H2Teesside Project

Environmental Statement

Volume III – Appendices

Appendix 8B: Air Quality – Operational Phase

Document Reference: 6.4.8

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

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

Rev: 0

TABLE OF CONTENTS

8B.0 AIR QUALITY – OPERATIONAL PHASE 5
8B.1 Introduction 5
8B.2 Scope 5
8B.3 Methodology 9
8B.4 Baseline Air Quality 23
8B.5 Summary of Background Air Quality 28
8B.6 Assessment of Limitations and Assumptions 28
8B.7 Operational Emissions Modelling Results 29
8B.8 Conclusions 67
8B.9 References 68
8B.10 Annex A: Sensitivity Testing of Model Inputs 69
8B.11 Annex B: Cumulative Assessment Inputs and In-Combination Results 70
8B.12 Annex C: 2023 Diffusion Tube Survey 89
8B.13 Annex D: Combined Construction Traffic and Operational Phase at Traffic Receptors 90

TABLES

Table 8B-1: General ADMS 5 Model Inputs 9
Table 8B-2: Emissions Inventory per Unit 12
Table 8B-3: Emissions Concentrations and the Assessed Emission Rate per Units 15
Table 8B-4: Human Receptor Locations 16
Table 8B-5: Ecological Receptor Locations 17
Table 8B-6: Modelled Domain, Receptor Grid 18
Table 8B-7: Buildings Incorporated into the Modelling Assessment 21
Table 8B-8: Conversion Factors – Calculation of Nutrient Nitrogen Deposition 23
Table 8B-9: Conversion Factors – Calculation of Acid Deposition 23
Table 8B-10: 2022 DEFRA Background Concentrations (NGR 456500, 525500) 25
Table 8B-11: AECOM Nitrogen Dioxide Diffusion Tube Monitoring 25
Table 8B-12: APIS Background Data NO_x 26
Table 8B-13: APIS Background Deposition Information 27
Table 8B-14: Predicted Change in Annual Mean NO_2 Concentrations – Normal Operation 32
Table 8B-15: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Normal Operation 34
Table 8B-16: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Start Up Scenario 35
Table 8B-17: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Emergency Scenario 36
Table 8B-18: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Normal Operation 38

Table 8B-19: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Start Up Scenario 39
Table 8B-20: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Emergency Scenario 40
Table 8B-21: Predicted Change in Annual Mean PM_{10} Concentrations – Normal Operation . 42
Table 8B-22: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41st Percentile of 24 Hour averages) – Normal Operation 43
Table 8B-23: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41st Percentile of 24 Hour averages) – Start Up Scenario 44
Table 8B-24: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41st Percentile of 24 Hour averages) – Emergency Scenario 45
Table 8B-25: Predicted Change in Annual Mean $PM_{2.5}$ Concentrations – Normal Operation 47
Table 8B-26: Predicted Change in 15 Minute Mean SO_2 Concentrations (as the 99.9th Percentile of 15 Minute averages) – Start-Up Operation 49
Table 8B-27: Predicted Change in 1 Hour Mean SO_2 Concentrations (as the 99.73rd Percentile of 1 Hour averages) – Start-Up Operation 50
Table 8B-28: Predicted Change in 24 Hour Mean SO_2 Concentrations (as the 99.18th Percentile of 24 Hour averages) – Start-Up Operation 51
Table 8B-29: NO_x Annual Mean Dispersion Modelling Results for Ecological Receptors..... 54
Table 8B-30: Maximum 24-hour NO_x Dispersion Modelling Results for Ecological Receptors 56
Table 8B-31: Dispersion Modelling Results for Ecological Receptors – Nutrient Nitrogen Deposition (Kg/Ha/Yr) 59
Table 8B-32: Dispersion Modelling Results for Ecological Receptors – Acid Deposition N (Keq/Ha/Yr) 63
Table 8B-33: Sensitivity Tests Results compared to the Main Assessment 69
Table 8B-34: Emission Inventory for the Cumulative Schemes (1) 72
Table 8B-35: Emission Inventory for the Cumulative Schemes (2) 73
Table 8B-36: Emission Inventory for the Cumulative Schemes (3) 74
Table 8B-37: Emission Inventory for the Cumulative Schemes (4) 75
Table 8B-38: Emission Inventory for the Cumulative Schemes (5) 76
Table 8B-39: Buildings for Inclusion in the Cumulative Scheme Model..... 77
Table 8B-40: Annual Mean NOx Dispersion Modelling Results for Ecological Receptors 78
Table 8B-41: Maximum 24-hour NOx Dispersion Modelling Results for Ecological Receptors80
Table 8B-42: Dispersion Modelling Results for Ecological Receptors - Nutrient Nitrogen Deposition (Kg/Ha/Yr) 82
Table 8B-43: Dispersion Modelling Results for Ecological Receptors - Acid Deposition N (Keq/Ha/Yr) 85
Table 8B-44: 2023 Diffusion Tube Survey Results 89
Table 8B-45: NO_x Annual Mean and Nitrogen Deposition Dispersion Modelling Results for Ecological Receptors for Construction Traffic and Operational Phase Combined 90
Table 8B-46: NO_2 Annual Mean Dispersion Modelling Results for Human Health Receptors for Construction Traffic and Operational Phase Combined 91

PLATES

Plate 8B-1: Windroses for Durham Tees Valley Airport Meteorological Station, 2018 to 2022 20
Plate 8B-2: Predicted Maximum Process Contribution to Ground Level NO_2 Concentrations at Stack Release Heights of 20 m to 100 m 31

8B.0 AIR QUALITY – OPERATIONAL PHASE

8B.1 Introduction

8B.1.1 This Technical Appendix supports Environmental Statement (ES) Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2) 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 (ES Volume I, EN070009/APP/6.2).

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 boilers, flare 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. Such emissions have the potential for significant short-term effects at sensitive receptors, and an assessment has been undertaken of non-routine operational scenarios. The plant operation will be tightly regulated by the Environment Agency through the Environmental Permit required for the operation of the Proposed Development.

8B.2 Scope

Operational Traffic Emissions

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 (Highways England, 2019) and Institute of Air Quality Management (IAQM) screening criteria (EPUK/IAQM, 2017) 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 operational 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 auxiliary boilers (one per phase) 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, 2028.

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 Heaters (natural gas fired), flare (to include pilot and flare operating as in Emergency scenario), and Auxiliary Boilers (natural gas fired);
- normal operation – including Auxiliary Boilers (hydrogen and tailings gas fired) and flare in normal operation (pilot and purge only); 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 H_2 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 reported within this Technical Appendix.

8B.2.6 The Study Area for the operational Proposed Development point source emissions extends up to 15 km from the emission sources to assess the potential impacts on ecological receptors. This is in line with the Environment Agency (EA) risk assessment methodology (Department for Environment, Food & Rural Affairs (Defra) and Environment Agency, 2016, as updated in 2023) but also includes additional sites requested by the biodiversity specialists based on their professional judgment:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites and Sites of Special Scientific Interest (SSSIs) within 15 km (10km set out in the guidance, plus a further 5km requested by the project's biodiversity specialists); and
- Local Nature Sites (including ancient woodlands, Local Wildlife Sites (LWSs) and National Nature Reserves (NNRs) and Local Nature Reserves (LNRs)) within 2 km.

8B.2.7 In terms of human health receptors, based on similar modelling studies and EA guidance, impacts from the operational Proposed Development become negligible

within approximately 2 km and therefore sensitive receptors for the human health impacts 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) (Version 6). The results are presented in both tabular format within this Technical 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 (ES Volume II, EN070009/APP/6.3):

- Figure 8-6: Annual Mean NO_2 Process Contribution for the Proposed Development during Normal Operations for Phase 1 and 2 Combined – 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 – for the Worst Affected Meteorological Year of 2021.
- Figure 8-8: 99.79th Percentile 1h NO_2 Process Contribution for the Proposed Development during Emergency Operations for Phase 1 and 2 Combined – for the Worst Affected Meteorological Year of 2022.
- Figure 8-9: 99.79th Percentile 1h NO_2 Process Contribution for the Proposed Development during Start Up for Phase 1 and 2 Combined – for the Worst Affected Meteorological Year of 2020.
- Figure 8-10: Nitrogen Deposition from Process Contribution for the Proposed Development during Normal Operations for Phase 1 and 2 Combined – 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 Heaters (start-up only), auxiliary boilers, operational flare (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).

8B.2.10 Emissions from Large Combustion Plant (LCP) are governed by the Industrial Emissions Directive (IED Directive 2010/75/EU) (European Union, 2010), 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) (European Commission, 2017). 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 supplied by the clients FEED contractor and are reviewed in this ES.

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 (ES Volume I, EN070009/APP/6.2).

Cumulative Impacts

8B.2.13 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. Two examples of proposed developments considered within the study area but that do not have operational emissions to air are HyGreen and Lightsource BP solar projects.

8B.2.15 The full list of cumulative schemes to be considered for the Proposed Development can be found below whilst details of the model inputs are provided in Annex B. The cumulative impact of the following consented schemes with the Proposed Development have been considered in this assessment:

- ID 2: The Tees Combined Cycle Power Plant, EN010082;
- ID 3: Net Zero Teesside, EN010103;
- ID 19: Peak Resources Ltd, R/2017/0876/FFM;
- ID 20: CBRE anaerobic biogas production facility and combined heat and power plant, R/2016/0484/FFM;
- ID 22: Grangetown energy recovery facility (ERF), R/2019/0767/OOM;
- ID 30: Tourian Renewables, R/2019/0031/FFM;
- ID 46: Redcar Energy Centre (REC), R/2020/0411/FFM;
- ID166: O2N Energy (materials recycling facility and production of energy from waste), 13/2892/EIS;
- ID 178: Green Lithium Refining, R/2023/0291/ESM;
- ID 212: Teesside Green Energy Park, 22/1525/EIS; and
- ID 219: Greenergy Renewable Fuels and Circular Products Facility, 23/1019/EIS.

8B.2.16 The results presented within the assessment are inherently cumulative, as the air quality modelling for the operational phase includes all relevant committed developments on top of the existing background, both with and without the Proposed Development. The results of the inherently cumulative assessment are presented in Section 8B.7, with the details of the cumulative developments included in the model presented in Annex B.

Sources of Information

8B.2.17 The data that has been used within this assessment includes pertinent information from:

- Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2);
- data on emissions to atmosphere from the operational process, supplied by the design contractor;
- details on the Proposed Development site layout;
- Ordnance Survey mapping (OS, 2023);
- baseline air quality data from project specific monitoring, published sources and Local Authorities; and
- meteorological data supplied by ADM Ltd (AMD Ltd, 2023).

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 ES 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-1 and Table 8B-2, 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	0.3 m
Surface Roughness at meteorological site	0.3 m

VARIABLE	INPUT
Receptors	Selected discrete receptors (see Tabe 8-4 and Table 8-5)
	Nested receptor grid, with variable spacing (see Table 8B-6)
Receptor Location	X, Y co-ordinates determined by GIS
	Z = 1.5 m for human health receptors
	Z = 0 m (ground level) for ecological receptors
Source Location	See Table 8B-2
Emissions	Data provided by designer
Sources	See Table 8B-2
Meteorological Data	5 years of hourly sequential meteorological data from Durham Tees Valley Airport meteorological station (2018 to 2022)
Terrain Data	Not required
Buildings that may cause building downwash effects	See Table 8B-7

Emissions Data

8B.3.4 During normal operation, the Auxiliary Boilers stacks would be the primary sources 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 (pilot and purge) and emergency operations, for phase 1 and 2), two stacks for the Fired Heaters (start-up only, one for each phase) and two stacks for the emergency diesel generators (one for each phase).

