H2Teesside Project

Preliminary Environmental Information Report

Volume III – Appendices

Appendix 8A: Air Quality - Construction Assessment

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)

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8A.0 AIR QUALITY – CONSTRUCTION ASSESSMENT

8A.1 Introduction

8A.1.1 This Technical Appendix supports Chapter 8: Air Quality (PEI Report, Volume I). For more details about the Proposed Development refer to Chapter 4: Proposed Development (PEI Report, Volume I).

8A.1.2 Emissions to air from the Proposed Development have the potential to adversely affect human health and sensitive ecosystems if not appropriately controlled. This technical appendix identifies and proposes measures to address the potential impacts and effects of the Proposed Development on air quality during construction and decommissioning. Emissions associated with 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 if not appropriately managed.

8A.1.3 The magnitude of air quality impacts at sensitive human receptors has been evaluated and – for traffic emissions - 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 all identified ecological receptors.

8A.2 Scope

Construction Phase Emissions

8A.2.1 The assessment has considered the impact of emissions during the construction and decommissioning of the Proposed Development on local air quality. The assessment considers impacts from the earliest year in which the construction works for the Proposed Development are due to commence, namely 2025. Demolition and site clearance of the Main Site will be undertaken prior to the main works, and these do not form part of this assessment.

8A.2.2 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 the sensitive human and ecological receptors in the vicinity of the Proposed Development Site have been assessed.

Cumulative Impacts

8A.2.3 Cumulative impacts from existing sources of pollution in the area are accounted for in the adoption of site-specific background pollutant concentrations from archive sources and a programme of project-specific baseline air quality monitoring in proximity to Proposed Development Site. 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.

8A.2.4 The full list of short-listed cumulative schemes to be considered for the Proposed Development is detailed within Chapter 23: Cumulative and Combined Effects (PEI Report, Volume I).

8A.2.5 There is a risk that there could be cumulative impacts at dust sensitive receptors screened into the construction dust assessment for the Proposed Development due to the construction of other committed developments happening simultaneously in the area that are within the sensitivity definition of the same receptors. The assessment of construction dust impacts reported in this assessment has been undertaken in line with industry-standard guidance to demonstrate the level of dust control required to mitigate any potential for significant effects. It is reasonable to assume that any other construction site in the vicinity of the Proposed Development will have done the same and will control dust through mitigation that is standard practice on all well managed construction sites across the UK. It is, therefore, concluded that the risk of cumulative construction dust impacts is Low and considered to be Not Significant.

8A.2.6 The traffic data used in this preliminary assessment includes predicted traffic growth on modelled roads between the current and the future year baselines. The methodology to determine the growth in traffic on the local road network is described in Chapter 15: Traffic and Transport (PEI Report, Volume I). The predicted growth included in the traffic data does not currently account for increases in traffic associated with other committed developments in the area – such allowances will be included in the assessment to be presented in the Environmental Statement (ES). Regardless, as any traffic associated with such committed developments will be included with both the with and without Proposed Development scenarios, the inclusion of traffic from committed developments is not currently anticipated to alter the assessment findings.

Sources of Information

8A.2.7 The information that has been used within this preliminary assessment includes pertinent information from:

- Chapter 4: Proposed Development (PEI Report, Volume I);
- Chapter 5: Construction Programme and Management (PEI Report, Volume I);
- details of the Proposed Development layout;
- Ordnance Survey mapping;
- construction traffic data as reported in Chapter 15: Traffic and Transport (PEI Report, Volume I); and
- baseline air quality data from AECOM diffusion tube monitoring within the air quality Study Area and from published sources and relevant local authorities.

8A.3 Methodology Overview

8A.3.1 This remainder of this appendix 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
- quantitative assessment of construction phase road traffic emissions on local roads through dispersion modelling.

8A.3.2 Non-Road Mobile Machinery (NRMM) is considered within Chapter 8: Air Quality (PEI Report, Volume I) which indicates that emissions from NRMM associated with the Proposed Development will be temporary and localised and will be controlled via the application of appropriate emissions standards and through best-practice mitigation measures. For that reason, effects associated with construction phase NRMM emissions are highly unlikely to be significant and, therefore, have been scoped out of the assessment.

8A.4 Construction Dust Assessment

8A.4.1 The following activities have been screened as potentially significant, based on the nature of construction activities proposed:

- earthworks (soil stripping, spoil movement and stockpiling);
- demolition (removal of existing buildings and infrastructure);
- construction (including on-site concrete batching); and
- trackout (Heavy Goods Vehicles (HGV) movements on unpaved roads and offsite mud on the highway).

Magnitude Definitions

8A.4.2 The potential magnitude of dust emissions has been categorised as detailed in Table 8A-1. Note that in each case not all the criteria need to be met, and that other criteria may be used if justified in the assessment.

Table 8A-1: Example Definitions of the Magnitude of Construction/Demolition Activities

MAGNITUDE	DEMOLITION	EARTHWORKS	CONSTRUCTION	TRACKOUT
Large	Total building volume >50,000 m^3, potentially dust construction material (e.g., concrete), on-site crushing and screening, demolition activities >20 m above ground level.	Site area >1 ha potentially dusty soil type (e.g., clay). >10 heavy earth moving vehicles at once, bunds >8m high, total material moved >100,000 tonnes.	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 content), unpaved road length >100 m.
Medium	Total building volume 20,000 – 50,000 m^3, potentially dusty construction material, demolition activities 10 to 20 m 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 m 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 er day, moderately dusty surface material (e.g., high clay content), unpaved road length 50 – 100 m.
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g., metal cladding or timber), demolition activities <10 m 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 <25,000 m^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 m.

Receptor Sensitivity Definitions

8A.4.3 The assessment of the significance of the effects of construction dust has been made with respect to the receptor and area sensitivity definitions as outlined in Table 8A-2 to Table 8A-5. Sensitivity definitions have been made with reference to the Institute of Air Quality Management (IAQM) guidance (IAQM, 2014); receptors beyond 100 m are defined as low sensitivity to construction impacts, as it is considered that beyond this distance impacts will be limited; ecological receptors (including statutory designations, and non-statutory ecological receptors of local importance such as Local Wildlife Sites, national and local nature reserves) have been included as there are a number of ecological sites within the 350 m Study Area from the Proposed Development Site boundary and 500 m Study Area from the site entrances.

Table 8A-2: Receptor Sensitivity to Construction/Demolition Dust Effects

SENSITIVITY	HUMAN PERCEPTION OF DUST SOILING EFFECTS	PM_{10} HEALTH EFFECTS	ECOLOGICAL DUST DEPOSITION EFFECTS
High	Experience a high level of amenity; appearance, aesthetics or value of property would be diminished by soiling' and receptor expected to be present continuously or regularly; for example, residential, museums, car showrooms or commercial horticulture.	Public present for eight hours per day or more, for example, residential, schools, care homes.	International/national designation and the designated feature is sensitive to dust soiling effects; for example, Special Areas of Conservation (SACs) for acid heathlands, or lichens, vascular species on Red Data List (Joint Nature Conservation Committee, JNCC).
Medium	Enjoy a reasonable level of amenity; appearance, aesthetics or value of property could be diminished by soiling; receptor not expected to be present continuously or regularly; for example, parks or places of work.	Only workforce present (no residential or high sensitivity receptors) eight hours per day or more.	Important plant species – unknown sensitivity to dust soiling; national designation which may be sensitive, for example Site of Special Scientific Interest (SSSI) with dust sensitive feature.
Low	Enjoyment of amenity not reasonably expected; appearance or aesthetics or value of property not diminished by soiling; receptors are transient or present for limited time; for example, playing fields, farmland, footpaths, short-term car parks and roads.	Transient human exposure, for example footpaths, playing fields, parks.	Local designation where feature may be sensitive to dust soiling, for example, local nature reserve.

8A.4.4 Distances have been measured from source to receptor in bands of less than 20 m, less than 50 m, less than 100 m and less than 350 m for earthworks and construction, in accordance with the IAQM guidance. For trackout the receptor distances have been measured from receptor to the trackout route (up to 50 m) and up to 500 m from the site exit. These distances bands have been applied in Table 8A-3 and Table 8A-4. For sensitivity of an area to ecological impacts, the distance bands are for less than 20 m and less than 50 m.

8A.4.5 In addition, the IAQM guidance considers the number of potentially affected receptors when defining the sensitivity i.e., the more receptors present, the more sensitive the area.

8A.4.6 The approach applied in the assessment and summarised in Table 8A-3 to Table 8A-5 differs from the default examples provided in the IAQM guidance in two respects:

- the adopted approach considers the sensitivity of individual receptors and their proximity to a source of emissions or work site, but not the absolute number of properties. This is considered to be a more robust and conservative approach than the default IAQM method; and
- distances have been calculated from the nearest boundary of the work site when considering on-site construction activities (earthworks, in this case), if the location of emissions source is not likely to be fixed throughout the duration of the works. This is a more conservative approach from the default IAQM method.

Table 8A-3: Sensitivity of the Area to Dust Soiling Effects on People/Property

INDIVIDUAL RECEPTOR SENSITIVITY	NUMBER OF RECEPTORS	DISTANCE FROM THE SOURCE (M)			
		LESS THAN 20	LESS THAN 50	LESS THAN 100	LESS THAN 350
High	1 or more	High	High	Medium	Low
Medium	1 or more	Medium	Low	Low	Low
Low	1 or more	Low	Low	Low	Low

Table 8A-4: Sensitivity of the Area to Human Health Impacts

INDIVIDUAL RECEPTOR SENSITIVITY	BASELINE ANNUAL MEAN PM_{10} CONCENTRATION	NUMBER OF RECEPTORS	DISTANCE FROM THE SOURCE (M)				
			LESS THAN 20	LESS THAN 50	LESS THAN 100	LESS THAN 200	LESS THAN 350
High	Greater than 32 µg/m^3	1 or more	High	High	High	Medium	Low
	28 to 32 µg/m^3	1 or more	High	High	Medium	Low	Low
	24 to 28 µg/m^3	1 or more	High	Medium	Low	Low	Low
	Less than 24 µg/m^3	1 or more	Medium	Low	Low	Low	Low
Medium	Greater than 32 µg/m^3	1 or more	High	Medium	Low	Low	Low
	28 to 32 µg/m^3	1 or more	Medium	Low	Low	Low	Low
	Less than 28 µg/m^3	1 or more	Low	Low	Low	Low	Low
Low	n/a	1 or more	Low	Low	Low	Low	Low

Table 8A-5: Sensitivity of the Area to Ecological Impacts

INDIVIDUAL RECEPTOR SENSITIVITY	DISTANCE FROM THE SOURCE (M)	
	LESS THAN 20	LESS THAN 50
High	High	High
Medium	Medium	Low
Low	Low	Low

<u>Risk Definitions</u>

8A.4.7 The potential dust emission magnitude of each type of activity and the sensitivity of the area are combined to establish the likely risk of impacts, based on the assumption of no applied mitigation. Each activity category is considered in turn, using the relationships set out in the risk matrices reported in Table 8A-6.

Table 8A-6: Classification of Risk of Unmitigated Impacts

SENSITIVITY OF AREA	SENSITIVITY OF AREA		
	LARGE	MEDIUM	SMALL
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible risk
Earthworks and Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible risk
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible risk
Low	Low risk	Low risk	Negligible risk

8A.4.8 Based on the risk level of dust impacts, suitable good practice measures for dust control should be applied based on the highest level of risk to the area posed by each category of activities. The IAQM have published recommended packages of mitigation measures that, based on the opinion of the membership of the professional body, represent the level of potential risk. These measures all have a long history of successful implementation in the UK, and most are established good practice measures on any large construction site.

Magnitude Assessment

8A.4.9 For the purpose of this assessment, the Proposed Development Site is considered to be a large emissions source for fugitive dust emissions from earthworks and construction, and medium sources for demolition and trackout related activities (as the Proposed Development Site has over 500 m of tarmacked road before joining the public highway), as defined in Table 8A-1.

8A.4.10 Exact details on earthworks area or construction material volumes are not known, but due to the overall scale of the Proposed Development, a “large” magnitude for all activities is a reasonable assumption. However, some areas away from the Main Site could be treated separately as lower magnitude sites as on-site activities will mainly relate to pipes installation, which as a lower dust production potential, as well as a shorter work time span.

Receptor Identification

8A.4.11 The construction area spreads on both sides of the River Tees. Representative receptors are those closest to the Proposed Development Site boundary and are predominantly commercial and industrial properties located within the existing industrial area adjacent to the Proposed Development Site, each side of the A1085 between Middlesborough and Redcar, around the river docks and east of Stockton on Tees. There are some residential properties near the edge of the Proposed Development Site boundary in Redcar and on Cowpen Lane.

8A.4.12 The Proposed Development Site boundary also extends near and across the Teesmouth and Cleveland Coast ecological site (Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar), the Redcar and Cleveland Local Wildlife Site (LWS), Hartlepool LWS and Stockton LWS.

8A.4.13 The magnitude of change in air pollutant concentrations of construction dust deposition rates will be greatest at these representative locations closest to the Proposed Development Site boundary. Assessment of the representative receptors therefore represents a worst-case assessment of the potential construction dust effects.

Area Sensitivity Assessment

8A.4.14 The sensitivity of the area is defined by considering the likely highest sensitivity receptors and the distance to the source for:

- dust soiling effects on people and amenity, including the number of affected receptors;
- human health effects of particulate matter (PM_{10}), including the number of affected receptors and consideration of existing background concentrations; and
- ecological effects of dust deposition.

8A.4.15 All sensitive receptors near to the Proposed Development Site are classified as being medium sensitive as they are all commercial properties except for some residential receptors located more than 20 m from the Proposed Development Site boundary.

8A.4.16 There are high sensitivity ecological sites within the Study Area, some less than 20 m from the Proposed Development Site boundary.

8A.4.17 The existing background PM_{10} concentration is 15.1 micrograms per cubic metre ($\mu g/m^3$), less than the lowest screening category within the IAQM methodology ($28 \mu g/m^3$), therefore representing the lowest baseline risk.

8A.4.18 The sensitivity of the area to dust soiling effects at nearby sensitive receptors is classified as high based on the number of high sensitivity receptors and their distance from dust sources – refer to Table 8A-7. The sensitivity of the area to human health impacts is low based on the existing baseline PM_{10} level, the number of sensitive receptors and their distance from the sources.

Table 8A-7: Area Sensitivity for Receptors of Construction Dust

ACTIVITY	POTENTIAL IMPACT	RECEPTOR SENSITIVITY AND DISTANCE	AREA SENSITIVITY
Demolition	Dust Soiling	High sensitivity and <20 m	Medium
	Human Health	Medium Sensitivity <20 m	Low
	Ecological	High sensitivity <20 m	High
Earthworks	Dust Soiling	High sensitivity and <20 m	Medium
	Human Health	Medium Sensitivity <20 m	Low
	Ecological	High sensitivity <20 m	High
Construction	Dust Soiling	High sensitivity and <20 m	Medium
	Human Health	Medium Sensitivity <20 m	Low
	Ecological	High sensitivity <20 m	High
Trackout	Dust Soiling	High sensitivity and <20 m	Medium
	Human Health	Medium Sensitivity <20 m	Low
	Ecological	High sensitivity <20 m	High

8A.4.19 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 8A-8.

Table 8A-8: Risk of Impacts from Unmitigated Activities

ACTIVITY	DEMOLITION	EARTHWORKS	CONSTRUCTION	TRACKOUT
Magnitude	Medium	Large	Large	Medium
Risk of impacts from unmitigated activities				
Dust soiling	Medium Risk	Medium Risk	Medium Risk	Low Risk
Health PM_{10}	Low Risk	Low Risk	Low Risk	Low Risk
Ecology	Medium Risk	High Risk	High Risk	Medium Risk

8A.4.20 The risk assessment for construction dust indicates that there will be a low risk of unmitigated dust impacts on human health (PM_{10}) and a low to medium risk of dust impacts on dust soiling from unmitigated earthworks, construction and track out activities. The assessment also shows that the impact of unmitigated construction activities on ecological sites is likely to be high.

8A.4.21 These risk classifications are solely used to select the appropriate schedule of mitigation measures from IAQM guidance. For all but the smallest of sites, the use of the high-risk schedule of measures represents good working practice.

8A.4.22 On consideration of the likely effectiveness of these measures, additional site-specific measures will be identified in the Final Construction Environmental Management Plan (CEMP) if required by the ES, but at this stage the requirement for any such measures has not been identified as being necessary.

8A.5 Construction Traffic Assessment

Introduction

8A.5.1 For the construction traffic assessment all affected roads have been assessed at a 'detailed level' of assessment. As detailed in IAQM Guidance, a 'detailed level' assessment uses dispersion modelling to estimate pollutant concentrations more accurately, 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 5.0.1) to predict road pollutant contributions at identified sensitive receptors.

8A.5.2 Predictions have been made for the baseline year (2019) and the peak construction year (month 14) with the Proposed Development construction work and without the Proposed Development construction work. 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.

8A.5.3 Predictions have been verified by comparing the baseline modelling predictions and baseline air quality monitoring data. Where systematic bias is evident in the base year verification, an adjustment factor has been calculated (as set out in the Bias Adjustment of Road Contribution Section of this Appendix) and applied to bring modelled concentrations more in line with monitored concentrations.

8A.5.4 The impact of the Proposed Development is based on modelled predictions of pollutant concentrations in the scenarios considered, and Defra Local Air Quality Management Technical Guidance (LAQM) guidance and tools, including the current version of the NO_x to NO_2 conversion approach and background maps. Predictions are also informed by two-way 24-hour Annual Average Daily Traffic (AADT) flow data as sourced from Chapter 15: Traffic and Transport (PEI Report, Volume I), and hourly sequential meteorological data from a representative meteorological station.

8A.5.5 Further details of the assessment methodology including the inputs used in the ADMS-Roads model (including meteorology data), model post-processing (e.g. NO_x 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.

8A.5.6 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.

8A.5.7 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/ Environmental Protection UK (EPUK) guidance. 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 National Highways (formerly 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.

8A.5.8 The significance of the effects on ecological receptors, including the magnitude of change in NOx and nitrogen deposition, are considered as part of the ecology and nature conservation assessment (see Chapter 12: Ecology and Nature Conservation (PEI Report, Volume I)).

Screening Criteria

8A.5.9 The construction phase traffic assessment considers the impact of emissions associated with additional heavy-duty vehicles (HDV – vehicles >3.5 tonnes (t) in weight) and light duty vehicles (LDV – vehicles <3.5 t 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 Proposed Development Site and the commuting of contractors.

8A.5.10 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.

8A.5.11 The IAQM approach identifies a larger air quality Study Area and more stringent criteria for the identification of affected road links, and therefore this has been applied to the assessment. The IAQM criteria is summarised in Table 8A-9.

