0	16.2	9.0	8.3	6.5	15.0	8.0
484500, 410500	13.0	9.9	16.3	9.0	9.3	7.3	15.1	8.0

Consideration of terrain

3.3.24 Emissions from road traffic make the greatest contribution to pollutant concentrations at sensitive receptors adjacent to the source (i.e. at the roadside). For this reason, there is not normally a large variation in height between the emission source and residential properties next to the roads included in the model. Therefore, terrain is not included in the road traffic modelling assessment.

NOx to NO_2 conversion

3.3.25 To accompany the publication of the guidance document LAQM.TG(16) (Defra, 2016), a NOx to NO_2 converter was made available as a tool to calculate the road NO_2 contribution from modelled road NOx contributions. The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NOx. Version 7.1 (April 2019) of this tool has been used to calculate the total NO_2 concentrations at receptors from the modelled road NOx contribution and associated background concentration. Due to the location of the Proposed Development, North Lincolnshire Council (NLC) has been specified as the local authority and the 'All other non-urban UK traffic' mix selected.

Bias adjustment of road contribution NOx, PM_{10} and $PM_{2.5}$

3.3.26 The modelled road NOx contributions from the ADMS-Roads model has been adjusted for bias through model verification, in line with the method described in LAQM.TG(16).

3.3.27 In the absence of Project-specific data a review of existing and publicly available local authority data has been undertaken. NLC do not undertake any air quality monitoring in the vicinity of the Proposed Development, or along any roads included as part of the **Appendix 10A:** Transport Assessment (PEI Report Volume I).

3.3.28 In the absence of data suitable for model verification, a hypothetical verification factor of 3.0 has been used to inform the current assessment. This factor is based on professional experience of dispersion model verification exercises in similar environments and is considered to be a conservative estimate of the model verification factor.

3.3.29 The verification factor was applied to the predicted road NOx concentrations prior to the conversion of road NOx to total NO_2 concentrations at the receptors.

3.3.30 There is insufficient roadside measurement data for the primary pollutants PM_{10} or $PM_{2.5}$ within the Study Area to derive a specific adjustment factor. The same bias adjustment factor derived for the modelled contributions of the primary pollutant NOx has been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions, as recommended in LAQM.TG(16).

Predicting the number of days in which the NO2 hourly mean objective is exceeded

3.3.31 Research projects completed on behalf of Defra and the Devolved Administrations, have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m^3 (Laxen and Marner, 2003, AEAT, 2008).

3.3.32 In 2003, Laxen and Marner concluded:

'*…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m3 and above*.'

3.3.33 The findings presented by Laxen and Marner are further supported by AEAT (2008) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

'*Local authorities should continue to use the threshold of 60 µg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective.*'

3.3.34 Therefore, this assessment evaluates the likelihood of exceeding the hourly mean NO_2 objective by comparing predicted annual mean NO_2 concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3. Where predicted concentrations are below this value, it can be concluded that the hourly mean NO_2 objective (200 µg/m^3 NO_2 not to be exceeded more than 18 times per year) will be achieved.

Predicting the number of days in which the PM10 24-hour mean objective is exceeded

3.3.35 The guidance document LAQM.TG(03) sets out the method by which the number of days in which the PM_{10} 24hr objective is predicted to be exceeded can be obtained

based on a relationship with the predicted PM_{10} annual mean concentration. The most recent guidance LAQM.TG(16) suggests no change to this method. As such, the formula used within this assessment is:

No. PM_{10} 24-hour mean exceedances = -18.5 + 0.00145 × C^3 + (206/C)

3.3.36 Where C is the annual mean concentration of PM_{10}.

Specialized model treatments

3.3.37 No specialised model treatments have been used in the assessment of construction road traffic emissions.

Calculation of nitrogen and acid deposition for ecological receptors

3.3.38 Conversion factors for calculating nitrogen and acid deposition from modelled NO_2 are found in the DMRB LA 105 Air Quality guidance.

Results of the Construction traffic assessment

3.3.39 Table 16 shows the predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$; and number of exceedances of the 24-hour 50 µg/m^3 PM_{10} objective for the Do Something scenario at the modelled receptor locations. The value in brackets indicates the difference between the Do Minimum and Do Something scenario.