8B.3.6 The main reported emissions for the Proposed Development have been modelled at a release height of 70 m above finished ground level for the Auxiliary Boilers, with an internal stack diameter of 1.65 m. This release height is based on the results of the Stack Height Assessment, see Section 8B.7: Evaluation of Stack Height. It is considered that this represents a conservative assessment, and the higher release height would result in lower impacts at modelled receptor locations. Following the same approach, the Fired Heaters have been modelled at a release height of 35 m above finished ground level for the Auxiliary Boilers, with an internal stack diameter of 0.55 m.

8B.3.7 For the flare, effective release heights and equivalent stack diameters have been calculated for each of the operational scenarios. This final release height of 65 m is based on the results of the Stack Height Assessment, as well as consideration of the minimum release height required for safety and design reasons. The release height

of 65 m is assessed as a minimum release height and at any increased release height, lower pollutant concentrations would be anticipated.

8B.3.8 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 stacks 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 (ES Volume II, EN070009/APP/6.3).

Table 8B-2: Emissions Inventory per Unit

PARAMETER	UNIT	FIRED HEATER (START-UP)	FLARE (NORMAL OPERATION)	FLARE (EMERGENCY/UPSET)	AUXILIARY BOILER (START UP)	AUXILIARY BOILER (NORMAL OPERATION)	EMERGENCY DIESEL GENERATORS
Stack Position	M (Easting, Northing National Grid)	Phase 1 – 456247, 525229 Phase 2 – 456461, 525665	Phase 1 – 456440, 525397	Phase 1 – 456440, 525397	Phase 1 – 456315, 525346 Phase 2 – 456349, 525723	Phase 1 – 456315, 525346 Phase 2 – 456349, 525723	Phase 1 – 456506, 525203 Phase 2 – 456662, 525763
Release Height (above ground level)	m	35	66.4*	104.2*	70	70	10
Effective internal stack diameter	m	0.55	0.9	4.248	1.65	1.65	0.96
Flue temperature	°C	200	1,000	1,000	259	155	600
Flue H_2O content	%	16.6	18.2	34.0	16.4	29.2	n/a
Flue O_2 content (wet)	%	3.19	0	0.05	2.5	1.6	n/a
Stack gas exit velocity	m/s	17.6	20	20	21.1	15.4	76.3

PARAMETER	UNIT	FIRED HEATER (START-UP)	FLARE (NORMAL OPERATION)	FLARE (EMERGENCY/UPSET)	AUXILIARY BOILER (START UP)	AUXILIARY BOILER (NORMAL OPERATION)	EMERGENCY DIESEL GENERATORS
Stack flow (actual)	Am^3/s	4.2	1.0	1131.0	45.1	33.0	55.3
Stack flow (actual)	kg/s	3.0	0.2	259.3	28.9	24.1	66.3

* Effective Stack Height (m)

8B.3.9 The modelled pollutant emission rates (in grams per second (g/s)) have been provided by the Applicant. The emission limits assumed to apply to the Proposed Development are shown in Table 8B-3.

8B.3.10 The assessment has assumed that the Proposed Development would operate at continuous design load (8,760 hours per year) during normal operation. No time-based variation in emissions have therefore been accounted for within the model.

Table 8B-3: Emissions Concentrations and the Assessed Emission Rate per Units

POLLUTANT	FIRED HEATER (START-UP)		FLARE (NORMAL OPERATION)		FLARE (EMERGENCY/UPSET)		AUXILIARY BOILER (START UP)		AUXILIARY BOILER (NORMAL OPERATION)		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	225	0.543	47.7	0.01	85.8	20.8	18.81	0.54	78.99	1.66	195.0	10.77
Carbon monoxide	-[1]	-[1]	217.6	0.05	391.0	94.8	11.45	0.33	-[1]	-[1]	51.5	2.85
Particulate Matter	-[1]	-[1]	3.8	0.0009	16.6	4.02	5	0.14	20	0.42	-[1]	-[1]
Sulphur Dioxide	3.9	0.009	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]
Ammonia	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	6.96	0.2	-[1]	-[1]	-[1]	-[1]

[1] No emission rate supplied.

Modelled Domain – Discrete Receptors

Sensitive Human Receptors

8B.3.11 The modelling has predicted concentrations of the modelled pollutants relevant to human health at discrete air quality sensitive receptors, as listed in Table 8B-4. The locations of these receptors are also shown in Figure 8-1: Air Quality Study Area Human Health Receptors and Monitoring (ES Volume II, EN070009/APP/6.3). 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-4: Human Receptor Locations

RECEPTOR REFERENCE	RECEPTOR DESCRIPTION	GRID REFERENCE		DISTANCE AND DIRECTION FROM THE OPERATIONAL SITE STACKS
		X	Y	
O1	Marsh Farm House, Warrenby Road, Coatham, Redcar	457950	525045	1.3 km east
O2	Cleveland Golf Links, Coatham, Redcar	458090	525550	1.2 km east
O3	South Gare Fishermans Association, Redcar	455680	527395	1.3 km north
O4	Marine Club, Redcar	455550	527345	1.3 km north
O5	Tingdene Beach Caravan Park, Coatham, Redcar	458675	525415	1.8 km east
O6	120 Broadway W, Dormanstown, Redcar	457895	523735	1.8 km south-east
O7	68 York Rd, Coatham, Redcar	458900	525060	2.2 km east
O8	Dormanstown Primary Academy, Redcar	458250	523585	2.2 km south-east
O9	Coatham Church of England School, Coatham, Redcar	459195	524980	2.5 km east

Sensitive Ecological Receptors

8B.3.12 In accordance with the Environment Agency's air emissions risk assessment guidance (Defra and Environment Agency, 2016, as updated in 2023), the impacts associated with emissions from the Proposed Development on statutory sensitive ecological sites have been quantified. The Study Area for the operational Proposed

Development point source emissions extends up to 15 km from the emission sources to assess the potential impacts on ecological receptors (including internationally and locally designated sites). This is in line with the Environment Agency Risk Assessment Methodology (Defra and Environment Agency, 2016, as updated in 2023) but also includes additional sites requested by the Proposed Development biodiversity specialists. Further details of the sites considered within 15 km is provided below.

8B.3.13 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 15 km of the operational Proposed Development, as recommended by the EA's risk assessment guidance for "large emitters" (Defra and Environment Agency, 2016, as updated in 2023). 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 addition, LWSs within 2 km of the Proposed Development have 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-5 and the locations of these receptors are shown in Figure 8-2: Air Quality Study Area Ecological Receptors (ES Volume II, EN070009/APP/6.3). The location reported for each ecological receptor is informed by the pattern of dispersion from the Proposed Development Main Site. In some instances, particularly for designated sites close to the Main Site, more than one receptor has been selected to provide an average for each type of designation (i.e. Ramsar, SPA, SSSI, NNR). Because some types of designation overlap in part of the same site more than receptor is sometimes presented (i.e. the Teesmouth and Cleveland Coast is a Ramsar, SPA and SSSI but the area covering the Ramsar is smaller than the one covering the SSSI for example).

Table 8B-5: Ecological Receptor Locations

RECEPTOR IDENTIFICATION	ECOLOGY SITE	GRID REFERENCE (X, Y)		DISTANCE AND DIRECTION FROM THE MAIN SITE
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	457283*	526000*	150 m north
OE2	Teesmouth and Cleveland Coast SPA, SSSI	456300*	526098*	0 m adjacent north
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	457860*	524991*	1.2 km east
OE4	Eston Pumping Station LWS	456474*	523797*	1 km south
OE5	Teesmouth NNR	454525*	527129*	1.78 km north-west

RECEPTOR IDENTIFICATION	ECOLOGY SITE	GRID REFERENCE (X, Y)		DISTANCE AND DIRECTION FROM THE MAIN SITE
OE6	Teesmouth and Cleveland Coast SSSI	455835*	526155*	0 m adjacent north
OE7	North York Moors SPA and SSSI	462481	513981	12.5 km south-east
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	448225	537450	13.6 km north-west
OE9	Cliff Ridge SSSI	457283	511718	13.2 km south
OE10	Durham Coast SSSI and Durham Coast NNR	448796	536560	12.6 km north-west
OE11	Durham Coast SSSI	449483	536169	12 km north-west
OE12	Hart Bog SSSI	445293	535376	14.3 km north-west
OE13	Langbaurgh Ridge SSSI	455524	512382	12.5 km south
OE14	Lovell Hill Pools SSSI	459643	519105	6.6 km south
OE15	Roseberry Topping SSSI	457878	512782	12.2 km south
OE16	Saltburn Gill SSSI	467005	521269	11 km south-east

**Coordinates for the closest point to the Main Site; results presented throughout this chapter and associated appendices are of the maximum impact anywhere within each site, so exact coordinates can vary.*

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-6.

Table 8B-6: 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

GRID SPACING (m)	DIMENSIONS (km)	NUMBER OF NODES IN EACH DIRECTION	NATIONAL GRID REFERENCE OF SOUTH-WEST CORNER
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 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 south-west 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 to 2022. Wind roses for each of the years within this period are shown in Plate 8B-1.

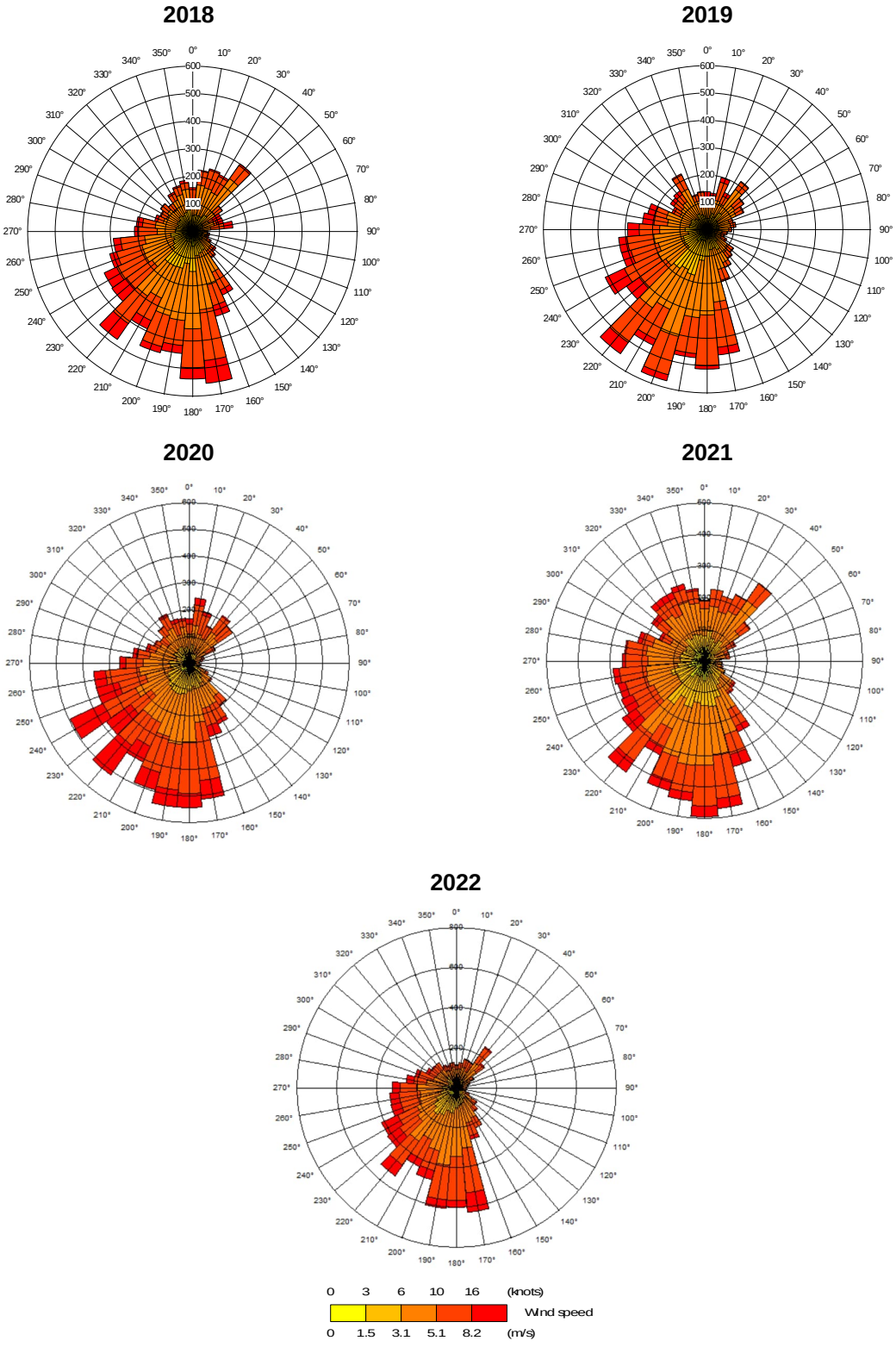


Plate 8B-1: Windroses for Durham Tees Valley Airport Meteorological Station, 2018 to 2022

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 as these are determined effective buildings. An approximation is made based on Equation 8B-1 and referenced in ADMS 6 User guide (CERC, 2023), where any buildings of height, H_i, less than a fraction 1 / α of the source height are excluded.