8A.5.12 The construction traffic assessment considers those areas where a change in traffic above the criteria identified in Table 8A-9 occurs in the immediate area around the Proposed Development Site. There are no Air Quality Management Areas (AQMAs) declared within the Study Area, 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 8-3 (PEI Report, Volume II).

Table 8A-9: 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.

Modelled Scenarios

8A.5.13 A quantitative assessment of the impact of exhaust emissions from additional road traffic has been undertaken for the following scenarios:

- 2019 Baseline Scenario (for model verification process) (Base);
- 2025/2026 Future Construction Year Base (Future Baseline); and
- 2026 Future Construction Year Base + Peak Construction Scenario (month 14) (Future Year with Proposed Development).

Model Inputs

8A.5.14 The general model conditions that have been used in the assessment of road traffic emissions are summarised in Table 8A-10. Other more detailed data used to model the dispersion of emissions is considered below.

Table 8A-10: General ADMS Roads Model Conditions

VARIABLE	INPUT
Surface Roughness at source	0.5 m
Minimum Monin-Obukhov length for stable conditions	10 m
Receptors	Selected discrete receptors
Receptor location	X,Y co-ordinates determined by GIS. The height of residential receptors will be set at 1.5 m
Emissions	NO_X, PM_{10} and $PM_{2.5}$

VARIABLE	INPUT
Emission Factors	Emission Factor Toolkit version 11.0 for 2019 for baseline and construction year (2026) scenarios
Meteorological Data	1 year of hourly sequential data, Durham Tees Valley meteorological site (2019)
Emission Profiles	None used
Terrain Types	Flat terrain
Model Output	Long-term annual mean NO_X 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

8A.5.15 The traffic data used in this assessment takes the form of AADT.

8A.5.16 The future construction base year is 2026. The construction base year is the period where the number of construction vehicles accessing the Proposed Development Site will peak and is assumed to be a worst-case scenario for assessing potential effects due to construction traffic (month 14 of construction). AADT traffic flows are presented in Table 8A-11 (refer to Chapter 15: Traffic and Transport (PEI Report, Volume I)).

Table 8A-11: Road Traffic Data

ROAD NAME	AVERAGE SPEED (KM/H)	BASE		FUTURE BASELINE		FUTURE YEAR WITH PROPOSED DEVELOPMENT	
		Total AADT	HDV	Total AADT	HDV	Total AADT	HDV
A1085 Trunk Road, 100m east of Ennis Road	70	12,274	1,049	12,948	1,107	13,162	1,107
A1085 Trunk Road, 1345m south of West Coatham Lane	82	14,387	1,275	15,176	1,345	15,933	1,444
A1042 Kirkleatham Lane, 85m south of Staintondale Avenue	52	11,791	762	12,438	804	12,545	804
A1085 Trunk Road, 500m north of A1053 Tees Dock Road	83	16,058	2,012	16,940	2,122	17,696	2,221
A1085 Broadway, 235m east of Birchington Avenue	53	8,093	521	8,537	549	8,713	549
B1380 High Street, east of Lackenby Lane	50	9,835	826	10,375	871	10,417	871
A66, east of Whitworth Road	66	19,865	3,662	20,955	3,863	21,468	3,912
A1046 Port Clarence Road, north of Beech Terrace	47	7,612	896	8,030	945	8,114	962
A178 Seaton Carew Road, north of Huntsman Drive	72	7,814	998	8,243	1,053	8,411	1,088
Unnamed Road, east of A178 Seaton Carew Road	59	4,206	860	4,437	907	4,631	941
A1053 Greystone Road	94	14,387	1,392	15,177	1,468	15,304	1,518
A174 (West of Greystone Roundabout)	106	31,758	1,936	33,502	2,042	33,587	2,092
B1275 Belasis Avenue	47	2,451	72	2,586	76	2,670	93
A1185 (west of A178 Seaton Carew Road)	72	5,651	1,026	5,961	1,082	6,022	1,117
Site Access	32	0	0	0	0	970	99

Emissions Data

8A.5.17 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 11.0. The assessment considers the construction phase impact of road traffic emissions at receptors adjacent to roads in the vicinity of the Proposed Development Site.

Modelled Domain – Discrete Receptors

8A.5.18 In line with guidance and standard practice, representative worst-case receptors located within 200 m of road links associated with the Proposed Development (i.e., the Study Area for the traffic assessment) 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.

8A.5.19 This report has considered all receptors that appear within 200 m of any road that was screened in using the criteria presented in Table 8A-9.

8A.5.20 The receptors for which the impact of road traffic emissions have been predicted are listed in Table 8A-12 and Table 8A-13 (R = Road Receptor and RE = Road Ecological Receptor).

Table 8A-12: Modelled Human Receptors

RECEPTOR ID	X (M)	Y (M)	DESCRIPTION
R_001	450068	521631	Saltview Terrace, Stockton-on-Tees, Middlesbrough TS2 1SQ
R_002	450049	521620	Saltview Terrace, Stockton-on-Tees, Middlesbrough TS2 1SQ
R_003	449463	521974	High Clarence Primary School. Port Clarence Road, Middlesbrough TS2 1SU
R_004	449092	522334	2 Fieldview Close, Stockton-on-Tees, Middlesbrough TS2 1TN
R_005	455429	520571	87 Broadway, Middlesbrough TS6 7HS
R_006	455434	520610	51 Eversham Road, Middlesbrough TS6 7ER
R_007	455189	520409	Grangetown Primary School, St Georges Rd W, Middlesbrough TS6 7JA
R_008	455306	520890	139 Bolckow Road, Grangetown, Middlesbrough TS6 7EJ

RECEPTOR ID	X (M)	Y (M)	DESCRIPTION
R_009	454846	520708	8 St Nicholas Close, Grangetown, Middlesbrough TS6 7SY
R_010	459216	524569	2 Kirkleatham Lane, Redcar TS10 5BZ
R_011	459262	524598	4 Corporation Road, Redcar TS10 1PB
R_012	456153	518576	2 Keepersgate, Eston, Middlesbrough TS6 9NY
R_013	456240	519019	19 Moorgate, Middlesbrough, TS6 9QE
R_014	456043	518989	19 Gaisdale Close, Middlesbrough, TS6 8DG
R_015	456119	518963	239 Wychgate, Middlesbrough TS6 9LW
R_016	456477	519134	23 High Street, Middlesbrough, TS6 8DL
R_017	458240	520240	North Lodge, Wilton, Lazenby, Redcar TS10 4QZ
R_018	457463	519859	Wilton Primary School, 12 High Street, Lazenby, Middlesbrough TS6 8DX
R_019	457559	519861	2 Grange Estate, Middlesbrough TS6 8EJ
R_020	457455	519763	Brookfield Care Home, High Street, Lazenby, Middlesbrough TS6 8DX
R_021	457311	519649	10 Chestnut Close, Middlesbrough TS6 8DT
R_022	457016	519403	Police House, Eston Road, Lazenby, Middlesbrough TS6 8DW

Table 8A-13: Modelled Ecological Receptors

RECEPTOR ID	X (M)*	Y (M)*	DESCRIPTION
RE001	450640	523527	Teesmouth and Cleveland Coast SSSI and SPA
RE002	458966	524537	Teesmouth and Cleveland Coast SSSI and SPA and Coathem Marsh LWS
RE003	457334	525348	Teesmouth and Cleveland Coast SSSI
RE004	446972	523081	Charlton's Pond LNR
RE005	450050	521413	Teesmouth and Cleveland Coast SSSI and SPA
RE006	450744	522993	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA
RE007	450758	522995	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA
RE008	451133	523662	Teesmouth and Cleveland Coast SSSI and SPA
RE009	450050	521413	Teesmouth and Cleveland Coast SSSI and SPA

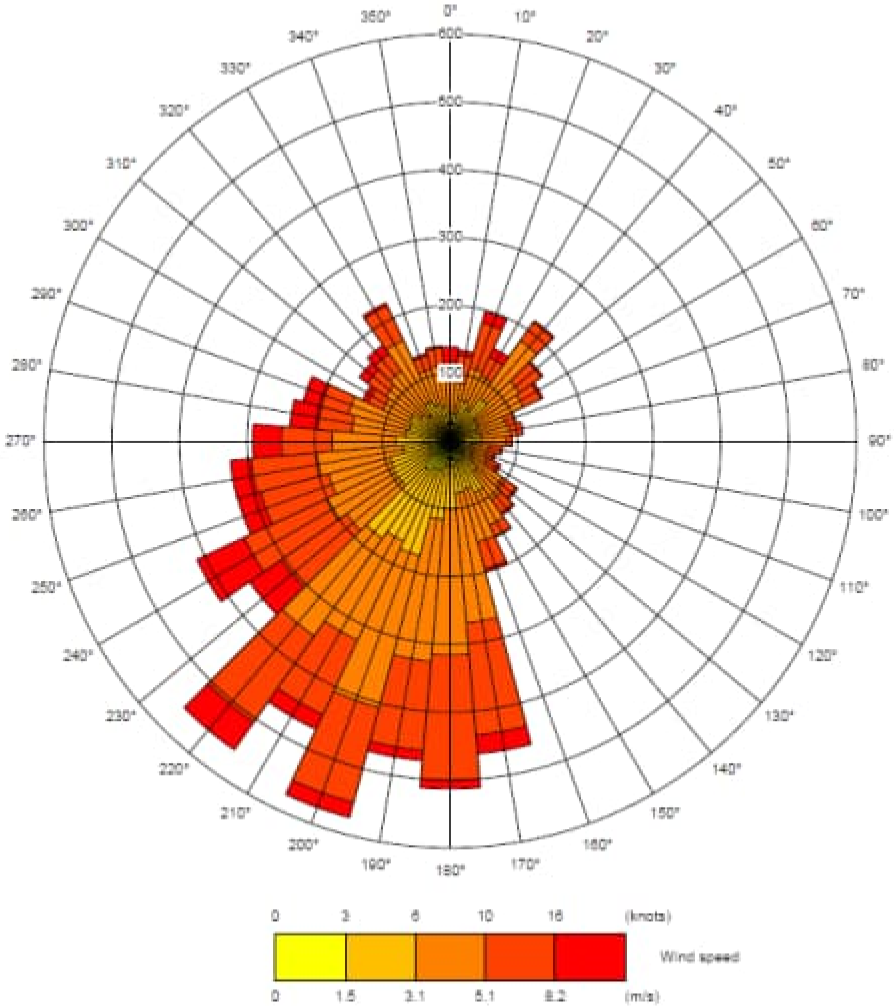
RECEPTOR ID	X (M)*	Y (M)*	DESCRIPTION
RE010	456441	518679	Wilton Woods Complex LWS

**Coordinate of the closest point to the modelled road, other points were also model to form a transect up to 200 m from the road's edge.*

Meteorological Data

8A.5.21 The model runs carried out for the Proposed Development used hourly sequential data from Durham Tees Valley, 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 21 km south-west of the Study Area with a measured prevailing wind of between 3 and 5 m/s from south-south-west. A wind rose for this site is presented in Plate 8A-1.

Plate 8A-1: Durham Tees Valley 2019 Wind Rose



Background Concentrations

8A.5.22 Annual average background concentrations were taken from Defra's 2018 baseline 1 x 1 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 1 x 1 km grid square in Table 8A-14. The Defra background concentrations have been compared against local authority background monitoring, which has suggested no uplift is required. Additionally, to provide for a conservative assessment, 2019 background concentrations have been used in the assessment of the construction phase, as can be seen in Table 8A-4 lower concentrations are expected in 2025 and so using 2019 backgrounds will result in higher total pollutant concentrations.

Table 8A-14: Modelled Background Concentrations

POLLUTANT	YEAR	CONCENTRATION RANGE ACROSS THE STUDY AREA (µG/M^3)
NO_2	2019	10.7 - 20.6
	2025	8.8 – 17.0
PM_{10}	2019	11.0 – 13.2
	2025	10.3 – 12.4
$PM_{2.5}$	2019	7.1 – 7.9
	2025	6.5 – 7.2

Consideration of Terrain

8A.5.23 Emissions from road traffic make the greatest contribution to pollutant concentrations at sensitive receptors adjacent to 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.

NO_x to NO_2 Conversion

8A.5.24 To accompany the publication of a previous version of the guidance document LAQM.TG(22) (Defra, 2022), a NO_x 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 8.1 (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, Redcar and Cleveland Borough Council (RCBC) has been specified as the local authority and the 'All other non-urban UK traffic' mix selected.

Bias Adjustment of Road Contribution NO_x, NO_2, PM_{10} and $PM_{2.5}$

8A.5.25 The modelled road NO_x contributions from the ADMS-Roads model has been adjusted for bias following the method described in LAQM.TG(22). The purpose of this exercise is to bring the baseline model performance in line with known pollutant concentrations at set locations within the model domain. The level of adjustment identified in the baseline scenario is then applied to future scenarios.

8A.5.26 Monitoring data used for model verification typically includes that sourced from local authorities, if appropriate, and data gathered by project-specific baseline surveys. A baseline NO_2 monitoring survey has been undertaken for the Proposed Development which included 21 monitoring locations. From these 21 monitoring locations DT1, DT2, DT4, DT5, DT6, DT7, DT8, DT18 and DT21 were on the roadside of roads included in the model and therefore these were appropriate to use in the construction road traffic model verification.

8A.5.27 Where diffusion tube monitoring survey has taken place for less than 12 months, it is necessary to annualise the monitoring results using the method described in LAQM.TG(22) in order to obtain a projected annual mean concentration for the existing baseline year of the assessment. This provides a monitored dataset against which modelled concentrations can be directly compared.

8A.5.28 Annualisation involves comparing the monitored diffusion tube concentrations from the survey to concentrations monitored at nearby (<50 km away) background continuous monitoring stations over the same period (July 2022 – Oct 2022). Monitored diffusion tube concentrations are adjusted using the Ra factor, which is the average of ratios between the period mean (Pm) and annual mean (Am) for each continuous monitor. Diffusion tubes concentrations are then adjusted using a national bias adjustment factor which accounts for systematic bias arising in the treatment of diffusion tubes during laboratory analysis. 2019 was used as it is the year the traffic assessment was completed and the last year without any impacts from Covid-19. The resultant NO_2 concentrations are presented in Table 8A-15.

Table 8A-15: Annualisation of Diffusion Tube Data

SITE	UNADJUSTED MEAN (µG/M^3)	ANNUALISED MEAN, A_M (µG/M^3) / PERIOD MEAN, P_M (µG/M^3)	BIAS ADJUSTED MEAN NO_2 (µG/M^3)
DT1	23.4	1.4	29.7
DT2	34.9	1.4	44.3
DT3	14.3	1.4	18.2
DT4	16.5	1.4	20.9
DT5	17.2	1.4	21.8
DT6	39.1	1.4	49.7
DT7	23.4	1.4	29.7
DT8	17.2	1.4	21.8

SITE	UNADJUSTED MEAN (µG/M^3)	ANNUALISED MEAN, A_M (µG/M^3) / PERIOD MEAN, P_M (µG/M^3)	BIAS ADJUSTED MEAN NO_2 (µG/M^3)
DT9	12.7	1.4	16.2
DT10	9.6	1.4	12.2
DT11	11.4	1.4	14.5
DT12	9.0	1.4	11.4
DT13	15.2	1.4	19.3
DT14	13.5	1.23	15.1
DT15	15.2	1.5	20.7
DT16	14.8	1.4	18.8
DT17	14.6	1.5	19.9
DT18	18.5	1.5	25.3
DT19	13.0	1.4	16.5
DT20	15.1	1.4	19.2
DT21	19.9	1.4	25.3

The continuous monitoring stations used for annualisation are Middlesborough, Stockton-on-Tees and Billingham, all part of the Defra's Automatic Urban Rural Network (AURN)

8A.5.29 A review of existing and publicly available local authority data has been undertaken and found that no monitoring locations were suitable for model verification.

8A.5.30 Verification calculations yielded a bias adjustment factor of 3.03 with a Root Mean Square Error (RMSE) of 5.2. An RMSE of less than 10% of the air quality objective (10% of 40.0 µg/m^3 is 4.0 µg/m^3) is considered ideal and an RMSE of less than 25% of the air quality objective (25% of 40.0 µg/m^3 is 10.0 µg/m^3) is considered acceptable.

8A.5.31 A second verification zone was defined, including all tubes next to acceleration zones as the model behaved differently there. This means DT2 and DT6 were separated off the main verification zone. However, as there are no sensitive receptors nearby, this separate factor was not used for any selected receptors.

Table 8A-16: Summary of the Bias Adjustment Process

TUBE ID	ZONE	2019 ANNUALISED MONITORED ROAD NO_X	2019 ANNUAL MEAN MODELLED ROAD NO_X (µG/M^3) BEFORE ADJUST-MENT	2019 ANNUAL MEAN MODELLED ROAD NO_X (µG/M^3) AFTER ADJUSTMENT	VERIFICATION FACTOR FOR ROAD NO_X ADJUSTMENT
DT1	Main	30.7	8.2	25.0	3.03

TUBE ID	ZONE	2019 ANNUALISED MONITORED ROAD NO_X	2019 ANNUAL MEAN MODELLED ROAD NO_X (µG/M^3) BEFORE ADJUST-MENT	2019 ANNUAL MEAN MODELLED ROAD NO_X (µG/M^3) AFTER ADJUSTMENT	VERIFICATION FACTOR FOR ROAD NO_X ADJUSTMENT
DT4		15.7	7.7	19.4	
DT5		17.4	6.4	30.8	
DT7		37.1	10.2	17.4	
DT8		19.8	11.0	28.7	
DT18		19.2	5.7	19.6	
DT21		9.1	9.5	16.9	

8A.5.32 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.

8A.5.33 There is insufficient roadside measurement data for the primary pollutants PM_{10} or $PM_{2.5}$ within the Study Area. 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(22).

Predicting the Number of Days in Which the NO_2 Hourly Mean Objective is Exceeded

8A.5.34 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.

8A.5.35 In 2003, Laxen and Marner (Laxen and Marner, 2003) 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/m^3 and above.*'

8A.5.36 The findings presented by Laxen and Marner (2003) are further supported by AEAT (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*.'

8A.5.37 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

8A.5.38 The guidance document LAQM.TG(03) (Defra, 2003) 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(22) suggests no change to this method. As such, the formula used within this assessment is:

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

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

Specialized Model Treatments

8A.5.39 No specialised model treatments have been used in the assessment of construction road traffic emissions.

Calculation of Nitrogen Deposition for Ecological Receptors

8A.5.40 Conversion factors for calculating nitrogen deposition from modelled NO_2 are found in the DMRB LA 105 Air Quality (Highways England, 2019).

8A.5.41 The conversion rates and factors used in the assessment are detailed in Table 8A-17.

