AIR DISPERSION MODELLING ASSESSMENT OF RELEASES FROM THE PROPOSED ENERGY RECOVERY FACILITY AT TEES VALLEY

ECL Ref: ECL.007.04.01/ADM
February 2022
Version: Issue 1a

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TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

LIST OF TABLES

LIST OF TABLES (cont.)

LIST OF FIGURES

LIST OF FIGURES (cont.)

APPENDICES

ACRONYMS / TERMS USED IN THIS REPORT

AAD	Ambient Air Directive
ADMS	Atmospheric Dispersion Modelling System
APIS	Air Pollution Information System
AQAL	Air Quality Assessment Level
AQDD	Air Quality Daughter Directive
AQMA	Air Quality Management Area
AQMAU	Air Quality Modelling Assessment Unit
AQO	Air Quality Objective
AQS	Air Quality Standard
As	Arsenic
ASR	Annual Status Report
B[a]P	Benzo[a]Pyrene
BAT	Best Available Techniques
BAT-AEL	Best Available Techniques–Associated Emission Level
Bref	Best Available Techniques Reference Document
BSG	BSG Ecology
Cd	Cadmium
CERC	Cambridge Environmental Research Consultants
CO	Carbon monoxide
Co	Cobalt
CrIII	Chromium III
CrVI	Chromium VI
cSAC	Candidate Special Areas of Conservation
Cu	Copper
DAS	Discretionary Advice Service
DEFRA	Department for Environment, Food and Rural Affairs
DT	Diffusion Tube
EA	Environment Agency
ECL	Environmental Compliance Ltd
ELV	Emission Limit Value
EP	Environmental Permit
EPAQS	Expert Panel on Air Quality Standards
EPR	Environmental Permitting Regulations
EPUK	Environmental Protection UK
ERF	Energy Recovery Facility
FCC	FCC Waste Services (UK) Limited
GLC	Ground Level Concentration
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
Hg	Mercury
HZI	Hitachi Zosen Inova
IAQM	Institute of Air Quality Management
IED	Industrial Emissions Directive
LNR	Local Nature Reserve
Met Data	Meteorological Data
Met Office	Meteorological Office
Met Station	Meteorological Station

ACRONYMS / TERMS USED IN THIS REPORT (cont.)

Met Year	Meteorological Year
Mn	Manganese
N	Nitrogen
NE	Natural England
NH_3	Ammonia
Ni	Nickel
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NRW	Natural Resources Wales
NWP	Numerical Weather Prediction
PAH	Polyaromatic Hydrocarbons
Pb	Lead
PC	Process Contribution
PCB	Polychlorinated Biphenyls
PEC	Predicted Environmental Concentration
PM_{10}	Particulate Matter (with a diameter of 10 µm or less)
$PM_{2.5}$	Particulate Matter (with a diameter of 2.5 µm or less)
Ramsar	Ramsar Convention on Wetlands of International Importance
RCBC	Redcar and Cleveland Borough Council
REC	Redcar Energy Centre
S	Sulphur
SAC	Special Areas of Conservation
Sb	Antimony
SEPA	Scottish Environment Protection Agency
sHRA	Shadow Habitats Regulation Assessment
SO_2	Sulphur Dioxide
SPA	Special Protection Areas
SSSI	Site of Special Scientific Interest
Tl	Thallium
The Installation	Tees Valley Energy Recovery Centre
V	Vanadium
VOC	Volatile Organic Compounds
WHO	World Health Organisation