Equation 8B-1: Determination of the 'effective building'

$$\alpha = 1 + 2\min(1, \frac{W_i}{H_i})$$

where W_i is the crosswind width of the building i.

8B.3.22 The modelled locations are shown in Table 8B-7 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 (ES Volume II, EN070009/APP/6.3). The dimensions of the buildings are indicative of the likely layout that could potentially be required.

Table 8B-7: Buildings Incorporated into the Modelling Assessment

BUILDING MODEL ID	BUILDING CENTRE GRID REFERENCE (X, Y)	HEIGHT (m)	LENGTH (m)	WIDTH (m)	ANGLE (°)
Cooler1P1	456310, 525274	17	12	19	110
Cooler2P1	456300, 525248	17	12	31	110
Cooler3P1	456447, 525151	17	33	33	110
CompHouseP1	456373, 525311	15	25	25	110
ASUP1	456426, 525047	52	26	30	110
Tank1P1	456208, 525134	22	17	17	0
Tank2P1	456230, 525126	22	17	17	0
Cooler1P2	456392, 525750	15	13	33	20
Cooler2P2	456444, 525729	15	13	31	20
Cooler3P2	456515, 525700	15	13	40	20
CompHouseP2	456411, 525787	16	20	19	20
SubU1P2	456456, 525761	16	22	31	20
SubU2P2	456437, 525748	15	12	13	20
ASUP2	456464, 525915	40	26	30	20
Tank1P2	456667, 525682	22	17	17	0

BUILDING MODEL ID	BUILDING CENTRE GRID REFERENCE (X, Y)	HEIGHT (m)	LENGTH (m)	WIDTH (m)	ANGLE (°)
Tank2P2	456658, 525660	22	17	17	0
CO2RemovalP1	456335, 525241	14	13	33	110
AuxBoilerandBFWP1	456306, 525349	15	48	16	110
WorkshopP1	456037, 525121	30	50	50	110
ControlRoomP1	456122, 525076	30	35	50	110
GHR_ATR_AnalyserP1	456278, 525253	23	27	43	110

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 is relatively flat. The Main Site is adjacent to the River Tees Estuary to the west. A surface roughness of 0.3 m, corresponding to the predominant 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, 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 (Defra and Environment Agency, 2016, as updated in 2023) 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 (Air Quality Advisory Group, 2014), 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-8 and Table 8B-9

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

POLLUTANT	DEPOSITION VELOCITY GRASSLAND (m/s)	DEPOSITION VELOCITY WOODLAND (m/s)	CONVERSION FACTOR (µg/m^3/s to keq/ha/yr)
NOx as NO_2	0.0015	0.003	96

Table 8B-9: Conversion Factors – Calculation of Acid Deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLAND (m/s)	DEPOSITION VELOCITY WOODLAND (m/s)	CONVERSION FACTOR (µg/m^3/s to keq/ha/yr)
SO_2	0.012	0.024	9.86
NO_2	0.0015	0.003	6.85

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 (RCBC, 2023);
- review of data from Defra's background mapping database (Defra, 2020);
- AECOM monitoring undertaken in the area around the Site; and
- review of background data and site relevant critical loads from the Air Pollution Information System (APIS) website.

Air Quality Management Areas

8B.4.2 RCBC, Hartlepool Borough Council 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 2022 was available at the time of writing with annual concentrations of NO_2, PM_{10} and $PM_{2.5}$ of 10 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 14 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 2022 and the average measured annual NO_2 concentration was 13.9 µg/m^3.

8B.4.5 All monitoring locations within the Study Area are below the annual mean NO_2 objective of 40 µg/m^3 in 2022.

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 to 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-10 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-10: 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

Survey Monitoring Data

8B.4.10 A three 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-11.

8B.4.11 A second survey was conducted for three months in 2023, from mid-June to mid-September, to confirm the air quality in the area had not changed substantially since the initial survey. Results show the NO_2 concentration in the area have been relatively stable and are presented in Annex C.

Table 8B-11: AECOM Nitrogen Dioxide Diffusion Tube Monitoring

SITE ID	MONITORING LOCATION	GRID REFERENCE		2022 ANNUAL MEAN CONCETRATION (µg/m^3)
		X	Y	
DT1	A1085, west of West Coatham Lane	457402	523655	24.0
DT2	A1085, east of West Coatham Lane	457668	523958	35.8
DT3	Teesmouth and Cleveland Coast SSSI, south of Warrenby	459008	524872	14.7
DT4	A1085, east of Grangetown	455455	520617	16.9
DT5	A1053, south of junction with A66	455431	520975	17.6
DT6	A1085, north of junction with A1053	455949	521326	40.1
DT7	Junction of Eston Road/A174	457131	519556	24.0
DT8	High Street, Old Lackenby	456466	519123	17.6
DT9	Woodlands Road, Normanby	455100	517473	13.0
DT10	Springhill, Ormesby	453905	517394	9.9

SITE ID	MONITORING LOCATION	GRID REFERENCE		2022 ANNUAL MEAN CONCETRATION (µg/m^3)
		X	Y	
DT11	Mosedale Road, Grangetown	455488	519463	11.7
DT12	Lilac Cloase, Lazenby	457237	519877	9.2
DT13	South Avenue, Dormanstown	458147	523551	15.5
DT14	Seaton Common Road, Seaton Carew	453310	528182	11.9
DT15	South Gare Access Road	457341	525680	16.9
DT16	South Gare Access Road	456650	525953	15.2
DT17	South Gare Access Road	456323	526112	16.3
DT18	A1046/Port clarence Road, Port Clarence	449399	522028	20.7
DT19	Limetrees Close, High Clarence	449091	522434	13.3
DT20	A178/Seaton Carew Road	450821	525066	15.5
DT21	A1046/Port clarence Road, Port Clarence	449943	521663	20.4

8B.4.12 The diffusion 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.4.13 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-12.

Table 8B-12: APIS Background Data NO_x

RECEPTOR ID	ECOLOGY SITE	BACKGROUND NO_x (µg/m^3)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	16.1
OE2	Teesmouth and Cleveland Coast SPA, SSSI	17.7
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	17.7
OE4	Eston Pumping Station LWS	17.7
OE5	Teesmouth NNR	17.7
OE6	Teesmouth and Cleveland Coast SSSI	18.6
OE7	North York Moors SPA and SSSI	23.5

RECEPTOR ID	ECOLOGY SITE	BACKGROUND NO_x ($\mu g/m^3$)
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	22.0
OE9	Cliff Ridge SSSI	18.9
OE10	Durham Coast SSSI and Durham Coast NNR	22.1
OE11	Durham Coast SSSI	20.6
OE12	Hart Bog SSSI	21.8
OE13	Langbaurgh Ridge SSSI	21.2
OE14	Lovell Hill Pools SSSI	21.0
OE15	Roseberry Topping SSSI	20.9
OE16	Saltburn Gill SSSI	20.7

8B.4.14 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-13.

Table 8B-13: APIS Background Deposition Information

RECEPTOR ID	ECOLOGY SITE	N-DEPOSITION	ACID DEPOSITION	
		(kg N/ha/yr)	(keq N/ha/yr)	(keq S/ha/yr)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	12.66	0.72	0.22
OE2	Teesmouth and Cleveland Coast SPA, SSSI	12.66	0.72	0.22
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	12.62	0.6	0.21
OE4	Eston Pumping Station LWS	12.95	0.62	0.21
OE5	Teesmouth NNR	13.75	N/A	N/A
OE6	Teesmouth and Cleveland Coast SSSI	12.66	0.72	0.22
OE7	North York Moors SPA and SSSI	16.9	1.21	0.17
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	12.62	0.88	0.14

RECEPTOR ID	ECOLOGY SITE	N-DEPOSITION	ACID DEPOSITION	
		(kg N/ha/yr)	(keq N/ha/yr)	(keq S/ha/yr)
OE9	Cliff Ridge SSSI	12.62	0.9	0.15
OE10	Durham Coast SSSI and Durham Coast NNR	12.62	0.9	0.14
OE11	Durham Coast SSSI	14.04	1	0.14
OE12	Hart Bog SSSI	14.51	N/A	N/A
OE13	Langbaurgh Ridge SSSI	20.19	1.44	0.16
OE14	Lovell Hill Pools SSSI	16.9	1.21	0.17
OE15	Roseberry Topping SSSI	12.62	0.88	0.14
OE16	Saltburn Gill SSSI	12.62	0.9	0.15

8B.5 Summary of Background Air Quality

8B.5.1 For human health receptors, the background concentrations for NO_2 and CO have been taken from the Defra background mapping, as presented in Table 8B-10. Although the diffusion tube data for Dormanstown indicates slightly higher NO_2 concentrations compared to the Defra background maps, 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 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 (Defra and Environment Agency, 2016, as updated in 2023).

8B.5.4 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 Assessment of Limitations and Assumptions

8B.6.1 This section outlines the potential limitations associated with the dispersion modelling assessment. Where assumptions have been made, this is also detailed here.

8B.6.2 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.6.3 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 Hydrogen Production Facility 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 2018 to 2022 inclusive, with the highest result being reported for all years assessed; This is considered to be conservative;
- the modelling is based on the current layout available; it is not proportionate to sensitivity test all the different building locations. The effect of buildings on pollutant dispersal is greatest in the immediate area within the site. It is considered unlikely that alterations to building layouts and dimensions would notably change offsite operational predictions of pollutant contributions and therefore effects are unlikely to change from not significant; and
- emission concentrations for the process are calculated based on the use of IED limits, Best Available Techniques Achievable Emission 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.6.4 The following assumption has been made in the preparation of the assessment:

- 70% NO_x 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.7 Operational Emissions Modelling Results

Evaluation of Stack Height

8B.7.1 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. The analysis considers each stack individually first, with sources built during Phase 2 referred to as “Phase 2” in the graphs below, then together to confirm the combined impacts are acceptable.