Table 8A-17: Conversion factors – calculation of nutrient nitrogen deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLANDS (M/S)	DEPOSITION VELOCITY FORESTS (M/S)	CONVERSION FACTOR (µG/M^3/S TO KG/HA/YR)
NOX as NO_2	0.0015	0.003	96

Results of the Construction Traffic Assessment

8A.5.42 The predicted change in annual mean NO_2 concentrations that are predicted to occur due to traffic associated with Proposed Development construction works at the selected sensitive receptors, are presented in Table 8A-18. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8A.5.43 The maximum predicted change in annual mean NO_2 concentrations at the selected sensitive receptors is +0.1 µg/m^3, which would occur in the vicinity of receptors near Saltview Terrace (R_001), Broadway (R_005), Eversham Road (R_006), Bolckow Road (R_008), St Nicholas Close (R_009) and Kirkleatham Lane (R_010). The reported change in NO_2 concentration at this location is predominantly due to the impact of emissions from construction road traffic.

8A.5.44 The total annual mean NO_2 at all the receptors would remain below the annual mean NO_2 Air Quality Assessment Level (AQAL), with the highest total concentration at receptor R003, therefore the change is not predicted to lead to a risk of the annual mean or the hourly mean AQAL being exceeded.

8A.5.45 The significance of the predicted change in annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations during Proposed Development construction in planning terms is discussed in Chapter 8: Air Quality (refer to PEI Report, Volume I).

Table 8A-18: Predicted change in annual mean NO_2 concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions, with comparison against AQAL.

RECEPTOR	2025 BASELINE	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
R_001	19.4	0.1	0.1	19.5	48.6
R_002	19.7	<0.1	0.1	19.8	49.4
R_003	25.6	<0.1	0.1	25.6	64.1
R_004	18.9	<0.1	0.1	19.0	47.4
R_005	16.2	0.1	0.2	16.3	40.6
R_006	17.4	0.1	0.1	17.5	43.7
R_007	14.2	<0.1	0.1	14.2	35.6
R_008	16.1	0.1	0.2	16.2	40.4
R_009	16.1	0.1	0.1	16.2	40.5
R_010	18.2	0.1	0.1	18.3	45.7
R_011	17.8	<0.1	0.1	17.8	44.6
R_012	20.3	<0.1	<0.1	20.3	50.7
R_013	15.8	<0.1	0.1	15.8	39.5
R_014	12.8	<0.1	0.1	12.8	32.0
R_015	14.4	<0.1	<0.1	14.4	36.0
R_016	18.1	<0.1	0.1	18.2	45.4
R_017	15.3	<0.1	<0.1	15.3	38.2
R_018	12.3	<0.1	<0.1	12.3	30.8
R_019	14.0	<0.1	0.1	14.1	35.1
R_020	14.0	<0.1	0.1	14.1	35.1
R_021	14.9	<0.1	0.1	15.0	37.4
R_022	15.4	<0.1	0.1	15.4	38.6

8A.5.46 Change in annual mean PM_{10} and $PM_{2.5}$ concentrations at discrete receptors that would occur from the road traffic associated with the construction of the Proposed Development, at the selected sensitive receptors, is presented in Table 8A-19 and Table 8A-20. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8A.5.47 The maximum predicted change in annual mean PM_{10} and $PM_{2.5}$ concentrations at the selected sensitive receptors is +0.1 µg/m^3. This change in annual mean PM_{10} and $PM_{2.5}$ concentrations would not be a perceptible at air quality sensitive receptors, nor would it result in additional days on which the PM_{10} 24-hour objective is exceeded.

8A.5.48 The predicted annual mean concentrations are well below the respective AQAL for PM_{10} and $PM_{2.5}$.

Table 8A-19: Predicted change in annual mean PM_{10} concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions, with comparison against AQAL.

RECEPTOR	2025 BASELINE	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL	EXCEEDANCES (NB OF DAYS)
R_001	12.6	<0.1	<0.1	12.7	25.3	<1
R_002	12.7	<0.1	<0.1	12.8	25.5	<1
R_003	13.6	<0.1	<0.1	13.6	27.2	<1
R_004	12.6	<0.1	<0.1	12.6	25.3	<1
R_005	13.1	<0.1	0.1	13.1	26.2	<1
R_006	13.6	<0.1	0.1	13.6	27.3	<1
R_007	12.2	<0.1	<0.1	12.2	24.4	1
R_008	13.1	<0.1	0.1	13.2	26.4	<1
R_009	13.2	<0.1	0.1	13.2	26.4	<1
R_010	13.0	<0.1	<0.1	13.1	26.1	1
R_011	12.8	<0.1	<0.1	12.9	25.7	1
R_012	15.2	<0.1	0.1	15.2	30.4	<1
R_013	15.0	<0.1	<0.1	15.0	30.1	<1
R_014	12.5	<0.1	<0.1	12.5	25.0	1
R_015	13.1	<0.1	<0.1	13.1	26.3	<1
R_016	16.0	<0.1	<0.1	16.0	32.1	<1
R_017	13.2	<0.1	<0.1	13.2	26.3	<1
R_018	12.1	<0.1	<0.1	12.1	24.1	1
R_019	12.8	<0.1	<0.1	12.8	25.6	1
R_020	12.8	<0.1	<0.1	12.8	25.6	1
R_021	13.2	<0.1	<0.1	13.2	26.4	<1
R_022	13.3	<0.1	<0.1	13.3	26.6	<1

Table 8A-20: Predicted change in annual mean $PM_{2.5}$ concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions, with comparison against AQAL.

RECEPTOR	2025 BASELINE	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
R_001	8.1	<0.1	0.1	8.1	40.5
R_002	8.1	<0.1	0.1	8.2	40.8
R_003	8.6	<0.1	0.1	8.7	43.3
R_004	8.0	<0.1	<0.1	8.0	40.2
R_005	8.3	<0.1	0.1	8.3	41.7
R_006	8.6	<0.1	0.1	8.6	43.2
R_007	7.9	<0.1	<0.1	7.9	39.3
R_008	8.4	<0.1	0.1	8.4	42.0
R_009	8.4	<0.1	0.1	8.4	41.9
R_010	8.4	<0.1	0.1	8.4	42.0
R_011	8.3	<0.1	<0.1	8.3	41.5
R_012	9.3	<0.1	0.1	9.3	46.5
R_013	8.9	<0.1	<0.1	8.9	44.4
R_014	7.8	<0.1	<0.1	7.8	39.0
R_015	8.2	<0.1	<0.1	8.2	40.8
R_016	9.4	<0.1	<0.1	9.4	47.1
R_017	8.0	<0.1	<0.1	8.0	40.0
R_018	7.5	<0.1	<0.1	7.6	37.8
R_019	7.9	<0.1	<0.1	8.0	39.8
R_020	7.9	<0.1	<0.1	8.0	39.8
R_021	8.2	<0.1	<0.1	8.2	40.8
R_022	8.2	<0.1	<0.1	8.2	41.1

8A.5.49 Table 8A-21 and Table 8A-22 display the relevant information and assessment results for the significance of construction traffic impacts of ecological sites to be discussed in Chapter 12: Ecology and Nature Conservation (PEI Report, Volume I).

Table 8A-21: Dispersion modelling results for ecological receptors – NOx Annual Mean (µg/m^3)

RECEPTOR*	SITE NAME	BACKGROUND	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE001	Teesmouth and Cleveland Coast SSSI and SPA	13.7	0.1	0.3	17.9	59.7
RE002	Teesmouth and Cleveland Coast SSSI and SPA and Coathem Marsh LWS	13.3	0.2	0.7	28.8	95.9
RE003	Teesmouth and Cleveland Coast SSSI	13.2	0.2	0.7	13.7	45.8
RE004	Charlton's Pond LNR	14.4	0.0	<0.1	14.6	48.8
RE005	Teesmouth and Cleveland Coast SSSI and SPA	16.2	0.0	0.1	20.6	68.7
RE006	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	14.5	0.2	0.5	23.1	76.9
RE007	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	14.5	0.2	0.6	27.9	93.1
RE008	Teesmouth and Cleveland Coast SSSI and SPA	13.7	0.4	1.2	24.8	82.6
RE009	Teesmouth and Cleveland Coast SSSI and SPA	16.2	<0.1	<0.1	16.9	56.2
RE010	Wilton Woods Complex LWS	11.0	<0.1	0.1	19.6	65.4

**Full transect results available in Annex A where "change as % of AQAL" is >1%*

Table 8A-22: Dispersion modelling results for ecological receptors – nutrient nitrogen deposition (kgN/ha/yr)

RECEPTOR*	SITE NAME	BACKGROUND	CRITAL LOAD (AQAL)	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE001	Teesmouth and Cleveland Coast SSSI and SPA	8.27	8	0.01	0.1	8.6	107.3
RE002	Teesmouth and Cleveland Coast SSSI and SPA and Coathem Marsh LWS	6.8	8	0.02	0.2	7.9	99.2
RE003	Teesmouth and Cleveland Coast SSSI	10.92	8	0.02	0.2	11.0	137.0
RE004	Charlton's Pond LNR	7.75	10	0.00	<0.1	7.8	78.0
RE005	Teesmouth and Cleveland Coast SSSI and SPA	8.27	8	0.00	<0.1	8.6	107.5
RE006	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	8.27	8	0.01	0.1	8.9	111.3

RECEPTOR*	SITE NAME	BACKGROUND	CRITAL LOAD (AQAL)	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE007	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	8.27	8	0.01	0.2	9.3	115.6
RE008	Teesmouth and Cleveland Coast SSSI and SPA	8.27	8	0.03	0.3	9.1	113.6
RE009	Teesmouth and Cleveland Coast SSSI and SPA	8.27	8	<0.01	<0.1	8.3	104.0
RE010	Wilton Woods Complex LWS	11.34	10	<0.01	<0.1	12.7	126.8

**Full transect results available in Annex A where ”change as % of AQAL” is >1%*

8A.5.50 It is considered that the assessment of construction traffic impacts carried out would be comparable with, or less than, the likely impacts associated with traffic impacts associated with Proposed Development decommissioning activities.

Conclusions

8A.5.51 This report has assessed the impact on local air quality of the construction and demolition activities associated with the Proposed Development. The assessment has used a sensitivity assessment methodology to assess the likelihood and scale of impacts on sensitive receptors located in the vicinity of the Proposed Development Site as associated with dust arisings from the construction and demolition activities and associated road traffic.

8A.5.52 The evaluation of expected dust arisings from the proposed construction and demolition works 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. However, appropriate mitigation measures for managing these risks will be set out in the CEMP and which will be in accordance with IAQM guidance. Such measures will be formalised through the Final CEMP to be prepared and implemented by the construction contractor. Through implementation of these mitigation measures, no significant dust effects are predicted on any sensitive receptors.

8A.5.53 The impacts of emissions from construction traffic are likely to result in insignificant effects, given the magnitude of change is considered to be negligible where human receptors are present.

8A.6 References

- AEAT. (2008). Analysis of the Relationship Between Annual Mean Nitrogen Dioxide Concentration and Exceedances of the 1-Hour Mean AQS Objective.
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ANNEX A

Dispersion modelling results for ecological receptor transects – NOx Annual Mean (µg/m^3)

RECEPTOR*	SITE NAME	BACKGROUND	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE001_20.45m	Teesmouth and Cleveland Coast SSSI and SPA	13.7	0.1	0.3%	17.9	59.7%
RE001_30m		13.7	0.1	0.3%	17.1	56.8%
RE001_40m		13.7	0.1	0.2%	16.5	55.0%
RE001_50m		13.7	0.1	0.2%	16.2	53.8%
RE001_60m		13.7	<0.1	0.2%	15.9	53.0%
RE001_70m		13.7	<0.1	0.1%	15.7	52.4%
RE001_80m		13.7	<0.1	0.1%	15.6	51.9%
RE001_90m		13.7	<0.1	0.1%	15.4	51.5%
RE001_100m		13.7	<0.1	0.1%	15.4	51.2%
RE001_110m		13.7	<0.1	0.1%	15.3	50.9%
RE001_120m		13.7	<0.1	0.1%	15.2	50.7%
RE001_130m		13.7	<0.1	0.1%	15.1	50.5%
RE001_140m		13.7	<0.1	0.1%	15.1	50.3%
RE001_150m		13.7	<0.1	0.1%	15.0	50.1%
RE001_160m		13.7	<0.1	0.1%	15.0	50.0%
RE001_170m		13.7	<0.1	0.1%	15.0	49.9%
RE001_180m		13.7	<0.1	0.1%	14.9	49.8%
RE001_190m		13.7	<0.1	0.1%	14.9	49.7%
RE001_200m		13.7	<0.1	0.1%	14.9	49.6%
RE002_5m	Teesmouth and Cleveland Coast SSSI and SPA and Coathem Marsh LWS	13.3	0.2	0.7%	28.8	95.9%
RE002_10m		13.3	0.2	0.5%	24.8	82.7%
RE002_15m		13.3	0.2	0.5%	22.6	75.3%
RE002_20m		13.3	0.1	0.4%	21.1	70.4%
RE002_25m		13.3	0.1	0.4%	20.1	67.1%
RE002_35m		13.3	0.1	0.2%	18.7	62.4%
RE002_45m		13.3	0.1	0.2%	17.9	59.6%
RE002_55m		13.3	0.1	0.2%	17.3	57.6%
RE002_65m		13.3	0.1	0.2%	16.8	56.2%
RE002_75m		13.3	0.1	0.2%	16.5	55.0%

RECEPTOR*	SITE NAME	BACKGROUND	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE002_85m		13.3	0.1	0.2%	16.2	54.1%
RE002_95m		13.3	0.1	0.2%	16.0	53.4%
RE002_105m		13.3	<0.1	0.2%	15.8	52.7%
RE002_130m		13.3	<0.1	0.1%	15.5	51.6%
RE002_155m		13.3	<0.1	0.1%	15.2	50.7%
RE002_180m		13.3	<0.1	0.1%	15.0	50.1%
RE002_200m		13.3	<0.1	0.1%	14.9	49.7%
RE006_3.15m	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	13.2	0.2	0.7%	13.7	45.8%
RE006_10m		13.2	0.2	0.6%	13.7	45.8%
RE006_20m		13.2	0.2	0.6%	13.7	45.8%
RE006_30m		13.2	0.2	0.6%	13.7	45.8%
RE006_40m		13.2	0.2	0.6%	13.7	45.8%
RE006_50m		13.2	0.2	0.5%	13.7	45.7%
RE006_60m		13.2	0.2	0.5%	13.7	45.7%
RE006_70m		13.2	0.1	0.5%	13.7	45.7%
RE006_80m		13.2	0.1	0.5%	13.7	45.7%
RE006_90m		13.2	0.1	0.4%	13.7	45.6%
RE006_100m		13.2	0.1	0.4%	13.7	45.6%
RE006_110m		13.2	0.1	0.4%	13.7	45.6%
RE006_120m		13.2	0.1	0.4%	13.7	45.6%
RE006_130m		14.4	<0.1	0.0%	14.6	48.8%
RE006_140m		14.4	<0.1	0.0%	14.6	48.8%
RE006_150m		14.4	<0.1	0.0%	14.6	48.7%
RE006_160m		14.4	<0.1	0.0%	14.6	48.7%
RE006_170m		14.4	<0.1	0.0%	14.6	48.7%
RE006_180m		16.2	<0.1	0.1%	20.6	68.7%
RE006_190m		16.2	0.1	0.2%	19.9	66.2%
RE006_200m		16.2	0.1	0.2%	19.3	64.2%
RE007_4.05m		15.2	<0.1	0.1%	17.8	59.5%
RE007_10m		15.2	<0.1	0.1%	17.5	58.4%
RE007_20m		15.2	<0.1	0.1%	17.3	57.6%
RE007_30m		15.2	<0.1	0.1%	17.1	57.0%

RECEPTOR*	SITE NAME	BACKGROUND	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE007_40m		15.2	<0.1	0.1%	16.9	56.4%
RE007_50m		15.2	<0.1	0.1%	16.8	56.0%
RE007_60m		15.2	<0.1	0.1%	16.7	55.6%
RE007_70m		15.2	<0.1	0.1%	16.6	55.3%
RE007_80m		15.2	<0.1	0.1%	16.5	55.0%
RE007_90m		15.2	<0.1	0.1%	16.4	54.8%
RE007_100m		15.2	<0.1	0.1%	16.4	54.6%
RE007_110m		15.2	<0.1	0.1%	16.3	54.4%
RE007_120m		15.2	<0.1	0.1%	16.3	54.2%
RE007_130m		15.2	<0.1	0.1%	16.2	54.1%
RE007_140m		15.2	<0.1	0.1%	16.2	54.0%
RE007_150m		14.5	0.2	0.5%	23.1	76.9%
RE007_160m		14.5	0.1	0.3%	19.9	66.4%
RE007_170m		14.5	0.1	0.2%	18.2	60.5%
RE007_180m		14.5	0.1	0.2%	17.3	57.8%
RE007_190m		14.5	<0.1	0.2%	16.8	56.1%
RE007_200m		14.5	<0.1	0.1%	16.5	55.0%
RE008_0m	Teesmouth and Cleveland Coast SSSI and SPA	14.5	<0.1	0.1%	16.3	54.2%
RE008_10m		14.5	<0.1	0.1%	16.1	53.7%
RE008_20m		14.5	<0.1	0.1%	16.0	53.2%
RE008_30m		14.5	<0.1	0.1%	15.8	52.8%
RE008_40m		14.5	<0.1	0.1%	15.8	52.5%
RE008_50m		14.5	<0.1	0.1%	15.7	52.2%
RE008_60m		14.5	<0.1	0.1%	15.6	52.0%
RE008_70m		14.5	<0.1	0.1%	15.5	51.8%
RE008_80m		14.5	<0.1	0.1%	15.5	51.7%
RE008_90m		14.5	<0.1	0.1%	15.5	51.5%
RE008_100m		14.5	<0.1	0.1%	15.4	51.4%
RE008_110m		14.5	<0.1	0.1%	15.4	51.3%
RE008_120m		14.5	<0.1	0.1%	15.3	51.2%
RE008_130m		14.5	<0.1	0.1%	15.3	51.1%
RE008_140m		14.5	<0.1	0.1%	15.3	51.0%

RECEPTOR*	SITE NAME	BACKGROUND	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE008_150m		14.5	0.2	0.6%	27.9	93.1%
RE008_160m		14.5	0.2	0.5%	23.6	78.8%
RE008_170m		14.5	0.1	0.4%	20.6	68.8%
RE008_180m		14.5	0.1	0.3%	19.2	64.1%
RE008_190m		14.5	0.1	0.3%	18.4	61.2%
RE008_200m		14.5	0.1	0.2%	17.8	59.3%

Dispersion modelling results for ecological receptor transects – nutrient nitrogen deposition (kgN/ha/yr)

RECEPTOR*	SITE NAME	BACKGROUND	CRITAL LOAD (AQAL)	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE008_0m	Teesmouth and Cleveland Coast SSSI and SPA	8.3	8	0.03	0.3%	9.1	113.6%
RE008_10m		8.3	8	0.01	0.2%	8.7	108.5%
RE008_20m		8.3	8	0.01	0.1%	8.6	107.0%
RE008_30m		8.3	8	0.01	0.1%	8.5	106.2%
RE008_40m		8.3	8	0.01	0.1%	8.5	105.8%
RE008_50m		8.3	8	0.01	0.1%	8.4	105.5%
RE008_60m		8.3	8	0.01	0.1%	8.4	105.3%
RE008_70m		8.3	8	<0.01	0.1%	8.4	105.1%
RE008_80m		8.3	8	<0.01	0.1%	8.4	105.0%
RE008_90m		8.3	8	<0.01	0.1%	8.4	104.9%
RE008_100m		8.3	8	<0.01	0.1%	8.4	104.8%
RE008_110m		8.3	8	<0.01	0.1%	8.4	104.7%
RE008_120m		8.3	8	<0.01	<0.1%	8.4	104.6%
RE008_130m		8.3	8	<0.01	<0.1%	8.4	104.6%
RE008_140m		8.3	8	<0.01	<0.1%	8.4	104.5%
RE008_150m		8.3	8	<0.01	<0.1%	8.4	104.5%
RE008_160m		8.3	8	<0.01	<0.1%	8.4	104.4%
RE008_170m		8.3	8	<0.01	<0.1%	8.4	104.4%
RE008_180m		8.3	8	<0.01	<0.1%	8.3	104.4%

RECEPTOR*	SITE NAME	BACKGROUND	CRITAL LOAD (AQAL)	CHANGE DUE TO ROAD	CHANGE AS % OF AQAL	TOTAL	TOTAL AS % OF AQAL
RE008_190m		8.3	8	<0.01	<0.1%	8.3	104.4%
RE008_200m		8.3	8	<0.01	<0.1%	8.3	104.3%

H2Teesside Project

Preliminary Environmental Information Report

Volume III – Appendices

Appendix 8B: Operational Phase Assessment

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)

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8B.0 OPERATIONAL PHASE – AIR QUALITY ASSESSMENT

8B.1 Introduction

8B.1.1 This Technical Appendix supports Chapter 8: Air Quality, of the Preliminary Environmental Impact Report (PEI Report, Volume I) and describes the additional details for the dispersion modelling of point source emissions from the Proposed Development once operational.