1. INTRODUCTION

1.1. The Study

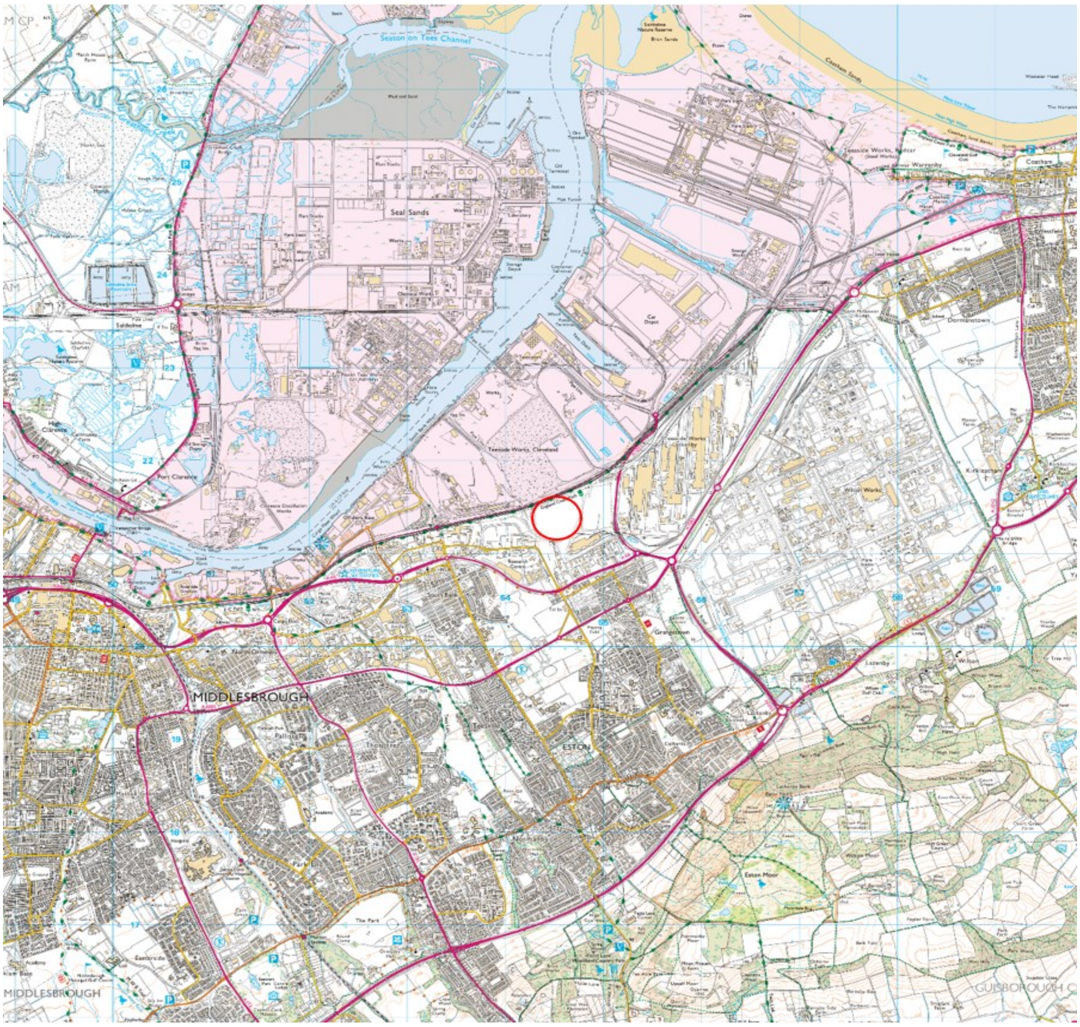
1.1.1. Environmental Compliance Ltd ("ECL") were commissioned by FCC Waste Services (UK) Limited ("FCC") to undertake an air quality assessment of releases from the proposed Energy Recovery Facility ("ERF") at Tees Valley ("the Installation"), in Grangetown, Redcar, in support of both a Planning Application to the Local Authority and an Environmental Permit ("EP") Application to the Environment Agency ("EA").

1.1.2. The study was conducted to determine the impact of emissions to air from the proposed Installation on both human health and local environmentally sensitive sites.

1.1.3. The study was undertaken using the ADMS modelling package, which is one of the models recognised as being suitable for this type of study.