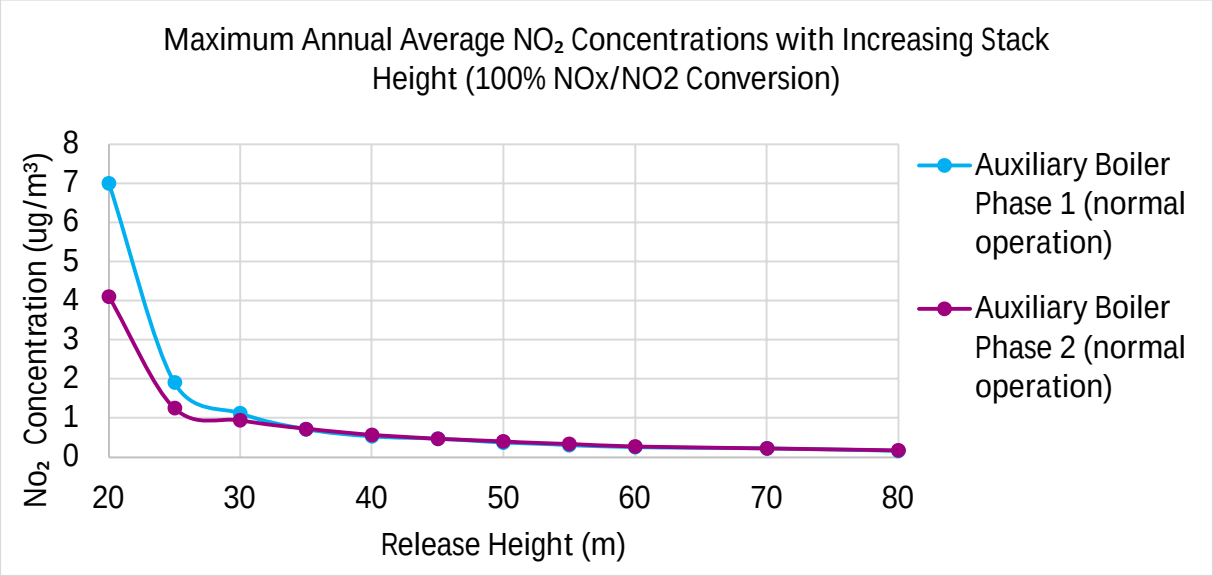
8B.7.2 Emissions from the Auxiliary Boilers stacks have been modelled at heights between 20 m and 80 m, at 5 m increments between 30 and 70 m. For the flare, emissions have been modelled with an initial release height between 65 m and 100 m. Short-term emissions from the Fired Heaters stacks have been modelled at heights between 20 m and 70 m, at 5 m increments, using start-up emissions. Graphs for the results, showing the predicted ground level concentrations for the annual mean

and maximum one 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.7.3 Analysis of the curves shows that the benefit of incremental increases in release heights of the Auxiliary Boilers after 40 m become less pronounced, but concentrations are still decreasing slowly. Because of the proximity of sensitive ecological habitats, that decrease in concentration is useful to limit impacts on ecosystems, even if the curve flattens. Benefits on air quality from increasing release height further is reduced, with this levelling out after 70 m. A release height of 70 m for the Auxiliary Boilers 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.7.4 For emissions from the flare, 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. This is due to the minimum height being already at 65 m for safety reasons.

8B.7.5 Analysis of the curves shows that the benefit of incremental increases in release heights of the Fired Heaters (used for start-up only) begins to be less pronounced at heights greater than 35 m above ground level and air quality benefits from increasing release height further are reduced. Looking at the predicted concentrations, a stack height of 35 m provides a sufficient degree of dispersion such that ground level concentrations are not significant.



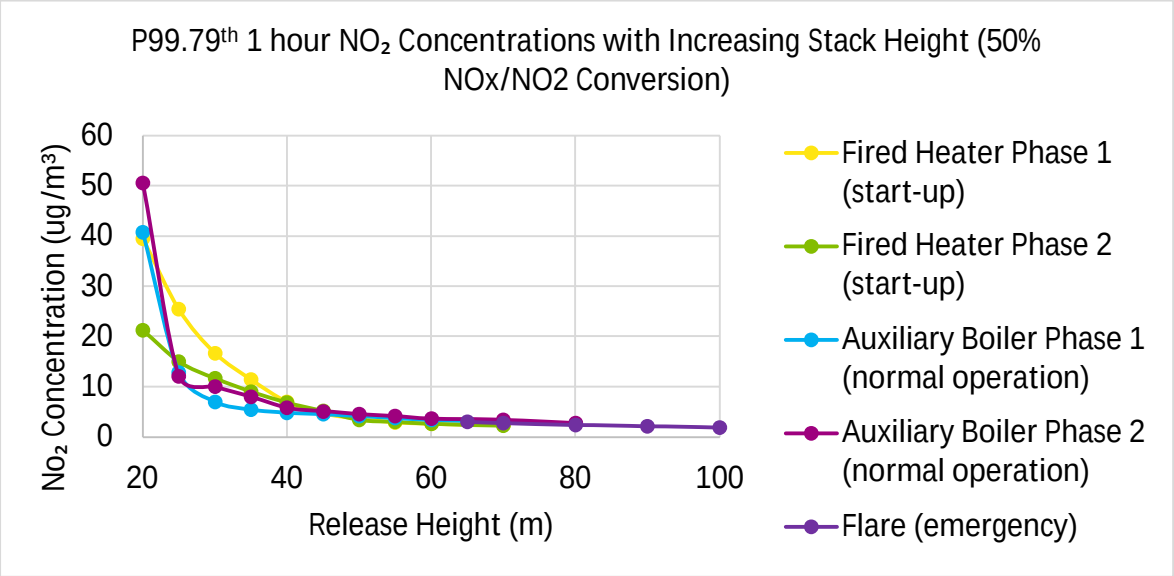


Plate 8B-2: Predicted Maximum Process Contribution to Ground Level NO_2 Concentrations at Stack Release Heights of 20 m to 100 m

Human Health Receptor Results

Nitrogen Dioxide Emissions

8B.7.6 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-14. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.7 The maximum predicted annual mean NO_2 concentration that occurs anywhere within the Study Area as a result of the Proposed Development is 0.3 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, existing background concentration and the process contributions of other committed developments) is 14.8 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.7.8 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 0.1 µg/m^3, representing 0.2% of the AQAL.

8B.7.9 The significance of the predicted change in annual mean NO_2 concentrations in planning terms is discussed in Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2).

Table 8B-14: Predicted Change in Annual Mean NO_2 Concentrations – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	40	0.1	0.2%	13.3	14.2	14.3	35.7%
O2	40	0.1	0.2%	13.3	14.4	14.4	36.1%
O3	40	0.1	0.2%	13.3	14.6	14.7	36.7%
O4	40	0.1	0.2%	13.3	14.5	14.6	36.4%
O5	40	0.1	0.1%	13.3	14.2	14.3	35.7%
O6	40	<0.1	0.1%	13.3	14.4	14.4	36.0%
O7	40	<0.1	0.1%	13.3	14.1	14.2	35.4%
O8	40	<0.1	0.1%	13.3	14.3	14.3	35.8%
O9	40	<0.1	0.1%	13.3	14.1	14.1	35.3%

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

8B.7.10 The predicted change in hourly mean NO_2 concentrations (as the 99.79th 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-15.

8B.7.11 The maximum predicted hourly mean NO_2 concentration (as the 99.79th percentile of hourly averages) during normal operation that occurs anywhere within the Study Area as a result of the Proposed Development is 3.13 µg/m^3, and this occurs again just to the north of the Proposed Development. The predicted environmental concentration (i.e., the process contribution, the existing background concentration and the process contribution from other committed developments) is 33.3 µg/m^3 and therefore is well below the hourly mean NO_2 AQAL of 200 µg/m^3.

8B.7.12 During the Start Up Scenario, the maximum predicted hourly mean NO_2 concentration (as the 99.79th percentile of hourly averages) during that occurs anywhere within the Study Area (2 km) as a result of the Proposed Development is 3.3 µg/m^3, and this occurs to the north of the Proposed Development. The predicted environmental concentration (i.e., the process contribution the existing background concentration and the process contribution from other committed developments) is 34.9 µg/m^3 and therefore is well below the hourly mean NO_2 AQAL of 200 µg/m^3.

8B.7.13 During the Emergency Scenario, the maximum predicted hourly mean NO_2 concentration (as the 99.79th percentile of hourly averages) during that occurs anywhere within the Study Area as a result of the Proposed Development is 72 µg/m^3, and this occurs to the east of the operational Proposed Development. The predicted environmental concentration (i.e., the process contribution, the existing background concentration and the process contribution from other committed developments) is 109.4 µg/m^3 and therefore is well below the hourly mean NO_2 AQAL of 200 µg/m^3.

8B.7.14 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 0.92 µg/m^3, and a PEC of 34.2 µg/m^3 during normal operation.

8B.7.15 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-15: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	200	0.8	0.4%	26.6	31.1	32.0	16.0%
O2	200	0.8	0.4%	26.6	31.4	32.2	16.1%
O3	200	0.9	0.5%	26.6	33.3	34.2	17.1%
O4	200	0.9	0.4%	26.6	32.9	33.8	16.9%
O5	200	0.6	0.3%	26.6	30.9	31.5	15.7%
O6	200	0.7	0.3%	26.6	30.3	30.9	15.5%
O7	200	0.6	0.3%	26.6	30.6	31.2	15.6%
O8	200	0.6	0.3%	26.6	30.2	30.7	15.4%
O9	200	0.5	0.3%	26.6	30.2	30.7	15.4%

Table 8B-16: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Start Up Scenario

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	200	2.2	1.1%	26.6	31.1	33.4	16.7%
O2	200	2.2	1.1%	26.6	31.4	33.7	16.8%
O3	200	2.0	1.0%	26.6	33.3	35.3	17.6%
O4	200	1.9	1.0%	26.6	32.9	34.9	17.4%
O5	200	1.8	0.9%	26.6	30.9	32.7	16.3%
O6	200	1.6	0.8%	26.6	30.3	31.9	15.9%
O7	200	1.6	0.8%	26.6	30.6	32.2	16.1%
O8	200	1.5	0.8%	26.6	30.2	31.7	15.8%
O9	200	1.5	0.7%	26.6	30.2	31.6	15.8%

Table 8B-17: Predicted Change in Hourly Mean NO_2 Concentrations (as the 99.79th Percentile of Hourly Averages) – Emergency Scenario

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	200	5.7	2.9%	26.6	31.1	36.9	18.4%
O2	200	4.9	2.5%	26.6	31.4	36.4	18.2%
O3	200	3.7	1.9%	26.6	33.3	37.1	18.5%
O4	200	3.8	1.9%	26.6	32.9	36.7	18.4%
O5	200	4.6	2.3%	26.6	30.9	35.5	17.7%
O6	200	3.9	2.0%	26.6	30.3	34.2	17.1%
O7	200	4.2	2.1%	26.6	30.6	34.7	17.4%
O8	200	3.7	1.8%	26.6	30.2	33.8	16.9%
O9	200	3.8	1.9%	26.6	30.2	34.0	17.0%

Carbon Monoxide Emissions

8B.7.16 The predicted change in the maximum eight 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-18 to Table 8B-20. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.17 The maximum eight 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 for every scenario. In addition, the maximum predicted PEC at any receptor is 2.8%. This is predicted to occur during the Start-Up and Emergency scenarios, and during normal operation the PC and PECs are predicted to be lower. It is considered that PC of CO would be unlikely to give rise to significant effects at any receptor location during all modelled scenarios.