8B.1.2 This assessment considers the likely significant effects on air quality as a result of the normal and non-routine (start-up and emergency) operation of the Proposed Development. For more details about the Proposed Development, refer to Chapter 4: Proposed Development (PEI Report, Volume I).

8B.1.3 Emissions associated with the operational Proposed Development have the potential to affect human health and sensitive ecosystems, if not appropriately managed. This Technical Appendix identifies and proposes measures required to address potential impacts and significant effects of the Proposed Development on air quality during its operational phase.

8B.1.4 The magnitude of air quality impacts at sensitive human and ecological receptors has been quantified for pollutants emitted from the main stacks associated with the Proposed Development. The impact of emissions on sensitive ecological receptors has been considered in the context of relevant critical levels and critical loads for designated and non-designated ecological sites.

8B.1.5 The assessment has considered emissions from the fired heaters, boilers, flares and emergency diesel generators during different operational conditions once Phase 2 is complete. Non routine emissions, such as those which may occur during the commissioning process or other short-term events would typically only occur on an infrequent basis, would be detected by the process control system and rectified within a short time period. The plant operation will be tightly regulated by the Environment Agency through the Environmental Permit required for the operation of the Proposed Development. Emissions during non-routine operation have the potential for significant short-term effects at sensitive receptors, and an assessment has been undertaken of non-routine operational scenarios.

8B.2 Scope

<u>Operational Traffic Emissions</u>

8B.2.1 No assessment of operational traffic emissions has been made, as the numbers of additional vehicles associated with the operational phase of the Proposed Development are below the DMRB and IAQM screening criteria for requiring such assessment. In addition, the predicted impacts for the construction phase traffic emissions showed that the effect of additional construction traffic was not significant at all receptors. The number of additional vehicles for the operational phase is well below the numbers assessed for the construction phase and therefore it is considered that the effect of operational traffic is also not significant, and that there will therefore be no in-combination effects with the operational traffic and operation Proposed Development.

Combustion Plant and Carbon Capture Plant

8B.2.2 The assessment has considered the impact of operational process emissions on local air quality, under normal operating conditions, with the fired heater and pilot flare operating for 8,760 hours per year, as this represents the worst case for annual average impacts. The assessment considers impacts in the earliest year in which the Proposed Development is due to commence operation, 2030.

8B.2.3 The assessment also considers two non-routine operating scenarios for the assessment of short-term impacts. These scenarios include different sources and fuel types, which can lead to different emission rates than during normal operation.

8B.2.4 The scenarios and sources included in this assessment are:

- Start Up – including Fired Heater (natural gas fired), flare (to include pilot and flare operating as in Emergency scenario, and Auxiliary Boiler (natural gas fired);
- Normal operation – including Fired Heater (hydrogen and tailings gas fired) and flare in normal operation; and
- Emergency – including Emergency flare operation and emergency diesel generators.

8B.2.5 The carbon capture plant (CCP) is designed as a closed loop system, as part of the hydrogen generation process and is not part of the combustion process for the Fired Heater or Auxiliary Boilers. Due to this, there are no predicted emissions from the CCP, and no assessment of the CCP has been undertaken within this Technical Appendix.

8B.2.6 The Study Area for the operational Proposed Development point source emissions extends up to 10 km from the Fired Heater in the Proposed Development Site, in to assess the potential impacts on ecological receptors, in line with the Environment Agency risk assessment methodology (Defra and Environment Agency, 2016):

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites and Sites of Special Scientific Interest (SSSIs) within 10 km; and
- Local Nature Sites (including ancient woodlands, Local Wildlife Sites (LWS) and National and Local Nature Reserves (NNR and LNR)) within 2 km.

8B.2.7 In terms of human health receptors, impacts from the operational Proposed Development become negligible well within approximately 2 km and therefore sensitive receptors for the human health impacts only are concentrated within a 2 km Study Area.

8B.2.8 The dispersion of emissions has been predicted using the latest version of the atmospheric dispersion model ADMS (currently version 6). The results are presented in both tabular format within this Appendix and as contours of predicted ground level process contributions (PCs) overlaid on mapping of the surrounding area, and the following figures have been produced showing the predicted isopleths (PEI Report, Volume II):

- Figure 8-6: Annual Mean NO_2 Process Contribution for the Proposed Development during Normal Operations for Phase 1 and 2 Combined – Case B, for the Worst Affected Meteorological Year of 2022;
- Figure 8-7: 99.79th Percentile 1h NO_2 Process Contribution for the Proposed Development during Normal Operations for Phase 1 and 2 Combined – Case B, for the Worst Affected Meteorological Year of 2022;
- Figure 8-8: 99.79th Percentile 1h NO_2 Process Contribution for the Proposed Development during Start Up for Phase 1 and 2 Combined – Case A, for the Worst Affected Meteorological Year of 2021;
- Figure 8-9: 99.79th Percentile 1h NO_2 Process Contribution for the Proposed Development during Emergency Operations for Phase 1 and 2 Combined – Case B, for the Worst Affected Meteorological Year of 2022;

8B.2.9 The dispersion modelling assessment has concentrated on the combustion emissions associated with the operation of the Fired Heater, auxiliary boiler, operational flares (both normal and emergency) and emergency diesel generators of oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) carbon monoxide (CO), Particulate Matter (PM_{10} and $PM_{2.5}$) and sulphur dioxide (SO_2). Selective Catalytic Reduction (SCR) NOx abatement would be fitted to the Fired Heater and Auxiliary Boiler and would be used during the start-up phase while running on natural gas fuel only. This would result in short term emissions of ammonia (NH_3) due to ammonia slip until the plant are switched to the primary fuel (hydrogen). Current environmental standards have been set for the long-term impacts of ammonia and their associated effects, and short-term impacts and effects are not assessed. The short-term emissions of ammonia have not been considered within this assessment and will be reviewed for the Environmental Statement for the DCO application.

8B.2.10 Emissions from Large Combustion Plant (LCP) are currently governed by the Industrial Emissions Directive (IED Directive 2010/75/EU), which contains measures relating to the control of emissions, including setting limits on emissions to air from LCP and requires operators to monitor and report emissions.

8B.2.11 The Proposed Development would be regulated under the IED and in accordance with the LCP Best Available Technique (BAT) Reference document (BRef). The current LCP BRef and associated BAT conclusion document was issued in 2017. The recommendations of the LCP BRef are enforceable through Environmental Permits and the Environment Agency would set specific emission limits in the Environmental Permit issued to the Proposed Development, based on the BAT-associated emission levels (BAT- AELs). Emission Limits Values (ELVs) used in this assessment have been supplier by the clients FEED contractor and will be reviewed as part of the Environmental Statement.

8B.2.12 A comparison has been made between predicted model output concentrations (process contributions), and short-term and long-term Air Quality Assessment Levels (AQALs) as detailed in Chapter 8: Air Quality (PEI Report, Volume I).

Cumulative Impacts

8B.2.13 Cumulative impacts from existing sources of pollution in the area are accounted for in the adoption of site-specific background pollutant concentrations from archive sources and a programme of project-specific baseline air quality monitoring in proximity to the Proposed Development site.

8B.2.14 It is recognised, however, that there is a potential impact on local air quality from emission sources which have either received or are about to receive planning permission but have yet to come into operation.

8B.2.15 The full list of cumulative schemes to be considered for the Proposed Development has not been finalised for this PEIR, and an assessment of the cumulative impact of consented schemes with the Proposed Development will be undertaken for the Environmental Statement.

Sources of Information

8B.2.16 The information that has been used within this assessment includes pertinent information from:

- Chapter 4: Proposed Development (PEI Report Volume I);
- Data on emissions to atmosphere from the process, taken from ELVs supplied by the FEED design contractor;
- Details on the proposed site layout;
- Ordnance Survey mapping;
- Baseline air quality data from project specific monitoring, published sources and Local Authorities; and
- Meteorological data supplied by ADM Ltd.

8B.3 Methodology

Dispersion Model Selection

8B.3.1 The assessment of emissions from the Proposed Development has been undertaken using the advanced dispersion model ADMS (version V6), supplied by Cambridge Environmental Research Consultants Limited (CERC). ADMS is a modern dispersion model that has an extensive published validation history for use in the UK. This model has been extensively used throughout the UK to demonstrate regulatory compliance.

8B.3.2 The dispersion modelling undertaken for this PIER for the assessment of emissions from the operational Proposed Development includes:

- Modelling of maximum ground-level impacts at a range of release heights, between 20 m and 90 m to evaluate the effect of increasing effective release height on dispersion; and

- Reporting of impacts at identified human health and sensitive ecological receptors from the combustion plant listed in Table 8B-2 and Table 8B-3, at their design release heights above ground level.

Model Inputs

8B.3.3 The general model conditions used in the assessment are summarised in Table 8B-1. Other more detailed data used to model the dispersion of emissions is considered below.

Table 8B-1: General ADMS 5 Model Inputs

VARIABLE	INPUT
Surface Roughness at source	0.3m
surface Roughness at meteorological site	0.3m
Receptors	Selected discrete receptors (see Table 8B-6 and Table 8B-7)
	Nested receptor grid, with variable spacing (see Table 8B-8)
Receptor Location	X, Y co-ordinates determined by GIS
	Z = 1.5m for human health receptors
	Z = 0m (ground level) for ecological receptors
Source Location	See Table 8-2 and Table 8B-3
Emissions	Data provided by designer
Sources	See Table 8-2 and Table 8B-3
Meteorological Data	5 years of hourly sequential meteorological data from Durham Tees Valley Airport meteorological station (2018-2022)
Terrain Data	Not required
Buildings that may cause building downwash effects	See Table 8B-9

Emissions Data

8B.3.4 During normal operation, the Fired Heater stack would be the primary source of emissions from both the hydrogen generation processes associated with the Proposed Development.

8B.3.5 In addition, there would be a stack associated with the flare (used during normal and emergency operations), an auxiliary boiler and emergency diesel generators.

8B.3.6 The combustion emissions (NO_x, PM_{10}, $PM_{2.5}$, SO_2 and CO) associated with these sources would differ dependent on the design case taken forward. Both design cases (Case A and Case B) have been assessed, to ensure any potential differences in the predicted concentrations due to changes in the design are captured in the assessment.

8B.3.7 The main reported emissions for the Proposed Development have been modelled at a release height of approximately 40 m above finished ground level for the Fired Heater and Auxiliary Boiler, with an internal stack diameter of 1.8 m and 1.7 m respectively for Case A, and 1.35 m and 1.5 m respectively for Case B. This release height is based on the results of the Stack Height Assessment, and the design release height of the Fired Heater and Auxiliary Boiler is 65 m above ground level. It is considered that this represents a conservative assessment, and the higher release height would result in lower impacts at modelled receptor locations.

8B.3.8 For the flare, effective release heights and equivalent stack diameters have been calculated based on the operational scenario. It is considered that release parameters that would provide the greatest benefit to aid dispersion and reduce the potential impact at human health and ecological receptors, with the current model input parameters and therefore has been used in the assessment.

8B.3.9 The physical properties of assessed emission sources, as represented within the model, are shown in Table 8B-2 and Table 8B-3. The position of the stack and the buildings included within the model are illustrated in Figure 8.4: Air Quality Study Area – Operation Model Inputs Phase 1 and Figure 8.5: Air Quality Study Area – Operation Model Inputs Phase 2 (PEI Report, Volume II).

Table 8B-2: Emissions Inventory – Case A

PARAMETER	UNIT	FIRED HEATER (START-UP)	FIRED HEATER (NORMAL)	FLARE (NORMAL OPERATION)	FLARE (EMERGENCY/UPSET)	AUXILIARY BOILER (START UP)	EMERGENCY DIESEL GENERATORS
Stack Position	m	Phase 1 – 456247, 525229 Phase 2 – 456461, 525665	Phase 1 – 456247, 525229 Phase 2 – 456461, 525665	Phase 1 – 456444, 525381 Phase 2 – 456604, 525837	Phase 1 – 456444, 525381 Phase 2 – 456604, 525837	Phase 1 – 456307, 525340 Phase 2 – 456350, 525723	456506, 525203
Release Height (above ground level)	m	40	40	66.4*	103.6*	40	10
Effective internal stack diameter	m	1.8	1.8	0.9	4.4	1.7	0.96
Flue temperature	°C	214	214	1000	1000	259	600
Flue H_2O content	%	16.4	31.1	11.6	30.69	16.4	
Flue O_2 content (dry)	%	2.5	2.3	0.0	0.03	2.5	
Stack gas exit velocity	m/s	19.0	15.2	20	20	17.4	76.3
Stack flow (actual)	Am^3/s	48.4	38.5	1.0	1222.4	39.5	55.3
Stack flow (reference conditions, STP, dry)	Nm^3/s	27.1	21.6	0.2	226.7	20.7	55.3

Table 8B-3: Emissions Inventory – Case B

PARAMETER	UNIT	FIRED HEATER (START-UP)	FIRED HEATER (NORMAL)	FLARE (NORMAL OPERATION)	FLARE (EMERGENCY/UPSET)	AUXILAIRY BOILER (START UP)	AUXILAIRY BOILER (NORMAL OPERATION)	EMERGENCY DIESEL GENERATORS
Stack Position	m	Phase 1 – 456247, 525229 Phase 2 – 456461, 525665	Phase 1 – 456247, 525229 Phase 2 – 456461, 525665	Phase 1 – 456444, 525381 Phase 2 – 456604, 525837	Phase 1 – 456444, 525381 Phase 2 – 456604, 525837	Phase 1 – 456307, 525340 Phase 2 – 456350, 525723	Phase 1 – 456307, 525340 Phase 2 – 456350, 525723	456506, 525203
Release Height (above ground level)	m	40	40	66.4*	104.2*	40	40	10
Effective internal stack diameter	m	1.35	1.35	0.9	104.2	1.5	1.5	0.96
Flue temperature	°C	200	214	1000	1000	259	200	600
Flue H_2O content	%	16.4	28.8	18.2	31.0	16.4	30.9	
Flue O_2 content (dry)	%	2.5	2.3	0	0.05	2.5	1.6	
Stack gas exit velocity	m/s	17.95	15.1	20	20	22.0	15.2	76.3

PARAMETER	UNIT	FIRED HEATER (START-UP)	FIRED HEATER (NORMAL)	FLARE (NORMAL OPERATION)	FLARE (EMERGENCY/UPSET)	AUXILAIRY BOILER (START UP)	AUXILAIRY BOILER (NORMAL OPERATION)	EMERGENCY DIESEL GENERATORS
Stack flow (actual)	Am^3/s	25.7	21.6	1.0	1131.0	38.9	26.9	55.3
Stack flow (reference conditions, STP, dry)	Nm^3/s	14.8	12.1	0.2	242.7	20.0	15.5	55.3

8B.3.10 The modelled pollutant emission rates (in grams per second (g/s)) have been calculated by multiplying the emission concentration by the volumetric flow rate at normalised reference conditions. The emission rate of sulphur dioxide has been calculated based on the anticipated sulphur content of the fuel, assuming 100% conversion to sulphur dioxide. The emission limits assumed to apply to the Proposed Development are shown in Table 8B-4 and Table 8B-5..

8B.3.11 The assessment has assumed that the Proposed Development would operate at continuous design load (8,760 hours per year). No time-based variation in emissions have therefore been accounted for within the model.

Table 8B-4: Emissions Concentrations and the Assessed Emission Rates – Case A

POLLUTANT	FIRED HEATER (START-UP)		FIRED HEATER (NORMAL)		FLARE (NORMAL OPERATION)		FLARE (EMERGENCY/UPSET)		AUXILIARY BOILER (START UP)		EMERGENCY DIESEL GENERATORS	
	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)
Oxides of Nitrogen	18.81	0.510	200	4.323	13.9	0.01	88.9	20.13	78.99	1.602	195.0	10.77
Carbon monoxide	11.45	0.311	100	2.161	63.2	0.05	405.3	91.77	-[1]	0.232	51.5	2.85
Particulate Matter	5	0.136	5	0.108	33.2	0.000835	16.0	3.62	20	0.406	-[1]	-[1]
Sulphur Dioxide	-[1]	-[1]	-[1]	0.756[2]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]

1) No emission rate supplied.
2) Emissions of SO_2 calculated from sulphur content in fuel.