Table 16: Results of construction traffic impact assessment at human health receptors

Receptor ID	Do Something Scenario Results			
	Annual Mean NO_2 (µg/m^3)	Annual Mean PM_{10} (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)	No. of days 24-hour mean PM_{10} >50µg/m^3
TR1	7.6 (<0.1)	15.8 (<0.1)	8.4 (<0.1)	1 (<1)
TR2	8.1 (0.1)	16.0 (<0.1)	8.5 (<0.1)	1 (<1)
TR3	8.7 (0.1)	15.8 (<0.1)	8.6 (<0.1)	1 (<1)
TR4	12.2 (0.1)	16.7(<0.1)	9.2 (<0.1)	1 (<1)
TR5	10.1 (0.1)	15.7 (<0.1)	8.6 (<0.1)	1 (<1)
TR6	9.2 (<0.1)	15.2 (<0.1)	8.3 (<0.1)	1 (<1)
TR7	8.4 (<0.1)	14.3 (<0.1)	8.0 (<0.1)	1 (<1)
TR8	8.4 (<0.1)	14.3 (<0.1)	8.0 (<0.1)	1 (<1)
TR9	7.7 (<0.1)	14.1 (<0.1)	7.9 (<0.1)	1 (<1)
TR10	8.9 (0.3)	16.8 (0.1)	9.0 (0.1)	1 (<1)
TR11	7.7 (0.1)	16.1 (0.1)	8.6 (<0.1)	1 (<1)
TR12	7.0 (0.1)	15.7 (<0.1)	8.4 (<0.1)	1 (<1)
Values in parentheses indicate the difference between the Do Something scenario results and the Do Minimum scenario results; (Do Something – Do Minimum)				

3.3.40 Table 17 and Table 18 display the relevant information and assessment results for the significance of construction traffic impacts to be discussed in **Chapter 11**: Biodiversity and Nature Conservation (PEI Report Volume I).

Table 17: Ecological sites within construction traffic study area containing features which are sensitive to air pollutants

Receptor ID	Ecological Site	Relevant Nitrogen Critical Load Class[1]	Lower Critical Load ($kgNha^{-1}yr^{-1}$)[1,2]	Background Nitrogen Deposition ($kgNha^{-1}yr^{-1}$)[1,3]	Background NOx Concentration ($\mu g/m^3$)
TE1, TE2	Hatfield Waste Drain LWS	Neutral grassland	20	18.06	14.61
TE3	North Engine Drain, Belton LWS	Neutral grassland	20	18.06	14.63
TE4	River Torne LWS	Neutral grassland	20	18.06	14.63
TE5	Three Rivers LWS	Neutral grassland	20	17.08	13.32
TE6	South Engine Drain, Belton LWS	Coastal and floodplain grazing marsh	20	17.92	13.5
TE7	Three Rivers LWS	Neutral grassland	20	17.08	14.27
TE8	Stainforth and Keadby Canal Corridor LWS	Coastal and floodplain grazing marsh	20	17.08	14.27
TE9	Keadby Wetland LWS	Neutral Grass Land	20	17.08	14.27
TE10a-j	Humber Estuary SSSI SAC	Coastal Stable dune grasslands	8	17.1	14.27

Receptor ID	Ecological Site	Relevant Nitrogen Critical Load Class[1]	Lower Critical Load (kgNha^{-1}yr^{-1})[1,2]	Background Nitrogen Deposition (kgNha^{-1}yr^{-1})[1,3]	Background NOx Concentration (µg/m^3)
TE11a-j	Humber Estuary SSSI SAC	Coastal Stable dune grasslands	8	17.1	16.12
TE12	Hatfield Chase Ditch SSSI	Fen, Marsh and Swamp (assumed)	15	18.06	14.61
TE13a-j	Crowle Borrow Pits SSSI	Broadleaved deciduous woodland	10	31.2	14.63
	[1]Relevant nitrogen critical load class, lower value of the critical load range, average nitrogen deposition rate and average NOx concentration data taken from Air Pollution Information System website (http://www.apis.ac.uk/). Note these values are statistics for the entire designated site. [2]Taken from 'Indicative values within nutrient nitrogen critical load ranges for use in air pollution impact assessments' (http://www.apis.ac.uk /indicative-critical-load-values), and advice from the project ecologists. [3]These data are the most recent available from the APIS website and are a 3-year mean for the period 2015-17.				