Table 8B-18: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	10,000	<0.1	<0.1%	221.8	250.3	250.3	2.5%
O2	10,000	<0.1	<0.1%	221.8	263.7	263.8	2.6%
O3	10,000	<0.1	<0.1%	221.8	240.7	240.7	2.4%
O4	10,000	<0.1	<0.1%	221.8	240.0	240.0	2.4%
O5	10,000	<0.1	<0.1%	221.8	253.2	253.3	2.5%
O6	10,000	<0.1	<0.1%	221.8	249.9	249.9	2.5%
O7	10,000	<0.1	<0.1%	221.8	247.8	247.8	2.5%
O8	10,000	<0.1	<0.1%	221.8	244.5	244.5	2.4%
O9	10,000	<0.1	<0.1%	221.8	245.1	245.1	2.5%

Table 8B-19: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Start Up Scenario

RECEPTOR	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) ($\mu g/m^3$)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/AQAL (%)
O1	10,000	20.0	0.2%	221.8	250.3	270.3	2.7%
O2	10,000	20.0	0.2%	221.8	263.7	283.7	2.8%
O3	10,000	20.0	0.2%	221.8	240.7	260.7	2.6%
O4	10,000	20.0	0.2%	221.8	240.0	260.0	2.6%
O5	10,000	20.0	0.2%	221.8	253.2	273.2	2.7%
O6	10,000	20.0	0.2%	221.8	249.9	269.9	2.7%
O7	10,000	10.0	0.1%	221.8	247.8	257.8	2.6%
O8	10,000	10.0	0.1%	221.8	244.5	254.5	2.5%
O9	10,000	10.0	0.1%	221.8	245.1	255.1	2.6%

Table 8B-20: Predicted Change in Maximum 8 Hour Rolling Mean CO Concentrations – Emergency Scenario

RECEPTOR	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) ($\mu g/m^3$)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/AQAL (%)
O1	10,000	20.8	0.2%	221.8	250.3	271.1	2.7%
O2	10,000	21.0	0.2%	221.8	263.7	284.7	2.8%
O3	10,000	19.8	0.2%	221.8	240.7	260.5	2.6%
O4	10,000	16.7	0.2%	221.8	240.0	256.7	2.6%
O5	10,000	20.3	0.2%	221.8	253.2	273.5	2.7%
O6	10,000	18.9	0.2%	221.8	249.9	268.8	2.7%
O7	10,000	15.7	0.2%	221.8	247.8	263.6	2.6%
O8	10,000	14.6	0.1%	221.8	244.5	259.1	2.6%
O9	10,000	15.1	0.2%	221.8	245.1	260.2	2.6%

Particulate Matter (PM_{10})

8B.7.18 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-21. The predicted change in the 90.41st percentile of 24-hour mean PM_{10} concentrations are shown in Table 8B-22 to Table 8B-24. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.19 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 38.8%, while at the point of maximum impact it is 38.8%. This is predicted to occur during Start-up 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-21: Predicted Change in Annual Mean PM_{10} Concentrations – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	40	<0.1	0.1%	9.6	9.6	9.6	24.1%
O2	40	<0.1	0.1%	9.6	9.6	9.6	24.1%
O3	40	<0.1	0.1%	9.6	9.6	9.7	24.2%
O4	40	<0.1	0.1%	9.6	9.6	9.7	24.2%
O5	40	<0.1	<0.1%	9.6	9.6	9.6	24.1%
O6	40	<0.1	<0.1%	9.6	9.6	9.6	24.1%
O7	40	<0.1	<0.1%	9.6	9.6	9.6	24.1%
O8	40	<0.1	<0.1%	9.6	9.6	9.6	24.1%
O9	40	<0.1	<0.1%	9.6	9.6	9.6	24.1%

Table 8B-22: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41st Percentile of 24 Hour averages) – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	19.3	38.7%
O2	50	0.1	0.2%	19.2	19.2	19.4	38.8%
O3	50	0.1	0.3%	19.2	19.2	19.4	38.7%
O4	50	0.1	0.2%	19.2	19.2	19.3	38.6%
O5	50	0.1	0.1%	19.2	19.2	19.3	38.7%
O6	50	0.1	0.1%	19.2	19.3	19.3	38.6%
O7	50	0.1	0.1%	19.2	19.2	19.3	38.6%
O8	50	<0.1	0.1%	19.2	19.3	19.3	38.6%
O9	50	0.1	0.1%	19.2	19.2	19.3	38.6%

Table 8B-23: Predicted Change in 24 Hour Mean PM_{10} Concentrations (as the 90.41st Percentile of 24 Hour averages) – Start Up Scenario

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	19.4	38.7%
O2	50	0.1	0.3%	19.2	19.2	19.4	38.8%
O3	50	0.1	0.2%	19.2	19.2	19.3	38.7%
O4	50	0.1	0.2%	19.2	19.2	19.3	38.6%
O5	50	0.1	0.2%	19.2	19.2	19.4	38.7%
O6	50	<0.1	0.1%	19.2	19.3	19.3	38.6%
O7	50	0.1	0.2%	19.2	19.2	19.3	38.6%
O8	50	<0.1	0.1%	19.2	19.3	19.3	38.6%
O9	50	0.1	0.2%	19.2	19.2	19.3	38.6%

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

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	50	0.1	0.2%	19.2	19.3	19.3	38.7%
O2	50	0.1	0.2%	19.2	19.2	19.4	38.7%
O3	50	0.1	0.2%	19.2	19.2	19.3	38.6%
O4	50	0.1	0.1%	19.2	19.2	19.3	38.6%
O5	50	0.1	0.2%	19.2	19.2	19.3	38.7%
O6	50	<0.1	0.1%	19.2	19.3	19.3	38.6%
O7	50	0.1	0.1%	19.2	19.2	19.3	38.6%
O8	50	<0.1	<0.1%	19.2	19.3	19.3	38.6%
O9	50	0.1	0.1%	19.2	19.2	19.3	38.6%

Particulate Matter ($PM_{2.5}$)

8B.7.20 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-25. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.21 The annual mean $PM_{2.5}$ PC that is predicted to occur anywhere in the study area as a result of the operation of the Proposed Development is less than 1% of the relevant AQAL. In addition, the maximum predicted short-term PEC at any receptor is 31.6%, while at the point of maximum impact it is 32.0%. 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-25: Predicted Change in Annual Mean $PM_{2.5}$ Concentrations – Normal Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	20	<0.1	0.1%	6.3	6.3	6.3	31.68%
O2	20	<0.1	0.1%	6.3	6.3	6.3	31.70%
O3	20	<0.1	0.2%	6.3	6.3	6.4	31.82%
O4	20	<0.1	0.1%	6.3	6.3	6.4	31.81%
O5	20	<0.1	0.1%	6.3	6.3	6.3	31.63%
O6	20	<0.1	0.1%	6.3	6.3	6.3	31.64%
O7	20	<0.1	0.1%	6.3	6.3	6.3	31.61%
O8	20	<0.1	0.1%	6.3	6.3	6.3	31.61%
O9	20	<0.1	0.1%	6.3	6.3	6.3	31.59%

Sulphur Dioxide

8B.7.22 The predicted change in SO_2 concentrations that would occur during the Start-Up operation of the Proposed Development, at the identified human health receptors are presented in Table 8B-26 to Table 8B-28. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.23 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. 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-26: Predicted Change in 15 Minute Mean SO_2 Concentrations (as the 99.9th Percentile of 15 Minute averages) – Start-Up Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	260	<0.1	<0.1%	4.0	9.2	9.3	3.6%
O2	260	0.1	<0.1%	4.0	8.7	8.7	3.4%
O3	260	<0.1	<0.1%	4.0	7.2	7.2	2.8%
O4	260	<0.1	<0.1%	4.0	7.1	7.2	2.8%
O5	260	<0.1	<0.1%	4.0	8.5	8.5	3.3%
O6	260	0.1	<0.1%	4.0	11.9	11.9	4.6%
O7	260	<0.1	<0.1%	4.0	8.9	8.9	3.4%
O8	260	<0.1	<0.1%	4.0	11.7	11.8	4.5%
O9	260	<0.1	<0.1%	4.0	8.6	8.6	3.3%

Table 8B-27: Predicted Change in 1 Hour Mean SO_2 Concentrations (as the 99.73rd Percentile of 1 Hour averages) – Start-Up Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	350	<0.1	<0.1%	4.0	7.0	7.0	2.0%
O2	350	<0.1	<0.1%	4.0	6.6	6.6	1.9%
O3	350	<0.1	<0.1%	4.0	5.8	5.8	1.7%
O4	350	<0.1	<0.1%	4.0	5.8	5.8	1.7%
O5	350	<0.1	<0.1%	4.0	6.5	6.5	1.9%
O6	350	<0.1	<0.1%	4.0	8.7	8.7	2.5%
O7	350	<0.1	<0.1%	4.0	6.6	6.7	1.9%
O8	350	<0.1	<0.1%	4.0	8.8	8.9	2.5%
O9	350	<0.1	<0.1%	4.0	6.6	6.6	1.9%

Table 8B-28: Predicted Change in 24 Hour Mean SO_2 Concentrations (as the 99.18th Percentile of 24 Hour averages) – Start-Up Operation

RECEPTOR	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/AQAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/AQAL (%)
O1	125	<0.1	<0.1%	4.0	4.9	4.9	3.9%
O2	125	<0.1	<0.1%	4.0	4.7	4.7	3.8%
O3	125	<0.1	<0.1%	4.0	4.4	4.4	3.5%
O4	125	<0.1	<0.1%	4.0	4.4	4.4	3.5%
O5	125	<0.1	<0.1%	4.0	4.7	4.7	3.8%
O6	125	<0.1	<0.1%	4.0	5.6	5.6	4.5%
O7	125	<0.1	<0.1%	4.0	4.8	4.8	3.8%
O8	125	<0.1	<0.1%	4.0	5.7	5.7	4.5%
O9	125	<0.1	<0.1%	4.0	4.7	4.7	3.8%

Ecological Receptors Results

8B.7.24 The results of the dispersion modelling of predicted impacts on sensitive ecological receptors are presented in Table 8B-29 to Table 8B-32. The tables set out the predicted PC to atmospheric concentrations of NO_x and nutrient nitrogen and acid deposition, as well as PEC (i.e., the process contribution, existing background concentration and the process contributions of other committed developments).

8B.7.25 Specific significance criteria relating to impacts on sensitive designated ecological receptors are set out within the Environment Agency air emissions risk assessment guidance (Defra and Environment Agency, 2016, as updated in 2023). 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; and / or
- the short-term PC is less than 10% of the critical level.

8B.7.26 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; and / or
- the short-term PC is less than 100% of the critical level.

8B.7.27 The effect of atmospheric NO_x concentrations, nitrogen deposition rates and acid deposition rates on the modelled receptor locations have been considered in detail in the Report to Inform Habitats Regulations Assessment (EN070009/APP/5.10) submitted with the Application. Further details on the impact of air quality on sensitive ecological receptors is provided in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

Oxides of Nitrogen Emissions – Critical Levels

8B.7.28 The assessment results show that the predicted annual and 24-hour average NO_x impacts are below the criteria for likely significance at all receptors. Any variations in the addition of the change to the baseline concentrations are due to rounding only.

8B.7.29 PCs of more than 1% of the long-term critical level for NO_x occur at the adjacent Teesmouth and Cleveland Coast SPA, SSSI and Ramsar, and the Coatham Marsh LWS but PECs are predicted to stay below 70% of the Critical Level at these locations.

8B.7.30 The need for further assessment at all locations can therefore be screened out based on the critical level criteria. Further details on oxides of nitrogen impacts from the Proposed Development on ecological receptors are presented in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

Nitrogen and acid deposition – Critical Loads

8B.7.31 The Environment Agency and Natural England have agreed that depositional impacts that are below 1% of the minimum relevant critical load for a site can be regarded as likely to be insignificant. Guidance from the IAQM 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). Further interpretation of the significance of the depositional results is provided in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

8B.7.32 The assessment results show that the predicted nitrogen and acid deposition impacts are below the criteria for likely significance at all receptors, as PCs are less than 1% of their respective minimum relevant critical loads at all receptors.