Table 8B-5: Emissions Concentrations and the Assessed Emission Rates – Case B

POLLUTANT	FIRED HEATER (START-UP)		FIRED HEATER (NORMAL)		FLARE (NORMAL OPERATION)		FLARE (EMERGENCY/UPSET)		AUXILAIRY BOILER (START UP)		AUXILIARY BOILER (NORMAL OPERATION)		EMERGENCY DIESEL GENERATORS	
	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/M^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)	EMISSIONS CONCENTRATION (MG/NM^3)	EMISSIONS RATE (G/S)
Oxides of Nitrogen	18.81	0.279	200	2.422	15.4	0.01	85.8	20.8	18.81	0.375	78.99	1.225	195.0	10.77
Carbon monoxide	11.45	0.170	100	1.211	70.3	0.05	391.0	94.8	11.45	0.229	-[1]	-[1]	51.5	2.85
Particulate Matter	5	0.074	5	0.061	30.9	0.000835	16.6	4.02	5	0.1	20	0.31	-[1]	-[1]
Sulphur Dioxide	-[1]	-[1]	-[1]	0.424*	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]

1) No emission rate supplied.
2) Emissions of SO_2 calculated from sulphur content in fuel

Modelled Domain – Discrete Receptors

Sensitive Human Receptors

8B.3.12 The modelling has predicted concentrations of the modelled pollutants relevant to human health at discrete air quality sensitive receptors, as listed in Table 8B-6. The locations of these receptors are also shown in Figure 8.1: Air Quality Study Area Human Health Receptors and Monitoring (PEI Report, Volume II). The receptors are selected to be representative of residential dwellings, recreational areas, and schools in the area around the Proposed Development. (OR = Operational Receptor).

Table 8B-6: Human Receptor Locations

RECEPTOR REFERENCE	RECEPTOR DESCRIPTION	GRID REFERENCE		DISTANCE AND DIRECTION FROM THE OPERATIONAL SITE
		X	Y	
O1	Residential receptor on Tod Point Road, Warrenby	457950	525045	1.28 km east
O2	Cleveland Links Golf Club	458090	525550	1.23 km east
O3	South Gare Fishermans Association	455680	527395	1.27 km north
O4	Marine Club	455550	527345	1.27 km north
O5	Redcar Beach Caravan Park	458675	525415	1.83 km east
O6	Residential receptor on Broadway West, Dormanstown	457895	523735	1.79 km southeast
O7	Residential receptor on York Road, Coatham	458900	525060	2.15 km east
O8	Dormanston Primary Academy	458250	523585	2.16 km southeast
O9	Coatham CofE Primary School	459195	524980	2.46 km east

Sensitive Ecological Receptors

8B.3.13 In accordance with the Environmental Agency's air emissions risk assessment guidance, the impacts associated with emissions from the Proposed Development on statutory sensitive ecological sites has been quantified. The assessment considers European designated sites (Special Areas of Conservation (SACs), Special Protection

Areas (SPAs) and Ramsar sites) and Sites of Special Scientific Interest (SSSIs) within 10 km of the operational Proposed Development, as recommended by the EA's risk assessment guidance for "large emitters". The most notable of these sites is the Teesmouth and Cleveland Coast Ramsar, SPA and SSSI, which is adjacent to the Proposed Development site.

8B.3.14 In additional, Local Wildlife Sites (LWSs) within 2 km of the Proposed Development have also been included in the assessment.

8B.3.15 Ground-level concentrations of the modelled pollutants relevant to sensitive ecological receptors have been predicted at locations listed in Table 8B-7 and the locations of these receptors are shown in Figure 8.2: Air Quality Study Area Ecological Receptors (PEI Report, Volume II). The location reported for each ecology site is the point closest to the Proposed Development, taken to be representative of the worst case.

Table 8B-7: Ecological Receptor Locations

RECEPTOR IDENTIFICATION	ECOLOGY SITE	GRID REFERENCE		DISTANCE AND DIRECTION FROM THE OPERATIONAL SITE
		X	Y	
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	457283	526000	410 m northeast
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	456579	526306	290 m north
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	456127	526339	170 m north
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	455726	526273	320 m west
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	456300	526098	0 m north
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	456849	525878	10 m north
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	455587	524856	320 m south

RECEPTOR IDENTIFICATION	ECOLOGY SITE	GRID REFERENCE		DISTANCE AND DIRECTION FROM THE OPERATIONAL SITE
		X	Y	
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	457860	524991	1.21 km east
OE4	Eston Pumping Station LWS	456474	523797	1.04 km south
OE5a	Teesmouth NNR	454525	527129	1.78 km northwest
OE5b	Teesmouth NNR	453980	526143	1.92 km west
OE6	Teesmouth and Cleveland Coast SSSI	455835	526155	170 m west

Modelled Domain – Receptor Grid

8B.3.16 Emissions from the Proposed Development have also been modelled on a receptor grid of variable spacing to determine the location and magnitude of maximum ground level impacts.

8B.3.17 The dispersion model output has been reported at specific receptors and as a nested grid of values. The inner grid extends 2,000 m at a resolution of 25 m x 25 m. The middle grid extends from 2,000 m to 5,000 m at a resolution of 100 m x 100 m. The outer grid extends from 5,000 m to 10,000 m at a resolution of 500 m x 500 m. Details of the receptor grid are summarised in Table 8B-8.

Table 8B-8: Modelled Domain, Receptor Grid

GRID SPACING (M)	DIMENSIONS (KM)	NUMBER OF NODES IN EACH DIRECTION	NATIONAL GRID REFERENCE OF SOUTH WEST CORNER
25	4x4	161	454461, 523665
100	10x10	101	451461, 520665
500	20x20	41	446461, 515665

Meteorological Data

8B.3.18 Actual measured hourly-sequential meteorological data is available for input into dispersion models, and it is important to select data as representative as possible for the site that will be modelled. This is usually achieved by selecting a meteorological station as close to the site as possible, although other stations may be used if the local terrain and conditions vary considerably, or if the station does not provide sufficient data.

8B.3.19 The meteorological site that was selected for the assessment is Durham Tees Valley Airport, located approximately 22 km southwest of the Proposed Development Site, at a flat airfield in a principally agricultural area, and therefore a surface roughness of 0.3 m (representative of an agricultural area) has been selected for the meteorological site within the model.

8B.3.20 The modelling for this assessment has utilised 5 years of meteorological data for the period 2018 – 2022. Wind roses for each of the years within this period are shown in Plate 8B-1.

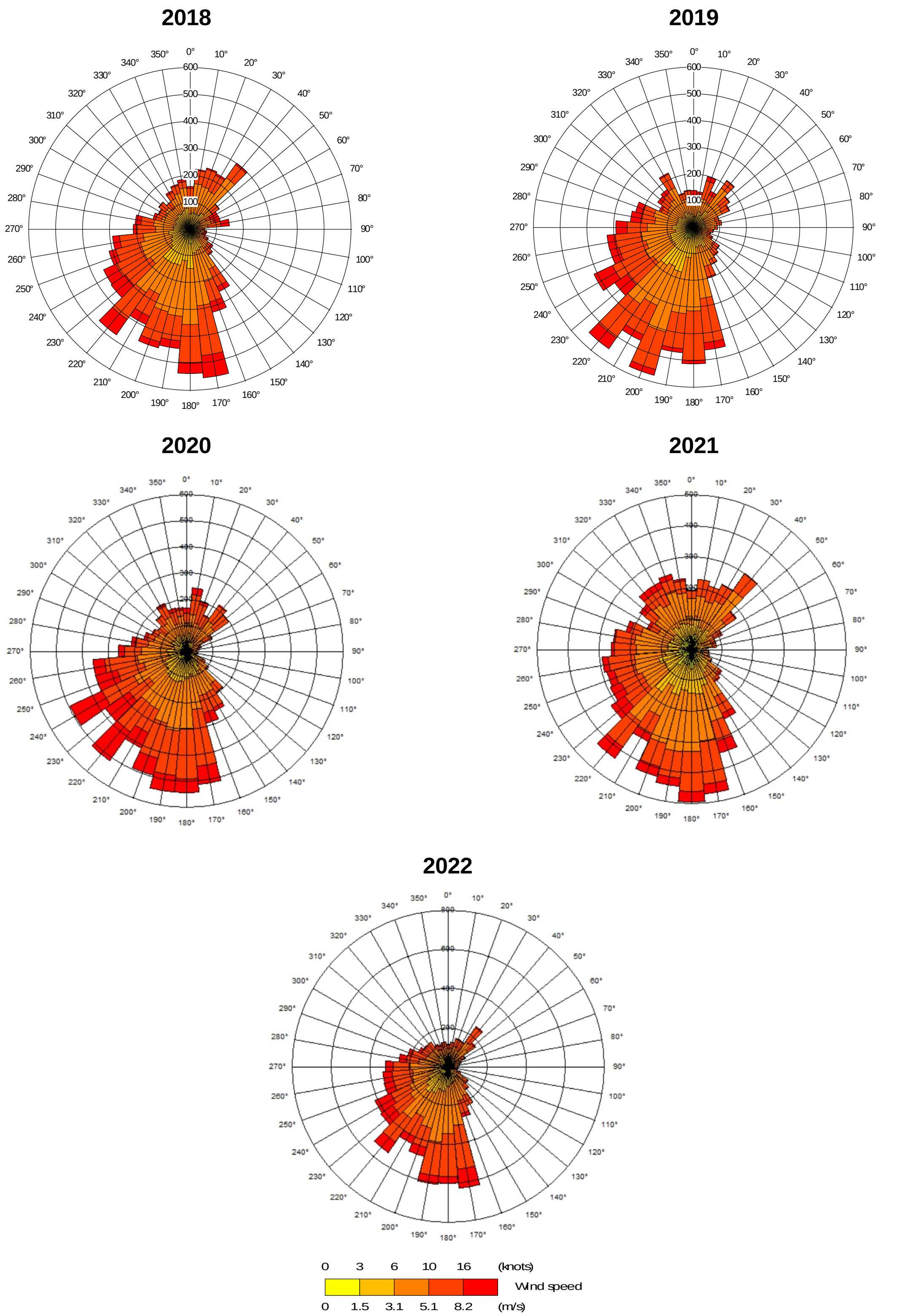


Plate 8B-1: Windroses for Durham Tees Valley Airport Meteorological Station, 2018-2022

Building Downwash Effects

8B.3.21 The buildings that make up the Proposed Development have the potential to affect the dispersion of emissions from the operational process stack. The ADMS buildings effect module has therefore been used to incorporate building downwash effects as part of the model set up. Buildings greater than one third of the range of stack heights modelled have been included within the modelling assessment.

8B.3.22 The modelled locations are shown in Table 8B-9 and a plan showing the building layout used in the ADMS simulation is illustrated in Figure 8.4: Air Quality Study Area – Operation Model Inputs Phase 1 and Figure 8.5: Air Quality Study Area – Operation Model Inputs Phase 2 (PEI Report, Volume II). The dimensions of the buildings are the maximum measurements that could potentially be required (as defined in the Rochdale Envelope) and have been provided by the Design Engineers.

Table 8B-9: Buildings Incorporated into the Modelling Assessment

BUILDING	BUILDING CENTRE GRID REFERENCE (X, Y)	HEIGHT (M)	LENGTH (M)	WIDTH (M)	ANGLE (°)
Cooler1P1	456332, 525297	15	13	33	110
Cooler2P1	456311, 525245	15	13	31	110
Cooler3P1	456283, 525173	15	13	40	110
CompHouseP1	456368, 525278	16	20	19	110
SubU1P1	456343, 525233	16	22	31	110
SubU2P1	456330, 525252	15	12	16	110
ASUP1	456429, 525043	40	26	30	110
Tank1P1	456176, 525034	22	17	17	0
Tank2P1	456185, 525056	22	17	17	0
Cooler1P2	456392, 525751	15	13	33	20
Cooler2P2	456444, 525730	15	13	31	20
Cooler3P2	456516, 525701	15	13	40	20
CompHouseP2	456412, 525787	16	20	19	20
SubU1P2	456457, 525762	16	22	31	20
SubU2P2	456438, 525748	15	12	13	20
ASUP2	456464, 525915	40	26	30	20
Tank1P2	456667, 525682	22	17	17	0
Tank2P2	456658, 525660	22	17	17	0

P1 – Phase 1, P2 – Phase 2

8B.3.23 The immediate local area downwind (north east) of the Proposed Development is flat and undeveloped land followed by the coast and the North Sea. Upwind (south west) of the Proposed Development Site is dominated by industrial land uses and relatively flat. The Site is adjacent to the River Tees Estuary to the west. A surface roughness of 0.3 m, corresponding to the minimum value associated with the terrain type, has therefore been selected to represent the local terrain.

8B.3.24 Site-specific terrain data has not been used in the model, as there are no potentially significant changes in gradient within the Study Area.

NO_x to NO_2 Conversion

8B.3.25 Emissions of nitrogen oxides from industrial point sources are typically dominated by nitric oxide (NO), with emissions from combustion sources typically in the ratio of nitric oxide to nitrogen dioxide of 9:1. However, it is nitrogen dioxide that has specified environmental standards due to its potential impact on human health. In the ambient air, nitric oxide is oxidised to nitrogen dioxide by the ozone present, and the rate of oxidation is dependent on the relative concentrations of nitric oxide and ozone in the ambient air.

8B.3.26 For the purposes of detailed modelling, and in accordance with Environment Agency technical guidance it is assumed that 70% of nitric oxide emitted from the stack is oxidised to nitrogen dioxide in the long term and 35% of the emitted nitric oxide is oxidised to nitrogen dioxide in the local vicinity of the site in the short-term.

Calculation of Deposition at Sensitive Ecological Receptors

8B.3.27 The deposition of nutrient nitrogen and acid at sensitive ecological receptors has been calculated, using the modelled process contribution predicted at the receptor points. The deposition rates are determined using conversion rates and factors contained within Environment Agency guidance, which account for variations deposition mechanisms in different types of habitats.

8B.3.28 The conversion rates and factors used in the assessment are detailed in Table 8B-10 and Table 8B-11.

Table 8B-10: Conversion Factors - Calculation of Nutrient Nitrogen Deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLAND (M/S)	DEPOSITION VELOCITY WOODLAND (M/S)	CONVERSION FACTOR (µG/M3/S TO KEQ/HA/YR)
NOx as NO_2	0.0015	0.003	96
NH_3	0.02	0.03	259.7

Table 8B-11: Conversion Factors - Calculation of Acid Deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLAND (M/S)	DEPOSITION VELOCITY WOODLAND (M/S)	CONVERSION FACTOR (µG/M3/S TO KEQ/HA/YR)
SO_2	0.012	0.024	9.86
NO_2	0.0015	0.003	6.85
NH_3	0.02	0.03	18.54

Specialised Model Treatments

8B.3.29 Emissions have been modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is likely to result in an over-estimation of impacts at receptors, and therefore is considered to be conservative.

8B.4 Baseline Air Quality

Overview

8B.4.1 This section presents the information used to evaluate the background and baseline ambient air quality in the area surrounding the Proposed Development. The following steps have been taken in the determination of background values. Where appropriate, the study focuses on data gathered in the vicinity of the site:

- Identification of Air Quality Management Areas;
- Review of Redcar and Cleveland Borough Council (RCBC) ambient monitoring data;
- Review of data from Defra's background mapping database;
- AECOM monitoring undertaken in the area around the application site; and
- Review of background data and site relevant critical loads from the APIS website.

Air Quality Management Areas

8B.4.2 Redcar and Cleveland Borough Council (RCBC) and Stockton on Tees Borough Council (STBC) have not declared any AQMAs within their administrative area, and there are no AQMAs declared by other Local Authorities within the Study Area.

Local Authority Ambient NO_x and NO_2 Monitoring Data

Redcar And Cleveland Borough Council

8B.4.3 RCBC currently operate one automatic monitoring site, located at Dormanstown Primary School, approximately 1.5 km to the south east of the operational Proposed Development. The site was chosen to monitor roadside and industrial emissions. Data for 2021 was available at the time of writing with annual concentrations of NO_2, PM_{10} and $PM_{2.5}$ of 11 µg/m^3, 14 µg/m^3, and 7 µg/m^3 respectively.

8B.4.4 In addition, NO_2 diffusion tube monitoring is carried out at 16 locations within the borough. The nearest NO_2 diffusion tubes are again located at Dormanstown Primary School (R17, R18, R19). At the time of writing, the most recent monitoring data available from RCBC diffusion tube monitoring is for 2021 and the average measured annual NO_2 concentration was 11.5 µg/m^3.

8B.4.5 All monitoring locations within the Study Area are below the annual mean nitrogen dioxide objective of 40µg/m^3 in 2021.

Defra Background Data

8B.4.6 Defra's 2018-based background maps are available at a 1x1 km resolution for the UK for the year 2018 and are projected forward to the year 2030. These projections of pollution concentrations across England are available for NO_2, PM_{10}, $PM_{2.5}$ and NO_x.

8B.4.7 Background concentrations from the Defra 2018-based background maps are presented for the year 2018 in Table 8B-10 taken for the grid square in which the operational Proposed Development is located (456500, 525500) for NO_x and NO_2. Background concentrations for CO are not available for the most recent Defra maps, but data for 2001-based background concentrations are available and this has been adjusted for 2018 using the Defra published year adjustment factors. Background concentrations for SO_2 are not available from Defra maps but available on APIS for 2020 (2019-2021 average).

8B.4.8 Data for 2018 has been presented, as the typical trend shown in the Defra background mapping is that over the projected time period, concentrations of NO_2 and NO_x are shown to be decreasing. This corresponds to a reduction overtime of vehicle emissions as newer, cleaner vehicles replace older ones. Therefore, assuming no reduction occurs until the opening year of the Proposed Development (2030, is considered to represent a conservative approach.

8B.4.9 A review of the background map concentrations over the Study Area for human health receptors shows that the concentration presented in Table 8B-12 for the Site location is also representative of the background concentrations at the receptor locations (the average NO_2 concentration in the grid squares with identified receptors was 12.8 µg/m^3).

Table 8B-12: 2022 DEFRA Background Concentrations (NGR 456500, 525500)

POLLUTANT	BACKGROUND CONCENTRATION (µG/M^3)
NO_2	13.3
PM_{10}	9.6
$PM_{2.5}$	6.3
CO	110.9
SO_2	2.02

AECOM Monitoring Data

8B.4.10 A 3 month diffusion tube monitoring survey of the Study Area commenced in July 2022, in order to gather data on the ambient concentrations of NO_2 at representative human health and ecological receptor locations. The data collected relevant to the Operational assessment are shown in Table 8B-13.