Table 18: Results of construction traffic impact assessment at ecological receptors

Ecological Receptor ID	Shortest Distance to Road Source (m)	Max DS[1] NOx conc. (µg/m^3)	Max NOx change (DS-DM[2]) (µg/m^3)	Max DS Ndep (kgNha^{-1}yr^{-1})	Max Ndep change (DS-DM) as % of critical load (%)
TE1	5	24.1	0.8	19.4	0.6
TE2	25	17.5	0.2	18.5	0.2
TE3	10	20.0	0.4	18.8	0.3
TE4	30	17.0	0.2	18.4	0.1
TE5	10	20.5	0.2	18.1	0.2
TE6	5	19.2	0.2	18.7	0.1
TE7	15	16.5	<0.1	17.4	<0.1
TE8	5	18.5	<0.1	17.7	<0.1
TE9	105	14.8	<0.1	17.2	<0.1
TE10a	10	17.7	<0.1	17.6	<0.1
TE10b	30	15.9	<0.1	17.3	<0.1

Ecological Receptor ID	Shortest Distance to Road Source (m)	Max DS[1] NOx conc. (µg/m^3)	Max NOx change (DS-DM[2]) (µg/m^3)	Max DS Ndep (kgNha^{-1}yr^{-1})	Max Ndep change (DS-DM) as % of critical load (%)
TE10c	55	15.4	<0.1	17.3	<0.1
TE10d	75	15.1	<0.1	17.2	<0.1
TE10e	100	15.0	<0.1	17.2	<0.1
TE10f	120	14.9	<0.1	17.2	<0.1
TE10g	140	14.9	<0.1	17.2	<0.1
TE10h	165	14.8	<0.1	17.2	<0.1
TE10i	185	14.8	<0.1	17.2	<0.1
TE10j	210	14.7	<0.1	17.2	<0.1
TE11a	5	34.4	0.3	19.7	0.6
TE11b	25	22.6	0.1	18.0	0.2
TE11c	40	20.2	0.1	17.7	0.1
TE11d	60	19.2	0.1	17.5	0.1
TE11e	80	18.6	<0.1	17.5	0.1
TE11f	100	18.2	<0.1	17.4	0.1
TE11g	120	17.9	<0.1	17.4	0.1
TE11h	140	17.7	<0.1	17.3	0.1
TE11i	155	17.5	<0.1	17.3	<0.1
TE11j	175	17.3	<0.1	17.3	<0.1
TE12	5	21.0	0.5	19.0	0.5
TE13a	30	18.1	0.3	31.7	0.4
TE13b	50	17.0	0.2	31.5	0.3
TE13c	75	16.5	0.2	31.5	0.2
TE13d	95	16.2	0.1	31.4	0.2
TE13e	115	15.9	0.1	31.4	0.2
TE13f	135	15.8	0.1	31.4	0.1
TE13g	155	15.6	0.1	31.3	0.1
TE13h	175	15.5	0.1	31.3	0.1
TE13i	200	15.5	0.1	31.3	0.1
TE13j	220	15.4	0.1	31.3	0.1

[1]DS = Do Something
[2]DM = Do Minimum

4.0 CONCLUSIONS

4.1.1 This report has assessed the impact on local air quality arising from the construction phases of the Proposed Development. The assessment has used a sensitivity assessment methodology to assess the likelihood and scale of impact on sensitive receptors located in the vicinity of the Proposed Development of the anticipated dust arisings from the construction and demolition activities and associated road traffic.

4.1.2 The evaluation of expected dust arisings from the proposed construction and demolition works and associated road traffic has shown that without mitigation there could be a short-term low to medium impact of dust emissions associated with the construction phase on human health and a potential high impact on the ecological receptors, with a significant effect.

4.1.3 However, appropriate mitigation measures for managing these risks will be set out in the framework CEMP and will be in accordance with the IAQM guidance. They will be formalised through the CEMP to be prepared by the construction contractor. Through implementation of these measures, no significant effects are predicted on any sensitive receptors.

4.1.4 This assessment will be reviewed and refined as further information related to construction of the Proposed Development becomes available and based on ongoing engagement with relevant stakeholders.

5.0 REFERENCES

AEAT (2008), *Analysis of the relationship between annual mean nitrogen dioxide concentrations and exceedances of the 1-hour mean AQS Objective*, [Online] [Accessed 01/06/2020] Available from: http://laqm.defra.gov.uk/documents/NO2relationship_report.pdf

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