8B.7.33 The need for further assessment at all locations can therefore be screened out based on the critical load criteria. Further details on depositional impacts from the Proposed Development are presented in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

Table 8B-29: NO_x Annual Mean Dispersion Modelling Results for Ecological Receptors

RECEPTOR	SITE NAME	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/EAL (%)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	30	0.4	1.4%	16.1	17.9	18.4	61.2%
OE2	Teesmouth and Cleveland Coast SPA, SSSI		0.4	1.4%	17.7	19.4	19.8	66.1%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		0.1	0.3%	17.7	19.0	19.1	63.6%
OE4	Eston Pumping Station LWS		0.1	0.3%	17.7	19.4	19.5	65.1%
OE5	Teesmouth NNR		<0.1	0.1%	17.7	18.6	18.7	62.2%
OE6	Teesmouth and Cleveland Coast SSSI		0.4	1.4%	18.6	20.3	20.7	69.1%

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) ($\mu g/m^3$)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
OE7	North York Moors SPA and SSSI		<0.1	<0.1%	23.5	23.8	23.8	79.3%
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar		<0.1	<0.1%	22.0	22.3	22.3	74.2%
OE9	Cliff Ridge SSSI		<0.1	<0.1%	18.9	19.2	19.2	64.0%
OE10	Durham Coast SSSI and Durham Coast NNR		<0.1	<0.1%	22.1	22.3	22.4	74.5%
OE11	Durham Coast SSSI		<0.1	<0.1%	20.6	20.8	20.9	69.5%
OE12	Hart Bog SSSI		<0.1	<0.1%	21.8	22.0	22.0	73.3%
OE13	Langbaurgh Ridge SSSI		<0.1	<0.1%	21.2	21.5	21.5	71.6%
OE14	Lovell Hill Pools SSSI		<0.1	0.1%	21.0	21.5	21.5	71.8%

RECEPTOR	SITE NAME	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/EAL (%)
OE15	Roseberry Topping SSSI		<0.1	<0.1%	20.9	21.2	21.2	70.6%
OE16	Saltburn Gill SSSI		<0.1	<0.1%	20.7	21.0	21.0	70.1%

Table 8B-30: Maximum 24-hour NO_x Dispersion Modelling Results for Ecological Receptors

RECEPTOR	SITE NAME	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) (µg/m^3)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/EAL (%)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	75	3.1	4.2%	32.2	38.6	41.8	55.7%
OE2	Teesmouth and Cleveland Coast SPA, SSSI		3.1	4.2%	35.4	40.0	43.2	57.6%
OE3	Coatham Marsh LWS and Teesmouth and		1.0	1.4%	35.4	39.0	40.0	53.3%

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) ($\mu g/m^3$)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
	Cleveland Coast SPA, SSSI							
OE4	Eston Pumping Station LWS		1.5	2.0%	35.4	38.8	40.4	53.8%
OE5	Teesmouth NNR		0.9	1.2%	35.4	39.7	40.6	54.1%
OE6	Teesmouth and Cleveland Coast SSSI		3.1	4.2%	37.2	41.9	45.0	60.0%
OE7	North York Moors SPA and SSSI		0.2	0.3%	47.0	49.3	49.5	66.0%
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar		0.2	0.2%	44.1	46.5	46.7	62.3%
OE9	Cliff Ridge SSSI		0.1	0.2%	37.9	40.1	40.2	53.6%
OE10	Durham Coast SSSI and		0.2	0.2%	44.2	46.8	47.0	62.6%

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROUND CONCENTRATION (BC) ($\mu g/m^3$)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
	Durham Coast NNR							
OE11	Durham Coast SSSI		0.2	0.3%	41.1	43.8	44.0	58.6%
OE12	Hart Bog SSSI		0.2	0.2%	43.6	45.9	46.1	61.5%
OE13	Langbaurgh Ridge SSSI		0.1	0.2%	42.4	44.6	44.7	59.7%
OE14	Lovell Hill Pools SSSI		0.3	0.4%	42.1	45.3	45.6	60.9%
OE15	Roseberry Topping SSSI		0.2	0.2%	41.8	44.7	44.9	59.8%
OE16	Saltburn Gill SSSI		0.1	0.2%	41.5	43.6	43.7	58.3%

Table 8B-31: Dispersion Modelling Results for Ecological Receptors – Nutrient Nitrogen Deposition (Kg/Ha/Yr)

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kgN/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kgN/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC % CRITICAL LOAD
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Coastal stable dune grassland (calcareous type)	10	0.06	0.6%	12.66	12.9	13.0	129.9%
OE2	Teesmouth and Cleveland Coast SPA, SSSI	Coastal stable dune grassland (calcareous type)	10	0.06	0.6%	12.66	12.9	13.0	129.7%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Sub-Atlantic semi-dry calcareous grassland	10	0.01	0.1%	12.62	12.8	12.8	128.2%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kgN/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kgN/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC % CRITICAL LOAD
OE4	Eston Pumping Station LWS	Sub-Atlantic semi-dry calcareous grassland	10	0.01	0.1%	12.95	13.2	13.2	132.1%
OE5	Teesmouth NNR	Coastal stable dune grassland (calcareous type)	10	0.01	0.1%	13.75	13.9	13.9	138.9%
OE6	Teesmouth and Cleveland Coast SSSI	Coastal stable dune grassland (calcareous type)	10	0.06	0.6%	12.66	12.9	13.0	129.7%
OE7	North York Moors SPA and SSSI	Dry heaths, Raised and blanket bogs, Valley mires, poor fens and	5	<0.01	<0.1%	16.9	16.9	16.9	338.8%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kgN/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kgN/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC % CRITICAL LOAD
		transition mires							
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	Coastal stable dune grassland (calcareous type)	10	<0.01	<0.1%	12.62	12.7	12.7	126.6%
OE10	Durham Coast SSSI and Durham Coast NNR	Coastal stable dune grassland (calcareous type)	10	<0.01	<0.1%	12.62	12.7	12.7	126.6%
OE11	Durham Coast SSSI	Coastal stable dune grassland (calcareous type)	10	<0.01	<0.1%	12.62	12.7	12.7	126.6%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kgN/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kgN/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC % CRITICAL LOAD
OE12	Hart Bog SSSI	Raised and blanket bogs, Valley mires, poor fens and transition mires	5	<0.01	<0.1%	14.04	14.1	14.1	281.7%
OE14	Lovell Hill Pools SSSI	Outstanding dragonfly assemblage and Coenagrion pulchellum	10	<0.01	<0.1%	14.51	14.5	14.5	145.4%
OE16	Saltburn Gill SSSI	Carpinus and Quercus mesic deciduous forest	15	<0.01	<0.1%	20.19	20.3	20.3	135.2%

Table 8B-32: Dispersion Modelling Results for Ecological Receptors – Acid Deposition N (Keq/Ha/Yr)

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD (CL) RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.004	<0.1%	0.93	0.96	0.97	5.6%
OE2	Teesmouth and Cleveland Coast SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.004	<0.1%	0.93	0.96	0.97	5.6%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.001	<0.1%	0.78	0.82	0.82	5.1%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD (CL) RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE4	Eston Pumping Station LWS	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.001	<0.1%	0.81	0.85	0.85	5.3%
OE5	Teesmouth NNR	No Sensitive Features							
OE6	Teesmouth and Cleveland Coast SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.004	<0.1%	0.93	0.96	0.97	5.6%
OE7	North York Moors SPA and SSSI	Calcareous grassland	Min CL min N 0.321 Min CL Max N 0.469 Min CL Max S 0.148	<0.001	<0.1%	1.38	1.39	1.39	274.9%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD (CL) RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	<0.001	<0.1%	1.02	1.02	1.03	21.1%
OE10	Durham Coast SSSI and Durham Coast NNR	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	<0.001	<0.1%	1.05	1.06	1.06	21.7%
OE11	Durham Coast SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	<0.001	<0.1%	1.04	1.05	1.05	21.5%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD (CL) RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	FUTURE YEAR WITHOUT PROPOSED DEVELOPMENT (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE12	Hart Bog SSSI	Calcareous grassland	Min CL min N 0.321 Min CL Max N 0.469 Min CL Max S 0.148	<0.001	0.01%	1.14	1.15	1.15	244.4%
OE14	Lovell Hill Pools SSSI	No Sensitive Features							
OE16	Saltburn Gill SSSI	Calcareous grassland	Min CL min N 0.142 Min CL Max N 2.639 Min CL Max S 2.448	<0.001	0.01%	1.59	1.60	1.60	60.7%

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 Proposed Development to the Study Areas for human health and designated ecosystems.

8B.8.2 Emissions from the Fired Heater stacks, Auxiliary Boilers, 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 receptors (SACs / Ramsar / SPAs and SSSIs) and other ecological sites has predicted that emissions would be unlikely to give rise to significant impacts with regard to increases in atmospheric concentrations of NO_x and nutrient nitrogen and acid deposition. The need for further assessment at all locations can therefore be screened out. Further details on depositional impacts from the Proposed Development are presented in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2).

8B.9 References

- Air Quality Advisory Group, 2014; *AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.*
- AMD Ltd, 2023; *Data Purchase* [online].
- Centre for Ecology and Hydrology and APIS (2017). *Air Pollution Information System.*
- CERC (2023). ADMS 6 Atmospheric Dispersion Modelling System User guide, V6.0
- Defra and Environment Agency (2016, as updated in 2023). *Air emissions risk assessment for your environmental permit.*
- Department for Environment, Food & Rural Affairs (Defra) (2003). Local Air Quality Management Technical Guidance LAQM.TG(03).
- Department for Environment, Food & Rural Affairs (Defra) (2022). *Local Air Quality Management Technical Guidance LAQM.TG(22).*
- *Department for Environment, Food and Rural Affairs (2020). 2018-based background maps for NOX, NO2, PM10 and PM2.5.*
- Environmental Protection UK (EPUK)/ Institute of Air Quality Management (IAQM) (2017). *Land-use Planning & Development Control: Planning for Air Quality v1.2.*
- European Commission (2017). *Best Available Techniques (BAT) Reference Document for Large Combustion Plants.*
- European Union (2010). *Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (2010). OJ L 334*
- Highways England (2019). *Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal- LA 105 Air Quality.*
- Highways England (HE) (2019). *Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal- LA 105 Air Quality.*
- Institute of Air Quality Management (IAQM) (2020). *A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites, Version 1.1.*
- OS, 2023; *Ordnance Survey Maps* [Online]
- Redcar and Cleveland Borough Council (RCBC) (2023). *2023 Air Quality Annual Status Report (ASR)*

8B.10 Annex A: Sensitivity Testing of Model Inputs

8B.10.1 The maximum predicted concentrations of NO_2 at the worst-affected human health receptors and NO_x at the worst-affected statutory designated ecological receptor associated with the variable input parameters, are presented in Table 8B-33 as the percentage of maximum reported values in Table 8B-14, Table 8B-15 and Table 8B-29 above. A variation below 100% shows that the results in the main assessment are most likely higher, and vice-versa.

Table 8B-33: Sensitivity Tests Results compared to the Main Assessment

MODEL INPUT VARIABLE	HUMAN HEALTH RECEPTORS		ECOLOGICAL RECEPTORS	
	SHORT-TERM	LONG-TERM	SHORT-TERM	LONG-TERM
Meteorological data (five year min to max)	92.6%	69.1%	79.9%	86.1%
Stack position	87.6%	85.6%	86.1%	95.5%
Surface roughness representation (0.5 m)	97.2%	107.7%	103.4%	110.5%
Surface roughness representation (0.2 m)	98.4%	92.3%	93.8%	89.5%
No buildings	94.3%	87.3%	92.1%	92.2%

8B.10.2 The main uncertainty associated with the model is considered to be the meteorological data, with a NO_2 process contribution variation of 69.1% in the annual mean NO_2 results.

8B.10.3 The surface roughness representation in the main model has been assessed at 0.3 m, representative of the maximum surface roughness associated with agricultural land. For the purposes of sensitivity testing, the surface roughness has been varied (between 0.5 and 0.2) and it was found that a higher surface roughness (0.5 m), on the whole resulted in higher impacts at the worst-case receptor, however for receptors further away from the source, the impacts would be reduced over those reported in the main assessment. The lower surface roughness of 0.2 m resulted in lower impacts.

8B.10.4 The stack position and presence of buildings have a less marked effect on the predicted process contributions than the stack position and meteorological data. The inclusion of buildings in the model slightly affects the model outcomes, with a variation of up to 87.3%.