Table 8B-13: AECOM Nitrogen Dioxide Diffusion Tube Monitoring

SITE ID	MONITORING LOCATION	GRID REFERENCE		2021 ANNUAL MEAN CONCETRATION (µG/M^3)
		X	Y	
DT1	A1085, west of West Coatham Lane	457402	523655	24.6
DT2	A1085, east of West Coatham Lane	457668	523958	36.7
DT3	Teesmouth and Cleveland Coast SSSI, south of Warrenby	459008	524872	15.0
DT4	A1085, east of Grangetown	455455	520617	17.3
DT5	A1053, south of junction with A66	455431	520975	18.1
DT6	A1085, north of junction with A1053	455949	521326	41.2
DT7	Junction of Eston Road/A174	457131	519556	24.6
DT8	High Street, Old Lackenby	456466	519123	18.1
DT9	Woodlands Road, Normanby	455100	517473	13.4
DT10	Springhill, Ormesby	453905	517394	10.1
DT11	Mosedale Road, Grangetown	455488	519463	12.0
DT12	Lilac Cloase, Lazenby	457237	519877	9.5
DT13	South Avenue, Dormanstown	458147	523551	16.0
DT14	Seaton Common Road, Seaton Carew	453310	528182	12.0
DT15	South Gare Access Road	457341	525680	17.6
DT16	South Gare Access Road	456650	525953	15.6
DT17	South Gare Access Road	456323	526112	17.0

SITE ID	MONITORING LOCATION	GRID REFERENCE		2021 ANNUAL MEAN CONCETRATION (µG/M³)
		X	Y	
DT18	A1046/Port clarence Road, Port Clarence	449399	522028	21.5
DT19	Limetrees Close, High Clarence	449091	522434	13.7
DT20	A178/Seaton Carew Road	450821	525066	15.9
DT21	A1046/Port clarence Road, Port Clarence	449943	521663	21.0

8B.4.11 The monitoring tube data suggests that the urban background monitoring sites have comparable or lower NO_2 concentrations that the Defra data, and therefore it was considered appropriate to use the Defra data for the assessment, as a worst case.

Ecological Site Background Data

8B.4.12 The NO_x concentrations are available from the APIS website for designated SAC, SPA and SSSI sites. The average concentrations present at the relevant habitat receptor sites are presented in Table 8B-14.

Table 8B-14: APIS Background Data NO_x

RECEPTOR ID	ECOLOGY SITE	BACKGROUND NO_x (µG/M³)
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	16.1
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	17.7
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	17.7
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	17.7
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	17.7
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	18.6
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	23.5
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	22.0
OE4	Eston Pumping Station LWS	18.9
OE5a	Teesmouth NNR	22.1

RECEPTOR ID	ECOLOGY SITE	BACKGROUND NO_x (µG/M³)
OE5b	Teesmouth NNR	20.6
OE6	Teesmouth and Cleveland Coast SSSI	21.8

8B.4.13 In addition, the APIS website provides information on the relevant critical loads for the assessment of depositional impacts, as well as background nitrogen deposition and acid deposition load. This data has been presented in Table 8B-15.

Table 8B-15: APIS Background Deposition Information

RECEPTOR ID	ECOLOGY SITE	N-DEPOSITION	ACID DEPOSITION	
		(KG N/HA/YR)	(KEQ N/HA/YR)	(KEQ S/HA/YR)
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	9.27	0.72	0.21
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	0.72	0.21
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	0.72	0.21
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	0.72	0.21
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	10.14	0.72	0.21
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	9.38	0.72	0.21
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	8.79	0.72	0.21
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	8.45	0.72	0.21
OE4	Eston Pumping Station LWS	7.86	0.72	0.21
OE5a	Teesmouth NNR	10.9	0.72	0.21

RECEPTOR ID	ECOLOGY SITE	N-DEPOSITION	ACID DEPOSITION	
		(KG N/HA/YR)	(KEQ N/HA/YR)	(KEQ S/HA/YR)
OE5b	Teesmouth NNR	10.9	0.72	0.21
OE6	Teesmouth and Cleveland Coast SSSI	10.14	0.72	0.21

8B.5 Summary of Background Air Quality

8B.5.1 For human health receptors, the background concentrations for nitrogen dioxide and CO have been taken from the Defra background mapping, as presented in Table 8B-12. Although the diffusion tube data for Dormanstown indicates slightly higher NO_2 concentrations, it is considered that as the Defra data and the automatic monitoring data at the same location show good correlation, this is most appropriate for use in the assessment.

8B.5.2 The background NO_x for ecological receptors were sourced from APIS using the specific location for the relevant ecological receptor, as detailed in Table 8B-13.

8B.5.3 There is little data on background amine concentrations in the UK and therefore background concentrations have been assumed to be zero as a worst case for the purpose of this assessment.

8B.5.4 Where no short-term concentrations are available, short-term background concentrations have been calculated by multiplying the selected annual mean background concentration by a factor of two, in accordance with the Environment Agency Risk Assessment methodology.

8B.5.5 To represent a conservative approach, it has been assumed that background concentrations would not decrease in future years. Therefore, the current background concentrations have been assumed to apply to the projected opening year of 2030

8B.6 Operational Emissions Modelling Results

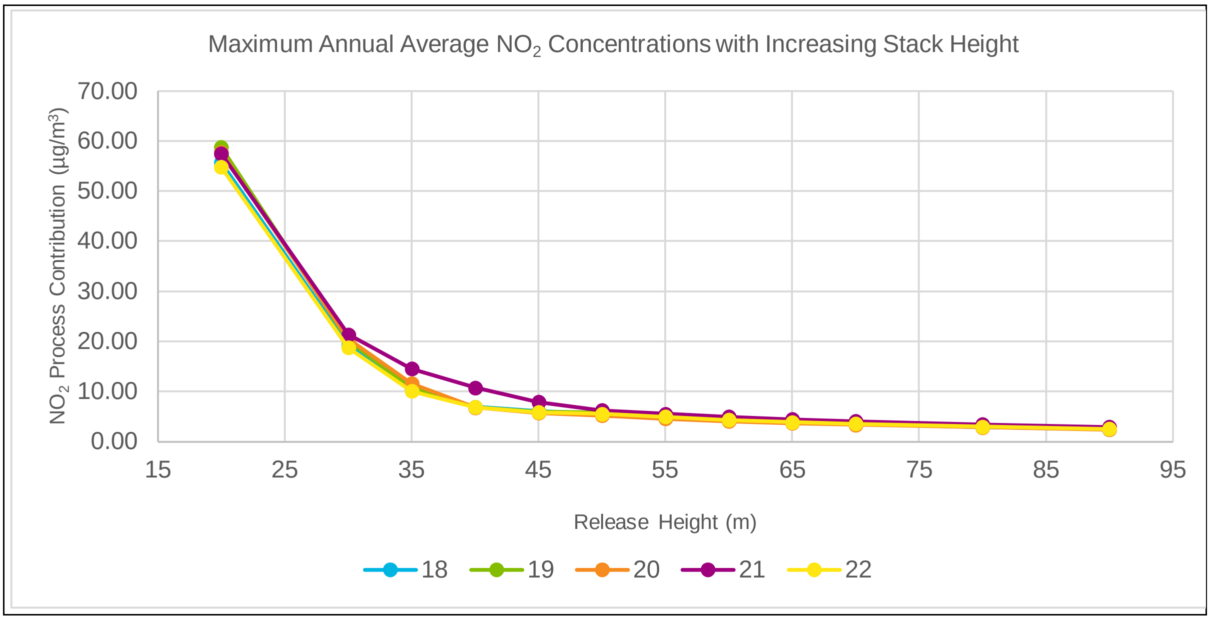
<u>Evaluation of Stack Height</u>

8B.6.1 The selection of an appropriate stack release height requires a number of factors to be taken into account, the most important of which is the need to balance a release height sufficient to achieve adequate dispersion of pollutants against other constraints such as the visual impact of tall stacks.

8B.6.2 Emissions from the Auxiliary Boiler and the Fired Heater stacks have been modelled at heights between 20 m and 90 m, at 5 m increments. For the flares, emissions have been modelled with an initial release height between 65m and 100m. Graphs for Case A results, showing the predicted ground level concentrations for the annual mean and maximum 1-hour NO_2 concentrations are presented in Plate 8B-2. The purpose of the graphs is to evaluate the optimum release height in terms of the dispersion of pollutants which would occur, against the visual constraints of further increases in release height, with the 'elbow' of the resulting curve showing where the reductions in ground level concentrations become disproportionate to the increasing height.

8B.6.3 Analysis of the curves shows that the benefit of incremental increases in release heights of the Auxiliary Boiler and the Fired Heater after 40 m become less pronounced although at heights above 45 m, the air quality benefit of increasing release height further is reduced, with this levelling out after 65 m. A release height of 40 m for the Auxiliary Boilers and Fired Heater is predicted to provide a sufficient degree of dispersion such that ground level PCs are below the Environment Agency's 1% and 10% screening criteria for long term and short-term impacts respectively.

8B.6.4 For emissions from the flares, there is a predicted steady decline in ground level impacts with respect in an increase in release height, although there is no clear release height at which the rate of decline diminishes.



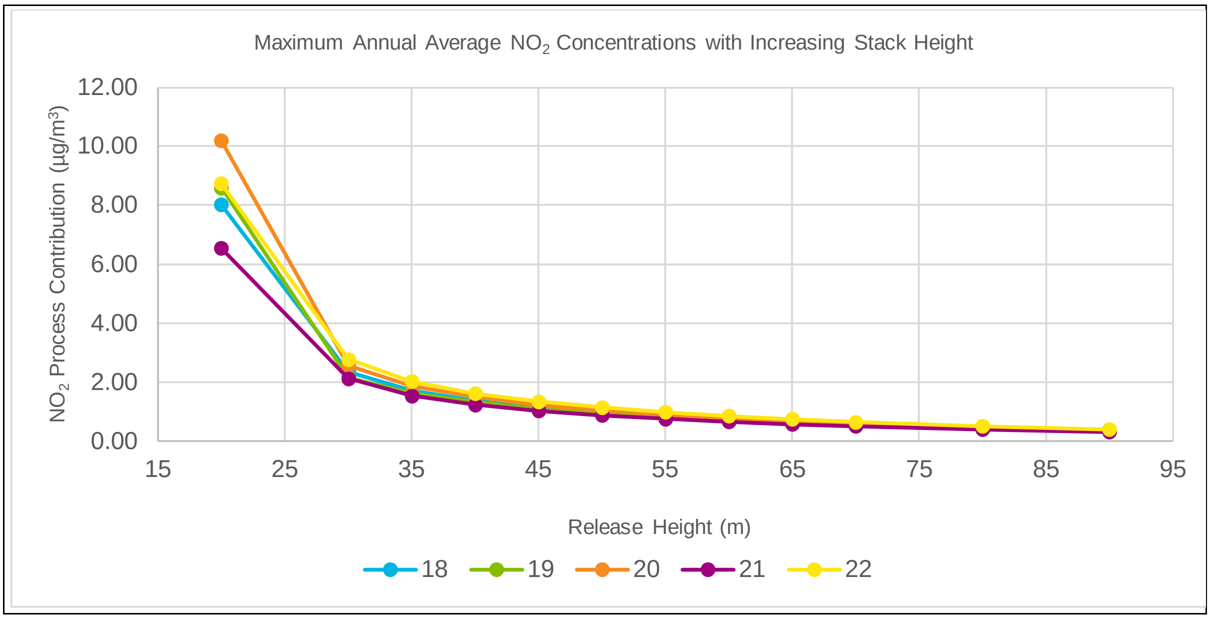


Plate 8B-2: Predicted Maximum Process Contribution to Ground Level NO_2 Concentrations at Stack Release Heights of 20m to 90m (Case A Phase 1 and 2 Fired Heater Only)

<u>Human Health Receptor Results</u>

Nitrogen dioxide emissions

8B.6.5 The predicted change in annual mean NO_2 concentrations that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-16 and Table 8B-17 for Case A and Case B scenarios respectively.

8B.6.6 The maximum predicted annual mean NO_2 concentration that occurs anywhere within the Study Area as a result of the Proposed Development is 1.7 µg/m^3, and this occurs at close to the northern boundary of the site, within the dunes of the Teesmouth and Cleveland Coast SSSI, SPA and RAMSAR site. The annual mean NO_2 predicted environmental concentration (i.e. the process contribution and the existing background concentration) is 14.9 µg/m^3 and therefore is below the annual mean NO_2 AQAL of 40 µg/m^3. NO_2 emissions from the Proposed Development are therefore not predicted to lead to a risk of the annual mean AQALs being exceeded anywhere within the Study Area.

8B.6.7 The discrete receptor most affected by long term emissions from the Proposed Development is receptor O3, South Gare Fisherman's Association with a predicted annual mean NO_2 concentration as a result of the Proposed Development of 0.3 µg/m^3, representing 0.8% of the AQAL.

8B.6.8 The significance of the predicted change in annual mean NO_2 concentrations in planning terms is discussed in Chapter 8: Air Quality (PEI Report, Volume I).

Table 8B-16: Predicted Change in Annual Mean NO_2 Concentrations – Case A, Normal Operation

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O1	40	0.2	0.6%	13.3	13.5	33.8%
O2	40	0.3	0.7%	13.3	13.6	34.0%
O3	40	0.3	0.8%	13.3	13.6	34.1%
O4	40	0.3	0.7%	13.3	13.6	34.0%
O5	40	0.2	0.5%	13.3	13.5	33.8%
O6	40	0.1	0.3%	13.3	13.4	33.6%
O7	40	0.2	0.4%	13.3	13.5	33.7%
O8	40	0.1	0.3%	13.3	13.4	33.6%
O9	40	0.1	0.4%	13.3	13.4	33.6%

PC = Process Contribution, AQAL = Air Quality Assessment Level, BC = Background Concentration, PEC = Predicted Environmental Concentration

Table 8B-17: Predicted Change in Annual Mean NO_2 Concentrations – Case B, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	40	0.2	0.6%	13.3	13.5	33.8%
O2	40	0.3	0.7%	13.3	13.6	34.0%
O3	40	0.3	0.8%	13.3	13.6	34.1%
O4	40	0.3	0.7%	13.3	13.6	34.0%
O5	40	0.2	0.5%	13.3	13.5	33.8%
O6	40	0.1	0.4%	13.3	13.4	33.6%
O7	40	0.2	0.4%	13.3	13.5	33.7%
O8	40	0.1	0.3%	13.3	13.4	33.6%
O9	40	0.1	0.3%	13.3	13.4	33.6%

PC = Process Contribution, AQAL = Air Quality Assessment Level, BC = Background Concentration, PEC = Predicted Environmental Concentration

8B.6.9 The predicted change in hourly mean NO_2 concentrations (as the 99.79^{th} percentile of hourly averages) that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-18 to Table 8B-23 for Case A and Case B scenarios.

8B.6.10 The maximum predicted hourly mean NO_2 concentration (as the 99.79^{th} percentile of hourly averages) during Normal Operation that occurs anywhere within the Study Area as a result of the Proposed Development is 9.3 $\mu g/m^3$, and this occurs again just to the north of the operational Proposed Development. The predicted environmental concentration (i.e., the process contribution and the existing background concentration) is 35.9 $\mu g/m^3$ and therefore is well below the hourly mean NO_2 AQAL of 200 $\mu g/m^3$.

8B.6.11 During the Start Up Scenario, the maximum predicted hourly mean NO_2 concentration (as the 99.79^{th} percentile of hourly averages) during that occurs anywhere within the Study Area as a result of the Proposed Development is 5.4 $\mu g/m^3$, and this occurs to the south of the operational Proposed Development. The predicted environmental concentration (i.e., the process contribution and the existing background concentration) is 32.0 $\mu g/m^3$ and therefore is well below the hourly mean NO_2 AQAL of 200 $\mu g/m^3$.

8B.6.12 During the Emergency Scenario, the maximum predicted hourly mean NO_2 concentration (as the 99.79^{th} percentile of hourly averages) during that occurs anywhere within the Study Area as a result of the Proposed Development is 69.5 $\mu g/m^3$, and this occurs to the south-west of the operational Proposed Development. The predicted environmental concentration (i.e., the process contribution and the existing background concentration) is 96.1 $\mu g/m^3$ and therefore is well below the hourly mean NO_2 AQAL of 200 $\mu g/m^3$.

8B.6.13 The discrete receptor most affected by short term emissions from the Proposed Development is receptor O3, South Gare Fisherman's Association, with a predicted hourly mean NO_2 Process Contribution as a result of the Proposed Development of 2.6 $\mu g/m^3$, and a PEC of 29.2 $\mu g/m^3$ during the Case B normal operation.

8B.6.14 NO_2 emissions from the Proposed Development are therefore not predicted to lead to a risk of the hourly mean air quality standard being exceeded anywhere within the Study Area.

Table 8B-18: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case A, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	200	2.0	1.0%	26.6	28.6	14.3%
O2	200	2.1	1.0%	26.6	28.7	14.4%
O3	200	2.4	1.2%	26.6	29.0	14.5%
O4	200	2.3	1.1%	26.6	28.9	14.5%
O5	200	2.0	1.0%	26.6	28.7	14.3%
O6	200	1.9	1.0%	26.6	28.5	14.3%
O7	200	1.9	1.0%	26.6	28.5	14.3%
O8	200	1.9	0.9%	26.6	28.5	14.2%
O9	200	1.9	0.9%	26.6	28.5	14.3%

Table 8B-19: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case B, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	200	2.0	1.0%	26.6	28.7	14.3%
O2	200	2.2	1.1%	26.6	28.8	14.4%
O3	200	2.6	1.3%	26.6	29.2	14.6%

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O4	200	2.5	1.3%	26.6	29.2	14.6%
O5	200	2.2	1.1%	26.6	28.8	14.4%
O6	200	2.1	1.1%	26.6	28.7	14.4%
O7	200	2.1	1.0%	26.6	28.7	14.3%
O8	200	1.9	1.0%	26.6	28.5	14.3%
O9	200	2.0	1.0%	26.6	28.6	14.3%

Table 8B-20: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case A, Start Up Scenario

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O1	200	3.0	1.5%	26.6	29.6	14.8%
O2	200	3.1	1.5%	26.6	29.7	14.9%
O3	200	3.2	1.6%	26.6	29.8	14.9%
O4	200	3.1	1.5%	26.6	29.7	14.8%
O5	200	2.7	1.4%	26.6	29.3	14.7%
O6	200	2.6	1.3%	26.6	29.2	14.6%
O7	200	2.6	1.3%	26.6	29.2	14.6%

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O8	200	2.3	1.1%	26.6	28.9	14.4%
O9	200	2.3	1.2%	26.6	29.0	14.5%

Table 8B-21: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case B, Start Up Scenario

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O1	200	2.7	1.3%	26.6	29.3	14.6%
O2	200	2.8	1.4%	26.6	29.4	14.7%
O3	200	2.9	1.5%	26.6	29.5	14.8%
O4	200	2.8	1.4%	26.6	29.4	14.7%
O5	200	2.5	1.3%	26.6	29.1	14.6%
O6	200	2.4	1.2%	26.6	29.0	14.5%
O7	200	2.4	1.2%	26.6	29.0	14.5%
O8	200	2.1	1.1%	26.6	28.8	14.4%
O9	200	2.2	1.1%	26.6	28.8	14.4%

Table 8B-22: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case A, Emergency Scenario

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	200	6.1	3.1%	26.6	32.7	16.4%
O2	200	6.1	3.0%	26.6	32.7	16.4%
O3	200	6.0	3.0%	26.6	32.6	16.3%
O4	200	5.7	2.9%	26.6	32.3	16.2%
O5	200	5.2	2.6%	26.6	31.9	15.9%
O6	200	5.2	2.6%	26.6	31.8	15.9%
O7	200	5.1	2.5%	26.6	31.7	15.8%
O8	200	5.0	2.5%	26.6	31.6	15.8%
O9	200	4.9	2.5%	26.6	31.5	15.8%

Table 8B-23: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Case B, Emergency Scenario

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	200	5.8	2.9%	26.6	32.4	16.2%
O2	200	5.1	2.6%	26.6	31.7	15.9%
O3	200	4.1	2.1%	26.6	30.8	15.4%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O4	200	4.0	2.0%	26.6	30.6	15.3%
O5	200	4.6	2.3%	26.6	31.2	15.6%
O6	200	4.0	2.0%	26.6	30.6	15.3%
O7	200	4.3	2.2%	26.6	30.9	15.5%
O8	200	3.5	1.8%	26.6	30.2	15.1%
O9	200	3.8	1.9%	26.6	30.5	15.2%

Carbon Monoxide emissions

8B.6.15 The predicted change in the maximum 8 hour rolling mean CO concentrations that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-24 to Table 8B-29 for Case A and Case B scenarios.