8B.11 Annex B: Cumulative Assessment Inputs and In-Combination Results

Introduction

8B.11.1 This Annex provides the details of the developments considered within the assessment to provide an inherently cumulative air quality assessment. This section is presented to inform on the cumulative inputs for the air quality model which have been utilised within the main air quality assessment and this section also present the In-Combination results. 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 close proximity to the Proposed Development site.

8B.11.2 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. Those that are relevant for consideration due to their potential operational air quality impacts are:

- ID 2: The Tees Combined Cycle Power Plant, EN010082;
- ID 3: Net Zero Teesside, EN010103;
- ID 19: Peak Resources Ltd, R/2017/0876/FFM;
- ID 20: CBRE anaerobic biogas production facility and combined heat and power plant, R/2016/0484/FFM;
- ID 22: Grangetown energy recovery facility (ERF), R/2019/0767/OOM;
- ID 30: Tourian Renewables, R/2019/0031/FFM;
- ID 46: Redcar Energy Centre (REC), R/2020/0411/FFM;
- ID166: O2N Energy (materials recycling facility and production of energy from waste), 13/2892/EIS;
- ID 178: Green Lithium Refining, R/2023/0291/ESM;
- ID 212: Teesside Green Energy Park, 22/1525/EIS; and
- ID 219: Greenergy Renewable Fuels and Circular Products Facility, 23/1019/EIS.

8B.11.3 Given the distance of one of the developments from the Proposed Development as well as the prevailing wind direction for the area and the number of pollutants emitted it is considered that the cumulative impacts will be not significant for the Greenergy Renewable Fuels and Circular Products Facility. Therefore, this development has not been included in the dispersion modelling. All other developments listed above have been included in the operational dispersion modelling. This has enabled their pollutant contributions to be added to background pollutant concentrations. This provides a total pollutant concentration for the future year without Proposed Development. The predicted environmental concentration can then be calculated by the addition of the process contribution from the Proposed Development.

8B.11.4 Information on the emissions from these sources has been derived from the available Planning Applications and has been included in the ADMS model. Due to the nature of these emissions, the cumulative assessment has only included emissions of NO_x, PM_{10}, CO and SO_2, as these are the only pollutant species common to all the cumulative schemes.

Model Inputs

8B.11.5 All cumulative model schemes have been assumed to run continuously at full output, therefore providing a worst-case assessment of the potential cumulative impact. The model inputs for the Proposed Development are as described in Tables 8B-2 and 8B-3, and those for the cumulative schemes are shown in Table 8B-34.

Table 8B-34: Emission Inventory for the Cumulative Schemes (1)

Scheme	Net Zero Teesside	Redcar Energy Centre		Grangetown ERF	The Tees Combined Cycle Power Plant		CBRE	O2N Energy
Source name	NZT NE	Redcar Energy 1	Redcar Energy 2	Grangetown P	Teesside CCPP 1	Teesside CCPP2	CBRE_CHP	O2N
Stack Location	457046, 525393	455890, 526032	455895, 526030	454592, 521251	456453.55, 520437.16	456512.57, 520465.83	457285.3, 522315.2	446979, 521895
Temperature (°C)	60	140	140	140	72	72	200	138
Actual or Normalised (NTP)	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Efflux type	Velocity	Velocity	Velocity	Velocity	Volume	Velocity	Volume	Velocity
Velocity (m/s) / Volume flux (m^3/s)	24.8	19.1	19.1	15	928	18.462	9	16.95
Height (m)	115	80	80	70	75	75	28	65
Diameter (m)	6.6	2.3	2.3	3.48	8	8	0.52	2.1
NOx (g/s)	-	-	-	-	-	-	-	-
CO(g/s)	100.20	2.80	2.80	4.00	22.30	22.30	7.18	0.98
SO_2(g/s)	-	-	-	-	-	-	1.80	0.98
PM_{10} (g/s)	-	-	-	-	-	-	-	0.20

Table 8B-35: Emission Inventory for the Cumulative Schemes (2)

Scheme	Green Lithium Refining				Teesside Green Energy Park
Source name	GreenLit1	GreenLit2	GreenLit3	GreenLit4	TeessideGreenPark
Stack Location	455768.9, 523356.714	455768.9, 523356.714	455452.814, 523651.395	455704.92, 523221.926	453157, 524499
Temperature (°C)	70	80	80	135	150
Actual or Normalised (NTP)	Actual	Actual	Actual	Actual	Actual
Efflux type	Velocity	Velocity	Velocity	Velocity	Velocity
Velocity (m/s) / Volume flux (m^3/s)	2.8	2.4	23.5	19.6	21.7
Height (m)	35	35	47	20	85
Diameter (m)	1.8	0.2	0.4	0.5	2
NOx (g/s)	-	-	-	-	-
CO(g/s)	0.5766	-	-	0.2579	1.492
SO_2(g/s)	-	-	-	-	0.895
PM_{10} (g/s)	0.1153	-	-	-	0.149

Table 8B-36: Emission Inventory for the Cumulative Schemes (3)

Scheme	Tourian Renewables							
Source name	TourianB1	TourianB2	TourianB3	TourianB4	TourianF1	TourianF2	TourianF3	TourianF4
Stack Location	457874.6, 521542.7	457881.7, 521526.8	457888.9, 521510.8	457896, 521494.9	457852.4, 521553.6	457856, 521555.2	457854, 521549.9	457857.7, 521551.6
Temperature (°C)	140	140	140	140	850	850	850	850
Actual or Normalised (NTP)	NTP	NTP	NTP	NTP	NTP	NTP	NTP	NTP
Efflux type	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume
Velocity (m/s) / Volume flux (m^3/s)	0.407	0.407	0.407	0.407	0.249	0.249	0.249	0.249
Height (m)	18	18	18	18	12	12	12	12
Diameter (m)	0.2	0.2	0.2	0.2	2	2	2	2
NOx (g/s)	-	-	-	-	-	-	-	-
CO(g/s)	0.0407	0.0407	0.0407	0.0407	0.0087	0.0087	0.0087	0.0087
SO_2(g/s)	0.0143	0.0143	0.0143	0.0143	0.0249	0.0249	0.0249	0.0249
PM_{10} (g/s)	0.00204	0.00204	0.00204	0.00204	0.00124	0.00124	0.00124	0.00124

Table 8B-37: Emission Inventory for the Cumulative Schemes (4)

Scheme	Peak Resources Ltd						
Source name	PeakRes1	PeakRes2	PeakRes3	PeakRes4	PeakRes5	PeakRes6	PeakRes7
Stack Location	452313.9,524445.5	452314.1,524423.1	452313.9,524400.4	452313.9,524377.8	452313.8,524355.4	452313.9,524332.7	452551.3,524556.4
Temperature (°C)	150	150	150	150	150	150	445
Actual or Normalised (NTP)	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Efflux type	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity
Velocity (m/s) / Volume flux (m^3/s)	24.93	24.93	24.93	24.93	24.93	24.93	22.4
Height (m)	80	80	80	80	80	80	60
Diameter (m)	0.66	0.66	0.66	0.66	0.66	0.66	0.45
NOx (g/s)	-	-	-	-	-	-	-
CO(g/s)	0.354	0.354	0.354	0.354	0.354	0.354	-
SO_2(g/s)	0.213	0.213	0.213	0.213	0.213	0.213	-
PM_{10} (g/s)	0.071	0.071	0.071	0.071	0.071	0.071	-

Table 8B-38: Emission Inventory for the Cumulative Schemes (5)

Scheme	Peak Resources Ltd										
Source name	PeakRes8	PeakRes9	PeakRes10	PeakRes11	PeakRes12	PeakRes13	PeakRes14	PeakRes15	PeakRes16	PeakRes17	PeakRes18
Stack Location	452414.5,524464.9	452365.6,524419.4	452383.2,524414.5	452552.3,524487.4	452552.3,524490.1	452579.8,524382	452628.3,524388.9	452624.8,524383.2	452281.3,524260.3	452302.8,524480.1	452302.5,524536.9
Temperature (°C)	150	150	150	445	445	445	445	445	15	15	15
Actual or Normalised (NTP)	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Efflux type	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity	Velocity
Velocity (m/s) / Volume flux (m^3/s)	15.8	22.8	23.3	23.2	22.4	24.3	23.4	23.4	21.4	19.2	20.2
Height (m)	60	60	60	60	60	60	60	60	28	20	20
Diameter (m)	1	0.35	0.2	0.7	0.45	2.15	0.45	0.26	2.5	1.3	1.15
NOx (g/s)	-	-	-	-	-	-	-	-	-	-	-
CO (g/s)	-	-	-	-	-	-	-	-	-	-	-
SO_2 (g/s)	-	-	-	-	-	-	-	-	-	-	-
PM_{10} (g/s)	-	-	-	-	-	-	-	-	-	-	-

8B.11.6 The buildings for each of the cumulative schemes, that may affect the dispersion of the emissions from the stacks have been included in the model run for the assessment of cumulative impacts. The buildings included in the model are shown in Table 8B-39.

Table 8B-39: Buildings for Inclusion in the Cumulative Scheme Model

CUMULATIVE SCHEME	BUILDING	GRID REFERENCE	HEIGHT (m)	LENGTH (m)	WIDTH (m)	ANGLE (°)
NZT Adsorber	Rectangular	457046, 525392	80.0	35.0	24.0	112.0
Redcar Energy Centre Boiler Hall	Rectangular	455863, 525961	49.0	25.0	63.0	112.5
Grangetown ERF	Rectangular	454568, 521276	45.0	25.0	63.0	65.0
The Tees CCPP HRSG 1	Rectangular	456468, 520407	45.0	26.0	30.0	65.0
The Tees CCPP HRSG 2	Rectangular	456528, 520434	45.0	26.0	30.0	65.0
CBRE CHP	Rectangular	457281, 522303	7.5	12.8	16.9	155.3
Green Lithium Refining	Rectangular	455571, 523563	43.0	317.3	69.2	135.2
Peak Resources Ltd	Rectangular	452304, 524389	47.0	65.2	129.9	269.7

Cumulative Assessment Results – Human Health and Ecological Receptors

8B.11.7 Results of the cumulative assessment are as presented in Section 8B.7. The results presented within the assessment are inherently cumulative, as explained in Section 8B.11.1. In summary, the main assessment in inherently cumulative because the air quality modelling for the operational phase includes all relevant committed developments on top of the existing background, both with and without the Proposed Development.

In Combination Assessment Results – Ecological Receptors.

8B.11.8 The in-combination assessment results below have been considered in the Report to Inform Habitats Regulations Assessment (EN070009/APP/5.10) submitted with the Application.

Table 8B-40: Annual Mean NOx Dispersion Modelling Results for Ecological Receptors

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROND CONCENTRATION (BC) ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	30	2.3	7.5%	16.1	18.4	61.2%
OE2	Teesmouth and Cleveland Coast SPA, SSSI		2.1	7.1%	17.7	19.8	66.1%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		1.4	4.6%	17.7	19.1	63.6%
OE4	Eston Pumping Station LWS		1.8	6.1%	17.7	19.5	65.1%
OE5	Teesmouth NNR		1.0	3.3%	17.7	18.7	62.2%
OE6	Teesmouth and Cleveland Coast SSSI		2.1	7.1%	18.6	20.7	69.1%
OE7	North York Moors SPA and SSSI		0.3	0.9%	23.5	23.8	79.3%

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROND CONCENTRATION (BC) ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar		0.2	0.8%	22.0	22.3	74.2%
OE9	Cliff Ridge SSSI		0.3	0.9%	18.9	19.2	64.0%
OE10	Durham Coast SSSI and Durham Coast NNR		0.3	0.9%	22.1	22.4	74.5%
OE11	Durham Coast SSSI		0.3	1.0%	20.6	20.9	69.5%
OE12	Hart Bog SSSI		0.2	0.6%	21.8	22.0	73.3%
OE13	Langbaurgh Ridge SSSI		0.3	1.0%	21.2	21.5	71.6%
OE14	Lovell Hill Pools SSSI		0.5	1.7%	21.0	21.5	71.8%
OE15	Roseberry Topping SSSI		0.3	1.0%	20.9	21.2	70.6%
OE16	Saltburn Gill SSSI		0.3	1.0%	20.7	21.0	70.1%

Table 8B-41: Maximum 24-hour NOx Dispersion Modelling Results for Ecological Receptors

RECEPTOR	SITE NAME	AQAL (µg/m^3)	PREDICTED CONCENTRATION (PC) (µg/m^3)	PC/EAL (%)	BACKGROND CONCENTRATION (BC) (µg/m^3)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) (µg/m^3)	PEC/EAL (%)
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	75	9.6	12.7%	32.2	41.8	55.7%
OE2	Teesmouth and Cleveland Coast SPA, SSSI		7.8	10.4%	35.4	43.2	57.6%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI		4.6	6.2%	35.4	40.0	53.3%
OE4	Eston Pumping Station LWS		5.0	6.6%	35.4	40.4	53.8%
OE5	Teesmouth NNR		5.2	7.0%	35.4	40.6	54.1%
OE6	Teesmouth and Cleveland Coast SSSI		7.8	10.4%	37.2	45.0	60.0%
OE7	North York Moors SPA and SSSI		2.5	3.3%	47.0	49.5	66.0%

RECEPTOR	SITE NAME	AQAL ($\mu g/m^3$)	PREDICTED CONCENTRATION (PC) ($\mu g/m^3$)	PC/EAL (%)	BACKGROND CONCENTRATION (BC) ($\mu g/m^3$)	PREDICTED ENVIRONMENTAL CONCENTRATIONS (PEC) ($\mu g/m^3$)	PEC/EAL (%)
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar		2.7	3.5%	44.1	46.7	62.3%
OE9	Cliff Ridge SSSI		2.4	3.2%	37.9	40.2	53.6%
OE10	Durham Coast SSSI and Durham Coast NNR		2.8	3.7%	44.2	47.0	62.6%
OE11	Durham Coast SSSI		2.8	3.8%	41.1	44.0	58.6%
OE12	Hart Bog SSSI		2.5	3.4%	43.6	46.1	61.5%
OE13	Langbaurgh Ridge SSSI		2.4	3.2%	42.4	44.7	59.7%
OE14	Lovell Hill Pools SSSI		3.6	4.8%	42.1	45.6	60.9%
OE15	Roseberry Topping SSSI		3.1	4.1%	41.8	44.9	59.8%
OE16	Saltburn Gill SSSI		2.2	3.0%	41.5	43.7	58.3%

Table 8B-42: Dispersion Modelling Results for Ecological Receptors - Nutrient Nitrogen Deposition (Kg/Ha/Yr)

RECEPTOR ID	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kg/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kg/ha/yr)	PEC (kg/ha/yr)	PEC % CRITICAL LOAD
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Coastal stable dune grassland (calcareous type)	10	0.33	3.3%	12.66	12.99	129.9%
OE2	Teesmouth and Cleveland Coast SPA, SSSI	Coastal stable dune grassland (calcareous type)	10	0.31	3.1%	12.66	12.97	129.7%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Sub-Atlantic semi-dry calcareous grassland	10	0.20	2.0%	12.62	12.82	128.2%

RECEPTOR ID	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kg/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kg/ha/yr)	PEC (kg/ha/yr)	PEC % CRITICAL LOAD
OE4	Eston Pumping Station LWS	Sub-Atlantic semi-dry calcareous grassland	10	0.26	2.6%	12.95	13.21	132.1%
OE5	Teesmouth NNR	Coastal stable dune grassland (calcareous type)	10	0.14	1.4%	13.75	13.89	138.9%
OE6	Teesmouth and Cleveland Coast SSSI	Coastal stable dune grassland (calcareous type)	10	0.31	3.1%	12.66	12.97	129.7%
OE7	North York Moors SPA and SSSI	Dry heaths, Raised and blanket bogs, Valley mires, poor fens and transition mires	5	0.04	0.8%	16.9	16.94	338.8%
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	Coastal stable dune grassland (calcareous type)	10	0.04	0.4%	12.62	12.66	126.6%

RECEPTOR ID	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (kg/ha/yr)	PC % CRITICAL LOAD	BACKGROUND NITROGEN DEPOSITION (kg/ha/yr)	PEC (kg/ha/yr)	PEC % CRITICAL LOAD
OE10	Durham Coast SSSI and Durham Coast NNR	Coastal stable dune grassland (calcareous type)	10	0.04	0.4%	12.62	12.66	126.6%
OE11	Durham Coast SSSI	Coastal stable dune grassland (calcareous type)	10	0.04	0.4%	12.62	12.66	126.6%
OE12	Hart Bog SSSI	Raised and blanket bogs, Valley mires, poor fens and transition mires	5	0.03	0.5%	14.04	14.07	281.3%
OE14	Lovell Hill Pools SSSI	Outstanding dragonfly assemblage and Coenagrion pulchellum	10	0.07	0.7%	14.51	14.58	145.8%
OE16	Saltburn Gill SSSI	Carpinus and Quercus mesic deciduous forest	15	0.09	0.6%	20.19	20.28	135.2%

Table 8B-43: Dispersion Modelling Results for Ecological Receptors - Acid Deposition N (Keq/Ha/Yr)

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE1	Teesmouth and Cleveland Coast Ramsar, SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.037	0.34%	0.93	0.97	5.6%
OE2	Teesmouth and Cleveland Coast SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.036	0.34%	0.93	0.97	5.6%
OE3	Coatham Marsh LWS and Teesmouth and Cleveland Coast SPA, SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.039	0.62%	0.78	0.82	5.1%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE4	Eston Pumping Station LWS	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.041	0.55%	0.81	0.85	5.3%
OE5	Teesmouth NNR	No Sensitive Features						
OE6	Teesmouth and Cleveland Coast SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.036	0.34%	0.93	0.97	5.6%
OE7	North York Moors SPA and SSSI	Calcareous grassland	Min CL min N 0.321 Min CL Max N 0.469 Min CL Max S 0.148	0.006	1.10%	1.38	1.39	274.9%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE8	North Cumbria Coast SPA, Durham Cost SAC, Northumbria Coast Ramsar	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.005	0.11%	1.02	1.03	21.1%
OE10	Durham Coast SSSI and Durham Coast NNR	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.005	0.11%	1.05	1.06	21.7%
OE11	Durham Coast SSSI	Calcareous grassland	Min CL min N 0.856 Min CL Max N 4.856 Min CL Max S 4.0	0.006	0.12%	1.04	1.05	21.5%

RECEPTOR	SITE NAME	MOST STRINGENT CRITICAL LOAD CLASS APPLICABLE FOR THE SITE	LOWER VALUE OF APPLICABLE CRITICAL LOAD RANGE	PC (keq/ha/yr)	PC % CRITICAL LOAD	BACKGROUND ACID DEPOSITION (keq/ha/yr)	PEC (keq/ha/yr)	PEC % CRITICAL LOAD
OE12	Hart Bog SSSI	Calcareous grassland	Min CL min N 0.321 Min CL Max N 0.469 Min CL Max S 0.148	0.005	1.12%	1.14	1.15	244.4%
OE14	Lovell Hill Pools SSSI	No Sensitive Features						
OE16	Saltburn Gill SSSI	Calcareous grassland	Min CL min N 0.142 Min CL Max N 2.639 Min CL Max S 2.448	0.012	0.45%	1.59	1.60	60.7%

8B.12 Annex C: 2023 Diffusion Tube Survey

Table 8B-44: 2023 Diffusion Tube Survey Results

SITE	UNADJUSTED MEAN (µg/m^3)	BIAS ADJUSTED MEAN NO_2 (µg/m^3)
DT01	22.6	19.0
DT02	35.0	29.4
DT04	13.0	11.0
DT05	13.0	10.9
DT06	37.3	31.3
DT07	21.7	18.2
DT08B*	12.9	10.8
DT09	10.6	8.9
DT10	7.9	6.6
DT11	8.9	7.5
DT12	7.5	6.3
DT13	14.1	11.8
DT14	10.5	8.8
DT15	16.6	13.9
DT16	13.8	11.6
DT17	12.8	10.8
DT18	18.5	15.6
DT19	13.6	11.4
DT20	14.4	12.1
DT21	18.8	15.8

*Moved slightly, along the same road

8B.13 Annex D: Combined Construction Traffic and Operational Phase at Traffic Receptors

Table 8B-45: NO_x Annual Mean and Nitrogen Deposition Dispersion Modelling Results for Ecological Receptors for Construction Traffic and Operational Phase Combined

SITE ID	SITE DESCRIPTION	NOx CONCENTRATION				NITROGEN DEPOSITION	
		PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (µg/m^3)	PC AS % OF CRITICAL LEVEL	PEC (µg/m^3)	PEC AS % OF CRITICAL LEVEL	PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (kgN/ha/yr)	PC AS % OF CRITICAL LOAD
RE_001	Teesmouth and Cleveland Coast SSSI and SPA	0.1	0.3%	17.2	57.4%	0.01	0.1%
RE_002	Teesmouth and Cleveland Coast SSSI and SPA and Coathem Marsh LWS	0.3	1.0%	28.2	94.0%	0.02	0.2%
RE_003	Teesmouth and Cleveland Coast SSSI	0.4	1.3%	14.3	47.6%	0.04	0.4%
RE_004	Charlton's Pond LNR	<0.1	0.1%	14.7	48.8%	<0.01	<0.1%
RE_005	Teesmouth and Cleveland Coast SSSI and SPA	0.1	0.4%	20.6	68.7%	0.01	0.1%
RE_006	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	0.2	0.6%	21.7	72.2%	0.01	0.1%

SITE ID	SITE DESCRIPTION	NOx CONCENTRATION				NITROGEN DEPOSITION	
		PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (µg/m^3)	PC AS % OF CRITICAL LEVEL	PEC (µg/m^3)	PEC AS % OF CRITICAL LEVEL	PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (kgN/ha/yr)	PC AS % OF CRITICAL LOAD
RE_007	Teesmouth and Cleveland Coast SSSI, RAMSAR and SPA	0.3	1.0%	25.7	85.8%	0.02	0.2%
RE_008	Teesmouth and Cleveland Coast SSSI and SPA	0.5	1.5%	23.5	78.4%	0.03	0.3%
RE_009	Teesmouth and Cleveland Coast SSSI and SPA	<0.1	0.1%	16.8	56.0%	<0.01	<0.1%
RE_010	Wilton Woods Complex LWS	0.1	0.2%	18.5	61.7%	0.01	0.1%

Table 8B-46: NO_2 Annual Mean Dispersion Modelling Results for Human Health Receptors for Construction Traffic and Operational Phase Combined

RECEPTOR	PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (µG/M3)	PC AS % OF AQAL
R001	0.1	0.2%
R002	0.1	0.2%
R003	0.1	0.3%
R004	0.1	0.2%
R005	0.1	0.2%

RECEPTOR	PC (CONSTRUCTION TRAFFIC + OPERATIONAL) (µG/M3)	PC AS % OF AQAL
R006	0.1	0.3%
R007	<0.1	0.1%
R008	0.1	0.3%
R009	0.1	0.3%
R010	0.1	0.3%
R011	0.1	0.2%
R012	<0.1	0.1%
R013	<0.1	0.1%
R014	<0.1	0.1%
R015	<0.1	0.1%
R016	<0.1	0.1%
R017	<0.1	0.1%
R018	<0.1	0.1%
R019	<0.1	0.1%
R020	<0.1	0.1%
R021	0.1	0.1%
R022	0.1	0.1%