8B.6.16 The maximum 8-hour rolling mean CO PC that is predicted to occur anywhere in the study area as a result of the Proposed Development is less than 1% of the relevant AQAL. In addition, the maximum predicted PEC at any receptor is 1.4%, while at the point of maximum impact it is 1.6%. This is predicted to occur during Emergency operation scenario, and during normal operation the PC and PECs are predicted to be lower. It is considered that PC of carbon monoxide would be unlikely to give rise to significant effects at any receptor location during all modelled scenarios.

Table 8B-24: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case A, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	10,000	2.7	0.0%	110.9	113.6	1.1%
O2	10,000	3.0	0.0%	110.9	113.9	1.1%
O3	10,000	2.9	0.0%	110.9	113.8	1.1%
O4	10,000	3.0	0.0%	110.9	113.9	1.1%
O5	10,000	2.8	0.0%	110.9	113.7	1.1%
O6	10,000	2.4	0.0%	110.9	113.3	1.1%
O7	10,000	2.4	0.0%	110.9	113.3	1.1%
O8	10,000	2.1	0.0%	110.9	113.0	1.1%
O9	10,000	2.4	0.0%	110.9	113.3	1.1%

Table 8B-25: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case B, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	10,000	1.8	0.0%	110.9	112.7	1.1%
O2	10,000	2.0	0.0%	110.9	112.9	1.1%
O3	10,000	1.9	0.0%	110.9	112.8	1.1%

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O4	10,000	2.0	0.0%	110.9	112.9	1.1%
O5	10,000	2.0	0.0%	110.9	112.9	1.1%
O6	10,000	1.7	0.0%	110.9	112.6	1.1%
O7	10,000	1.8	0.0%	110.9	112.7	1.1%
O8	10,000	1.5	0.0%	110.9	112.4	1.1%
O9	10,000	1.8	0.0%	110.9	112.7	1.1%

Table 8B-26: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case A, Start Up Scenario

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O1	10,000	27.9	0.3%	110.9	138.8	1.4%
O2	10,000	29.9	0.3%	110.9	140.8	1.4%
O3	10,000	28.7	0.3%	110.9	139.6	1.4%
O4	10,000	28.4	0.3%	110.9	139.3	1.4%
O5	10,000	26.0	0.3%	110.9	136.9	1.4%
O6	10,000	23.6	0.2%	110.9	134.5	1.3%
O7	10,000	23.3	0.2%	110.9	134.2	1.3%

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O8	10,000	23.8	0.2%	110.9	134.7	1.3%
O9	10,000	21.4	0.2%	110.9	132.3	1.3%

Table 8B-27: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case B, Start Up Scenario

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	10,000	30.1	0.3%	110.9	141.0	1.4%
O2	10,000	31.8	0.3%	110.9	142.7	1.4%
O3	10,000	30.7	0.3%	110.9	141.6	1.4%
O4	10,000	30.0	0.3%	110.9	140.9	1.4%
O5	10,000	27.4	0.3%	110.9	138.3	1.4%
O6	10,000	24.6	0.2%	110.9	135.5	1.4%
O7	10,000	24.4	0.2%	110.9	135.3	1.4%
O8	10,000	24.8	0.2%	110.9	135.7	1.4%
O9	10,000	22.4	0.2%	110.9	133.3	1.3%

Table 8B-28: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case A, Emergency Scenario

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	10,000	30.0	0.3%	110.9	140.9	1.4%
O2	10,000	31.9	0.3%	110.9	142.8	1.4%
O3	10,000	30.5	0.3%	110.9	141.4	1.4%
O4	10,000	30.2	0.3%	110.9	141.1	1.4%
O5	10,000	27.4	0.3%	110.9	138.3	1.4%
O6	10,000	24.9	0.2%	110.9	135.8	1.4%
O7	10,000	24.5	0.2%	110.9	135.4	1.4%
O8	10,000	24.9	0.2%	110.9	135.8	1.4%
O9	10,000	22.5	0.2%	110.9	133.4	1.3%

Table 8B-29: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Case B, Emergency Scenario

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	10,000	30.4	0.3%	110.9	141.3	1.4%
O2	10,000	32.3	0.3%	110.9	143.2	1.4%
O3	10,000	31.3	0.3%	110.9	142.2	1.4%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O4	10,000	30.4	0.3%	110.9	141.3	1.4%
O5	10,000	27.8	0.3%	110.9	138.7	1.4%
O6	10,000	25.6	0.3%	110.9	136.5	1.4%
O7	10,000	24.8	0.2%	110.9	135.7	1.4%
O8	10,000	25.5	0.3%	110.9	136.4	1.4%
O9	10,000	22.8	0.2%	110.9	133.7	1.3%

Particulate Matter (PM_{10})

8B.6.17 The predicted change in annual mean PM_{10} concentrations that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-30 and Table 8B-31 for Case A and Case B scenarios respectively. The predicted change in the 90.41^{th} percentile of 24 hour (daily) mean PM_{10} concentrations are shown in Table 8B-32 to Table 8B-37.

8B.6.18 The annual mean PM_{10} PC that is predicted to occur anywhere in the study area as a result of the Proposed Development is less than 1% of the relevant AQALs for both long-term (annual mean) and short-term (daily mean) impacts. In addition, the maximum predicted short-term PEC at any receptor is 38.7%, while at the point of maximum impact it is 39.1%. This is predicted to occur during Emergency operation scenario, and during normal operation the PC and PECs are predicted to be lower. It is considered that the PC of PM_{10} would be unlikely to give rise to significant effects at any receptor location during all modelled scenarios.

Table 8B-30: Predicted Change in Annual Mean PM_{10} Concentrations – Case A, Normal Operation

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O1	40	0.01	0.0%	9.6	9.6	24.0%
O2	40	0.01	0.0%	9.6	9.6	24.0%
O3	40	0.01	0.0%	9.6	9.6	24.0%
O4	40	0.01	0.0%	9.6	9.6	24.0%
O5	40	0.01	0.0%	9.6	9.6	24.0%
O6	40	0.01	0.0%	9.6	9.6	24.0%
O7	40	0.01	0.0%	9.6	9.6	24.0%
O8	40	0.00	0.0%	9.6	9.6	24.0%
O9	40	0.01	0.0%	9.6	9.6	24.0%

Table 8B-31: Predicted Change in Annual Mean PM_{10} Concentrations – Case B, Normal Operation

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O1	40	0.03	0.1%	9.6	9.6	24.0%
O2	40	0.04	0.1%	9.6	9.6	24.1%
O3	40	0.05	0.1%	9.6	9.6	24.1%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O4	40	0.04	0.1%	9.6	9.6	24.1%
O5	40	0.03	0.1%	9.6	9.6	24.0%
O6	40	0.02	0.0%	9.6	9.6	24.0%
O7	40	0.02	0.1%	9.6	9.6	24.0%
O8	40	0.02	0.0%	9.6	9.6	24.0%
O9	40	0.02	0.0%	9.6	9.6	24.0%

Table 8B-32: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41th Percentile of 24 Hour averages) – Case A, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	50	0.03	0.1%	19.2	19.2	38.4%
O2	50	0.04	0.1%	19.2	19.2	38.4%
O3	50	0.04	0.1%	19.2	19.2	38.4%
O4	50	0.04	0.1%	19.2	19.2	38.4%
O5	50	0.03	0.1%	19.2	19.2	38.4%
O6	50	0.02	0.0%	19.2	19.2	38.4%
O7	50	0.02	0.0%	19.2	19.2	38.4%

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O8	50	0.01	0.0%	19.2	19.2	38.4%
O9	50	0.02	0.0%	19.2	19.2	38.4%

Table 8B-33: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41th Percentile of 24 Hour averages) – Case B, Normal Operation

RECEPTOR	AQAL (µG/M3)	PREDICTED CONCENTRATION (PC) (µG/M3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M3)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	38.6%
O2	50	0.1	0.3%	19.2	19.3	38.6%
O3	50	0.2	0.4%	19.2	19.4	38.7%
O4	50	0.2	0.3%	19.2	19.3	38.7%
O5	50	0.1	0.2%	19.2	19.3	38.6%
O6	50	0.1	0.1%	19.2	19.2	38.5%
O7	50	0.1	0.2%	19.2	19.3	38.5%
O8	50	0.1	0.1%	19.2	19.2	38.5%
O9	50	0.1	0.2%	19.2	19.3	38.5%

Table 8B-34: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41th Percentile of 24 Hour averages) – Case A, Start Up Scenario

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	50	0.2	0.4%	19.2	19.4	38.8%
O2	50	0.3	0.7%	19.2	19.5	39.0%
O3	50	0.3	0.7%	19.2	19.5	39.0%
O4	50	0.3	0.5%	19.2	19.4	38.9%
O5	50	0.2	0.5%	19.2	19.4	38.8%
O6	50	0.1	0.3%	19.2	19.3	38.6%
O7	50	0.2	0.4%	19.2	19.4	38.8%
O8	50	0.1	0.2%	19.2	19.3	38.6%
O9	50	0.2	0.4%	19.2	19.4	38.7%

Table 8B-35: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41th Percentile of 24 Hour averages) – Case B, Start Up Scenario

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	50	0.2	0.3%	19.2	19.3	38.7%
O2	50	0.3	0.5%	19.2	19.4	38.9%
O3	50	0.2	0.5%	19.2	19.4	38.8%

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O4	50	0.2	0.3%	19.2	19.3	38.7%
O5	50	0.2	0.4%	19.2	19.4	38.8%
O6	50	0.1	0.2%	19.2	19.3	38.5%
O7	50	0.2	0.3%	19.2	19.3	38.7%
O8	50	0.1	0.2%	19.2	19.3	38.5%
O9	50	0.1	0.3%	19.2	19.3	38.6%

Table 8B-36: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41^{th} Percentile of 24 Hour averages) – Case A, Emergency Scenario

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	38.5%
O2	50	0.2	0.3%	19.2	19.3	38.7%
O3	50	0.1	0.3%	19.2	19.3	38.6%
O4	50	0.1	0.2%	19.2	19.3	38.5%
O5	50	0.1	0.3%	19.2	19.3	38.6%
O6	50	0.1	0.1%	19.2	19.2	38.4%
O7	50	0.1	0.2%	19.2	19.3	38.6%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O8	50	0.0	0.1%	19.2	19.2	38.4%
O9	50	0.1	0.2%	19.2	19.3	38.5%

Table 8B-37: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41th Percentile of 24 Hour averages) – Case B, Emergency Scenario

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	38.6%
O2	50	0.2	0.4%	19.2	19.4	38.7%
O3	50	0.2	0.3%	19.2	19.3	38.7%
O4	50	0.1	0.2%	19.2	19.3	38.6%
O5	50	0.2	0.3%	19.2	19.3	38.7%
O6	50	0.1	0.1%	19.2	19.2	38.5%
O7	50	0.1	0.2%	19.2	19.3	38.6%
O8	50	0.1	0.1%	19.2	19.2	38.5%
O9	50	0.1	0.2%	19.2	19.3	38.6%

Particulate Matter ($PM_{2.5}$)

8B.6.19 The predicted change in annual mean $PM_{2.5}$ concentrations that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-38 and Table 8B-39 for Case A and Case B scenarios respectively.

8B.6.20 The annual mean $PM_{2.5}$ PC that is predicted to occur anywhere in the study area as a result of the Proposed Development is less than 1% of the relevant AQAL. In addition, the maximum predicted short-term PEC at any receptor is 31.7%, while at the point of maximum impact it is 32.7%. This is predicted to occur during normal operation. It is considered that the PC of $PM_{2.5}$ would be unlikely to give rise to significant effects at any receptor location during all modelled scenarios.

Table 8B-38: Predicted Change in Annual Mean $PM_{2.5}$ Concentrations – Case A, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	20	0.01	0.0%	6.3	6.3	31.5%
O2	20	0.01	0.1%	6.3	6.3	31.5%
O3	20	0.01	0.1%	6.3	6.3	31.5%
O4	20	0.01	0.1%	6.3	6.3	31.5%
O5	20	0.01	0.0%	6.3	6.3	31.4%
O6	20	0.01	0.0%	6.3	6.3	31.4%
O7	20	0.01	0.0%	6.3	6.3	31.4%
O8	20	0.00	0.0%	6.3	6.3	31.4%
O9	20	0.01	0.0%	6.3	6.3	31.4%

Table 8B-39: Predicted Change in Annual Mean $PM_{2.5}$ Concentrations – Case B, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	20	0.03	0.2%	6.3	6.3	31.6%
O2	20	0.04	0.2%	6.3	6.3	31.6%
O3	20	0.05	0.2%	6.3	6.3	31.7%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O4	20	0.04	0.2%	6.3	6.3	31.6%
O5	20	0.03	0.1%	6.3	6.3	31.5%
O6	20	0.02	0.1%	6.3	6.3	31.5%
O7	20	0.02	0.1%	6.3	6.3	31.5%
O8	20	0.02	0.1%	6.3	6.3	31.5%
O9	20	0.02	0.1%	6.3	6.3	31.5%

Sulphur Dioxide

8B.6.21 The predicted change in SO_2 concentrations that would occur during the operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-40 and Table 8B-45 for Case A and Case B scenarios.

8B.6.22 The SO_2 PC that is predicted to occur anywhere in the study area as a result of the Proposed Development is less than 1% of the relevant AQALs for short-term (24 hour mean, 1 hour mean and 15-minute mean) impacts. In addition, the maximum predicted short-term PEC at any receptor is 3.7% for the 24-hour mean, while at the point of maximum impact it is 5.1%. For all other averaging periods, the PC and PEC are predicted to be lower. It is considered that the PC of SO_2 would be unlikely to give rise to significant effects at any receptor location during all modelled scenarios.

Table 8B-40: Predicted Change in 15 Minute Mean SO_2 Concentrations (as the 99.9th Percentile of 15 Minute averages) – Case A, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	260	1.2	0.5%	4.0	5.3	1.5%
O2	260	1.2	0.5%	4.0	5.3	1.5%
O3	260	1.3	0.5%	4.0	5.4	1.5%
O4	260	1.5	0.6%	4.0	5.5	1.6%
O5	260	1.2	0.5%	4.0	5.2	1.5%
O6	260	1.2	0.5%	4.0	5.2	1.5%
O7	260	1.1	0.4%	4.0	5.2	1.5%
O8	260	1.3	0.5%	4.0	5.3	1.5%
O9	260	1.2	0.5%	4.0	5.2	1.5%

Table 8B-41: Predicted Change in 15 Minute Mean SO_2 Concentrations (as the 99.9th Percentile of 15 Minute averages) – Case B, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	260	0.9	0.3%	4.0	4.9	1.4%
O2	260	0.9	0.3%	4.0	4.9	1.4%
O3	260	1.0	0.4%	4.0	5.0	1.4%

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O4	260	1.0	0.4%	4.0	5.0	1.4%
O5	260	0.9	0.3%	4.0	4.9	1.4%
O6	260	0.8	0.3%	4.0	4.9	1.4%
O7	260	0.8	0.3%	4.0	4.9	1.4%
O8	260	0.8	0.3%	4.0	4.8	1.4%
O9	260	0.8	0.3%	4.0	4.9	1.4%

Table 8B-42: Predicted Change in 1 Hour Mean SO_2 Concentrations (as the 99.73th Percentile of 1 Hour averages) – Case A, Normal Operation

RECEPTOR	AQAL (µG/M^3)	PREDICTED CONCENTRATION (PC) (µG/M^3)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M^3)	PEC/AQAL (%)
O1	350	1.0	0.3%	4.0	5.0	1.4%
O2	350	1.0	0.3%	4.0	5.1	1.4%
O3	350	1.1	0.3%	4.0	5.2	1.5%
O4	350	1.1	0.3%	4.0	5.2	1.5%
O5	350	1.0	0.3%	4.0	5.0	1.4%
O6	350	0.9	0.3%	4.0	5.0	1.4%
O7	350	0.9	0.3%	4.0	5.0	1.4%

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O8	350	0.9	0.3%	4.0	4.9	1.4%
O9	350	0.9	0.3%	4.0	5.0	1.4%

Table 8B-43: Predicted Change in 1 Hour Mean SO_2 Concentrations (as the 99.73th Percentile of 1 Hour averages) – Case B, Normal Operation

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O1	350	0.7	0.2%	4.0	4.7	1.3%
O2	350	0.7	0.2%	4.0	4.7	1.4%
O3	350	0.8	0.2%	4.0	4.9	1.4%
O4	350	0.8	0.2%	4.0	4.8	1.4%
O5	350	0.7	0.2%	4.0	4.8	1.4%
O6	350	0.7	0.2%	4.0	4.7	1.3%
O7	350	0.7	0.2%	4.0	4.7	1.3%
O8	350	0.6	0.2%	4.0	4.7	1.3%
O9	350	0.6	0.2%	4.0	4.7	1.3%

Table 8B-44: Predicted Change in 24 Hour Mean SO_2 Concentrations (as the 99.18th Percentile of 24 Hour averages) – Case A, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	125	0.5	0.4%	4.0	4.5	3.6%
O2	125	0.5	0.4%	4.0	4.6	3.7%
O3	125	0.5	0.4%	4.0	4.6	3.7%
O4	125	0.5	0.4%	4.0	4.6	3.7%
O5	125	0.4	0.3%	4.0	4.4	3.6%
O6	125	0.5	0.4%	4.0	4.5	3.6%
O7	125	0.3	0.3%	4.0	4.4	3.5%
O8	125	0.4	0.3%	4.0	4.4	3.5%
O9	125	0.3	0.2%	4.0	4.3	3.5%

Table 8B-45: Predicted Change in 24 Hour Mean SO_2 Concentrations (as the 99.18th Percentile of 24 Hour averages) – Case B, Normal Operation

RECEPTOR	AQAL (µG/M³)	PREDICTED CONCENTRATION (PC) (µG/M³)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) (µG/M³)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µG/M³)	PEC/AQAL (%)
O1	125	0.3	0.3%	4.0	4.4	3.5%
O2	125	0.4	0.3%	4.0	4.4	3.5%
O3	125	0.3	0.3%	4.0	4.4	3.5%

RECEPTOR	AQAL ($\mu G/M^3$)	PREDICTED CONCENTRATION (PC) ($\mu G/M^3$)	PC/AQAL (%)	BACKGROND CONCENTRATION (BC) ($\mu G/M^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu G/M^3$)	PEC/AQAL (%)
O4	125	0.3	0.3%	4.0	4.4	3.5%
O5	125	0.3	0.2%	4.0	4.3	3.4%
O6	125	0.3	0.2%	4.0	4.3	3.5%
O7	125	0.2	0.2%	4.0	4.3	3.4%
O8	125	0.2	0.2%	4.0	4.3	3.4%
O9	125	0.2	0.2%	4.0	4.2	3.4%

Ecological Receptors Results

8B.6.23 The results of the dispersion modelling of predicted impacts on sensitive ecological receptors are presented in Table 8B-46 to Table 8B-53. The tables set out the predicted PC to atmospheric concentrations of NOx and SO_2 and also nutrient nitrogen and acid deposition.

8B.6.24 Specific significance criteria relating to impacts on sensitive designated ecological receptors are set out within the Environmental Agency air emissions risk assessment guidance. The impact of stack emissions can be regarded as insignificant at sites with statutory designations if:

- The long-term PC is less than 1% of the critical level, or if greater than 1% then the PEC is less than 70% of the critical level.
- The short-term PC is less than 10% of the critical level.

8B.6.25 The impact of stack emissions can be regarded as insignificant at sites of local importance if:

- The long-term PC is less than 100% of the critical level.
- The short-term PC is less than 100% of the critical level

8B.6.26 The effect of atmospheric NOx concentrations, nitrogen deposition rates and acid deposition rates on the modelled receptor locations have been considered in detail in the Habitats Regulations Assessment Report (Document Ref. 5.13) submitted with the Application. Further discussion on the significance of the impact on sensitive ecological receptors is provided in Chapter 12: Terrestrial Ecology and Nature Conservation (PEI Report, Volume I).

Oxides of nitrogen emissions – Critical Levels

8B.6.27 The assessment results show that the predicted annual average NOx impacts are below the criteria for likely insignificance at nice of the 12 receptors, and predicted daily averages are below the criteria for likely significance at 6 of the 12 receptors.

8B.6.28 PCs of more than 1% of the long-term critical level and 10% of the daily critical level for NOx occur at the adjacent Teesmouth and Cleveland Coast SPA, SSSI and Ramsar, and the Coatham Marsh LWS.

8B.6.29 The annual average PEC at the Teesmouth and Cleveland Coast site is 68% of the annual average critical level and 61% of the daily average critical level respectively. The annual average value is therefore just under 70% of the critical level threshold for likely insignificance.

8B.6.30 The daily critical level screening criteria is predicted to be exceeded for the Teesmouth and Cleveland Coast SSSI, however there is also no exceedance of the daily average critical level predicted. Significant effects at this location cannot be screened out based on the critical level criteria, and further assessment of the effects of oxides of nitrogen impacts from the Proposed Development has been undertaken in Chapter 12: Terrestrial Ecology and Nature Conservation (PEI Report, Volume I).

8B.6.31 Annual average impacts at the Coatham Marsh LWS represent 1.1% of the critical level and is well below the 100% threshold for likely insignificance at sites of local importance.

8B.6.32 The background NOx concentration at the site represents 90% of the critical level without the contribution from the Proposed Development, and therefore the PEC represents 74.5% of the annual critical level. This is below the level of likely insignificance for LWSs. The daily PC represents 5% of the critical level, and therefore is screened as being likely insignificant.

8B.6.33 Due to the worst-case assumptions used in the assessment, it is considered that the predicted impacts are conservative and that an exceedance of the critical level is unlikely to occur as a result of the emissions from the operational development.

Sulphur Dioxide – Critical Levels

8B.6.34 The assessment results show that the predicted annual average SO_2 impacts are below the criteria for likely insignificance (<1% of the critical level) at nine of the twelve receptors, and therefore can be considered as likely to be insignificant. The predicted annual average SO_2 impacts at parts of the Teesmouth and Cleveland coast receptor are slightly over the threshold of insignificance at 1.7% of the critical level, however in combination with the background concentration it represents only 11% of the critical level and therefore can be considered likely to be insignificant.

Nitrogen deposition – Critical Loads

8B.6.35 The Environment Agency and Natural England have agreed that depositional impacts that are below 1% of the relevant critical load for a site can be regarded as likely to be insignificant. Guidance from the Institute of Air Quality Management clarifies that the 1% threshold is not intended to be precise to a set number of decimal places but to the nearest whole number (paragraph 5.5.2.6 of Institute of Air Quality Management, 2020[1]). Further interpretation of the significance of the depositional results is provided in Chapter 12: Terrestrial Ecology and Nature Conservation (PEI Report, Volume I).

[1] Institute of Air Quality Management (2020). A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites, Version 1.1 [Online]. Available from: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

Table 8B-46: NO_x Dispersion Modelling Results for Ecological Receptors – Case A

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M^3)					24 HOUR AVERAGE (µG/M^3)					
		CL	PC (µG/M^3)	PC % OF CL	BC (µG/M^3)	PEC (µG/M^3)	CRITICAL LEVEL (CL)	PC (µG/M^3)	PC % OF CL	BC (µG/M^3)	PEC (µG/M^3)	PEC % OF CL
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	30	1.05	3.5%	16.1	17.2	75	7.84	10.5%	32.2	40.0	53.4%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.70	5.7%	17.7	19.4		10.69	14.3%	35.4	46.1	61.4%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.25	4.2%	17.7	18.9		8.73	11.6%	35.4	44.1	58.8%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.48	1.6%	17.7	18.2		6.08	8.1%	35.4	41.5	55.3%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI		1.90	6.3%	17.7	19.6		11.00	14.7%	35.4	46.4	61.8%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI		1.80	6.0%	18.6	20.4		12.74	17.0%	37.2	50.0	66.6%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI		0.53	1.8%	23.5	24.0		10.66	14.2%	47.0	57.7	76.9%

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					24 HOUR AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	CRITICAL LEVEL (CL)	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		0.33	1.1%	22.0	22.4		3.77	5.0%	44.1	47.8	63.8%
OE4	Eston Pumping Station LWS		0.28	0.9%	18.9	19.2		4.28	5.7%	37.9	42.1	56.2%
OE5a	Teesmouth NNR		0.13	0.4%	22.1	22.2		2.46	3.3%	44.2	46.6	62.2%
OE5b	Teesmouth NNR		0.07	0.2%	20.6	20.6		1.99	2.7%	41.1	43.1	57.5%
OE6	Teesmouth and Cleveland Coast SSSI		0.61	2.0%	21.8	22.4		6.92	9.2%	43.6	50.5	67.3%

Table 8B-47: NO_x Dispersion Modelling Results for Ecological Receptors – Case B

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					24 HOUR AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	CRITICAL LEVEL (CL)	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	30	1.01	3.4%	16.1	17.1	75	6.75	9.0%	32.2	38.9	51.9%

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					24 HOUR AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	CRITICAL LEVEL (CL)	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.76	5.9%	17.7	19.5		10.69	14.3%	35.38	46.1	61.4%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.38	4.6%	17.7	19.1		10.09	13.5%	35.38	45.5	60.6%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.49	1.6%	17.7	18.2		6.29	8.4%	35.38	41.7	55.6%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI		2.25	7.5%	17.7	19.9		12.01	16.0%	35.38	47.4	63.2%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI		1.80	6.0%	18.6	20.4		11.03	14.7%	37.22	48.3	64.3%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI		0.54	1.8%	23.5	24.1		9.53	12.7%	47.02	56.6	75.4%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		0.33	1.1%	22.0	22.4		3.92	5.2%	44.06	48.0	64.0%

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					24 HOUR AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	CRITICAL LEVEL (CL)	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE4	Eston Pumping Station LWS		0.29	1.0%	18.9	19.2		4.00	5.3%	37.86	41.9	55.8%
OE5a	Teesmouth NNR		0.13	0.4%	22.1	22.2		2.52	3.4%	44.18	46.7	62.3%
OE5b	Teesmouth NNR		0.07	0.2%	20.6	20.6		2.13	2.8%	41.12	43.2	57.7%
OE6	Teesmouth and Cleveland Coast SSSI		0.62	2.1%	21.8	22.4		7.32	9.8%	43.58	50.9	67.9%

Table 8B-48: SO_2 Dispersion Modelling Results for Ecological Receptors - Case A

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	20	0.9%	1.8	1.98	9.9%	0.9%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.5%	1.9	2.15	10.7%	1.5%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		1.1%	1.8	2.05	10.2%	1.1%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.4%	2.1	2.21	11.1%	0.4%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI		1.7%	1.9	2.18	10.9%	1.7%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI		1.6%	2.0	2.33	11.7%	1.6%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI		0.5%	2.4	2.49	12.5%	0.5%

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		0.3%	4.1	4.16	20.8%	0.3%
OE4	Eston Pumping Station LWS		0.2%	2.6	2.60	13.0%	0.2%
OE5a	Teesmouth NNR		0.1%	2.2	2.18	10.9%	0.1%
OE5b	Teesmouth NNR		0.1%	2.2	2.25	11.3%	0.1%
OE6	Teesmouth and Cleveland Coast SSSI		0.5%	2.1	2.24	11.2%	0.5%

Table 8B-49: SO_2 Dispersion Modelling Results for Ecological Receptors - Case B

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.12	0.6%	1.8	1.9	9.6%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.21	1.1%	1.9	2.1	10.3%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI		0.15	0.7%	1.8	2.0	9.9%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	20	0.06	0.3%	2.1	2.2	10.9%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI		0.24	1.2%	1.9	2.1	10.4%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI		0.22	1.1%	2.0	2.2	11.2%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI		0.06	0.3%	2.4	2.5	12.3%

RECEPTOR ID	SITE NAME	ANNUAL AVERAGE (µG/M³)					
		CL	PC (µG/M³)	PC % OF CL	BC (µG/M³)	PEC (µG/M³)	PEC % OF CL
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		0.04	0.2%	4.1	4.1	20.7%
OE4	Eston Pumping Station LWS		0.04	0.2%	2.6	2.6	12.9%
OE5a	Teesmouth NNR		0.02	0.1%	2.2	2.2	10.9%
OE5b	Teesmouth NNR		0.01	0.0%	2.2	2.2	11.2%
OE6	Teesmouth and Cleveland Coast SSSI		0.07	0.4%	2.1	2.2	11.0%

Table 8B-50: Dispersion Modelling Results for Ecological Receptors – Nutrient Nitrogen Deposition (Kg/Ha/Yr), Case A

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	9.27	Coastal stable dune grassland (calcareous type)	10	0.15	1.5%	9.42	94.2%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.24	2.4%	10.38	103.8%

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.18	1.8%	10.32	103.2%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.07	0.7%	10.21	102.1%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.27	2.7%	10.41	104.1%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	9.38	Coastal stable dune grassland (calcareous type)	10	0.26	2.6%	9.64	96.4%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	8.79	Coastal stable dune grassland (calcareous type)	10	0.08	0.8%	8.87	88.7%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	8.45	Sub-atlantic semi-dry calcareous grassland	15	0.05	0.3%	8.50	56.6%

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
OE4	Eston Pumping Station LWS	7.86	Sub-atlantic semi-dry calcareous grassland	15	0.04	0.3%	7.90	52.7%
OE5a	Teesmouth NNR	10.9	Coastal stable dune grassland (calcareous type)	10	0.02	0.2%	10.92	109.2%
OE5b	Teesmouth NNR	10.9	Coastal Saltmarsh	20	0.01	0.0%	10.91	54.5%
OE6	Teesmouth and Cleveland Coast SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.09	0.9%	10.23	102.3%

Table 8B-51: Dispersion Modelling Results for Ecological Receptors – Nutrient Nitrogen Deposition (Kg/Ha/Yr), Case B

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	9.27	Coastal stable dune grassland (calcareous type)	10	0.15	1.5%	9.42	94.2%

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.25	2.5%	10.39	103.9%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.20	2.0%	10.34	103.4%
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.07	0.7%	10.21	102.1%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.32	3.2%	10.46	104.6%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	9.38	Coastal stable dune grassland (calcareous type)	10	0.26	2.6%	9.64	96.4%
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	8.79	Coastal stable dune grassland (calcareous type)	10	0.08	0.8%	8.87	88.7%
OE3	Coatham Marsh LWS and Teesmouth and	8.45	Sub-atlantic semi-dry calcareous grassland	15	0.05	0.3%	8.50	56.6%

RECEPTOR ID	SITE NAME	BACKGROUND NITROGEN DEPOSITION (KG N/HA/YR)	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (KGN/HA/YR)	PC % CRITICAL LOAD	PEC (KGN/HA/YR)	PEC % CRITICAL LOAD
	Cleveland Coast SPA, SSSI							
OE4	Eston Pumping Station LWS	7.86	Sub-atlantic semi-dry calcareous grassland	15	0.04	0.3%	7.90	52.7%
OE5a	Teesmouth NNR	10.9	Coastal stable dune grassland (calcareous type)	10	0.02	0.2%	10.92	109.2%
OE5b	Teesmouth NNR	10.9	Coastal Saltmarsh	20	0.01	0.1%	10.91	54.6%
OE6	Teesmouth and Cleveland Coast SSSI	10.14	Coastal stable dune grassland (calcareous type)	10	0.09	0.9%	10.23	102.3%

Table 8B-52: Dispersion Modelling Results for Ecological Receptors – Acid Deposition N (Keq/Ha/Yr) – Case A

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.033	0.54%	5.8%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.053	0.88%	6.1%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.039	0.64%	5.9%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.015	0.25%	5.5%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.059	0.98%	6.2%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.056	0.93%	6.2%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.016	0.27%	5.5%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 1.07 Min CL Max N 5.071 Min CL Max S 4.0	0.78	Calcareous grassland	4.5%	0.010	0.17%	4.7%
OE4	Eston Pumping Station LWS	Min CL min N 1.07 Min CL Max N 5.071 Min CL Max S 4.0	0.81	Calcareous grassland	4.8%	0.009	0.15%	4.9%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE5a	Teesmouth NNR	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	No background determined		0.0%	0.004	0.07%	0.1%
OE5b	Teesmouth NNR	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	No background determined		0.0%	0.002	0.04%	0.0%
OE6	Teesmouth and Cleveland Coast SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.019	0.32%	5.6%

Table 8B-53: Dispersion Modelling Results for Ecological Receptors – Acid Deposition N (Keq/Ha/Yr) – Case B

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE1a	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.025	0.36%	5.6%
OE1b	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.043	0.62%	5.9%
OE1c	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.032	0.44%	5.7%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE1d	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.012	0.17%	5.4%
OE2a	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.051	0.70%	6.0%
OE2b	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.044	0.64%	5.9%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE2c	Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.013	0.18%	5.4%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Min CL min N 1.07 Min CL Max N 5.071 Min CL Max S 4.0	0.78	Calcareous grassland	4.5%	0.008	0.12%	4.6%
OE4	Eston Pumping Station LWS	Min CL min N 1.07 Min CL Max N 5.071 Min CL Max S 4.0	0.81	Calcareous grassland	4.8%	0.007	0.10%	4.9%

RECEPTOR ID	SITE NAME	CRITICAL LOAD	ACID DEPOSITION (KEQ/HA/YR)			PC ACID DEPOSITION (KEQ/HA/YR)		
			BASELINE	LOWEST CRITICAL LOAD CLASS APLICABLE	BASELINE % OF CRITICAL LOAD	PC	PC % OF CRITICAL LOAD	PEC % OF CRITICAL LOAD
OE5a	Teesmouth NNR	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0		0.0%	0.003	0.04%	0.0%
OE5b	Teesmouth NNR	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0		0.0%	0.002	0.02%	0.0%
OE6	Teesmouth and Cleveland Coast SSSI	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.93	Calcareous grassland	5.3%	0.015	0.22%	5.5%

8B.7 Assessment of Limitations and Assumptions

8B.7.1 This section outlines the potential limitations associated with the dispersion modelling assessment. Where assumptions have been made, this is also detailed here.

8B.7.2 The greatest uncertainty associated with any dispersion modelling assessment arises through the inherent uncertainty of the dispersion modelling process itself. Nevertheless, the use of dispersion modelling is a widely applied and accepted approach for the prediction of impacts from industrial sources.

8B.7.3 To minimise the likelihood of under-estimating the PC to ground level concentrations from the main stack, the following conservative assumptions have been made within the assessment:

- The operational Proposed Development has been assumed to operate on a continuous basis i.e., for 8,760 hour per year, although in practice the plant would require routine maintenance periods;
- The modelling predictions are based on the use of five full years of meteorological data from Durham Tees Valley Airport meteorological station for the years 2015 to 2019 inclusive, with the highest result being reported for all years assessed; This is considered to be conservative.
- The largest possible building sizes within the Rochdale Envelope have been included in the assessment, including for the stack height assessment; therefore, the stack height represents the lowest required to achieve the impacts presented in this assessment;
- Emission concentrations for the process are calculated based on the use of IED limits, BAT-AEL concentrations, or maximum envisaged emission rates from licensors; in practice annual average rates would be below this to enable continued compliance with environmental permit requirements.

8B.7.4 The following assumption has been made in the preparation of the assessment:

- 70% NOx to NO_2 conversion rate has been assumed in predicting the long-term process contribution, and 35% for the short-term process contribution respectively.

8B.8 Conclusions

8B.8.1 This report has assessed the impact on local air quality of the operation of the Proposed Development. The assessment has used the dispersion model ADMS to predict the increases in pollutant species released from the operational Development to the local Study Area.

8B.8.2 Emissions from the fired Heater stack, Auxiliary Boiler, flare and emergency generator stacks would result in small increases in ground-level concentrations of the modelled pollutants. Taking into account available information on background concentrations within the modelled domain, predicted operational concentrations of the modelled pollutants would be within current environmental standards for the protection of human health.

8B.8.3 The modelling of impacts at designated ecological sites (SACs / Ramsar / SPAs and SSSIs) has predicted that emissions would be unlikely to give rise to significant impacts with regard to increases in atmospheric concentrations of NOx and SO_2 at the majority of modelled receptor locations, however depositional impacts of nutrient nitrogen are above the insignificance threshold at the Teesmouth and Cleveland Coast SPA. Further interpretation and discussion of these impacts is provided in the Chapter 12: Ecology and Nature Conservation (PEI Report, Volume I).