1.1.4. The approximate site location is shown on the Site Location Map, outlined in red, which is presented as Figure 1.

Figure 1: Site Location Map



1.2. Objectives of the Study

1.2.1. The objectives of this study are as follows:

- to determine suitable discharge stack heights for the two emission points associated with the proposed Installation's twin lines, by undertaking a stack height screening assessment;
- to determine the maximum ground level concentrations ("GLCs") arising from the emission of pollutants from the Installation's two discharge stacks; the pollutants are assumed to be released from the Installation at the upper end of the Emission Limit Values ("ELVs") defined in the Best Available Techniques ("BAT") Reference Document ("Bref") for Waste Incineration[1] (i.e., the BAT-associated emission levels ("BAT-AELs") will be used). Annex VI of the Industrial Emissions Directive ("IED")[2] - *Technical provisions relating to waste incineration plants and waste co-incineration plants* will also be referred to. Maximum GLCs have been determined with the plant operating normally and abnormally;
- to assess the impact of emissions from the Installation's two discharge stacks on existing local air quality in relation to human health at a range of potentially sensitive receptors by comparison with relevant air quality standards ("AQSs").
- to assess the impact of emissions from the Installation's two discharge stacks on potentially sensitive ecological receptors and compare these to the Critical Levels set for the protection of Ecosystems.
- to predict deposition rates of acids and nutrient nitrogen from the modelled emissions and compare these with relevant Critical Loads at a range of sensitive habitat sites;
- to assess plume visibility;
- to assess abnormal emissions as detailed in IED; and
- to assess any cumulative impacts.

1.3. Scope of the Study

1.3.1. The first part of the study comprised a screening assessment to determine a suitable height for the Installation's two discharge stacks. The impact of the Installation on human health and sensitive habitats was assessed for a range of stack heights between 45m and 110m.

1.3.2. The main study determined the maximum predicted GLCs of the following pollutants:

- nitrogen oxides (NO_x and NO_2);
- total fine particles (PM_{10} and $PM_{2.5}$);
- carbon monoxide;
- gaseous and vaporous organic substances ("VOCs"), expressed as total organic carbon and assumed to comprise entirely of benzene (this is in accordance with the EA's guidance when grouping air emissions[3], which says where characterisation of VOCs has not been undertaken, treat all VOCs as benzene);

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[1] *Best Available Techniques (BAT) Reference Document for Waste Incineration* (published December 2019). Available online via: https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

[2] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast)

[3] *Air emissions risk assessment for your environmental permit*: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

- sulphur dioxide;
- hydrogen chloride;
- hydrogen fluoride;
- ammonia;
- mercury and its compounds;
- cadmium and thallium and their compounds;
- antimony, arsenic, chromium, cobalt, copper, lead, manganese, nickel, vanadium and their compounds (note for ease of reporting, this group of nine metals and their compounds are hereinafter referred to as "Group 3 metals and their compounds";
- dioxins and furans;
- polychlorinated biphenyls and
- PAH, as benzo[a]pyrene (the AQS for PAH is expressed as benzo[a]pyrene, and, accordingly, for the purposes of the assessment, all PAH are assumed to be present as benzo[a]pyrene).

1.3.3. Modelling was carried out using the upper end of the BAT-AELs outlined for New Plant; as specified in the BAT conclusions of the Bref document on waste incineration (published December 2019).

1.3.4. As requested by the EA, where short-term half-hourly ELVs are specified in the guidance (i.e., in Annex VI of the IED), these have also been used. It has been considered that, by assessing the impact of abnormal releases, this will help to ensure the assessment is as conservative as possible. The Daily BAT-AELs were used for the pollutants in which half-hourly ELVs have not been assigned.

1.3.5. The effects of prevailing meteorological conditions, building downwash effects, local terrain and existing ambient air quality were also taken into account.

1.3.6. The maximum predicted pollutant ground level concentrations ("GLCs") - also known as the process contributions ("PCs") - for each of the releases were compared with the relevant AQSs.

1.3.7. The predicted environmental concentrations ("PECs") - the sum of the pollutant PC and the existing pollutant background concentration from other sources - were also compared to the relevant standards. Results are presented as the maximum predicted GLC and the maximum sensitive receptor GLC.

1.3.8. The maximum predicted annual mean GLCs of NO_x, sulphur dioxide ("SO_2"), hydrogen fluoride ("HF") and ammonia ("NH_3") were compared with the Critical Levels for the Protection of Ecosystems or Vegetation detailed in the Environment Agency's online guidance[4].

1.3.9. The maximum predicted pollutant GLCs at sixteen human receptors were also compared to the relevant AQSs. There are currently no declared Air Quality Management Areas ("AQMAs") in Redcar and Cleveland Borough Council ("RCBC"). Consequently, the assessment of impact on AQMAs is not required.

[4] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

1.3.10. Using ADMS, the rates of deposition for acids (nitrogen and sulphur, as kilo-equivalents) and nutrient nitrogen were predicted for all relevant habitat sites. These rates were then compared to the appropriate critical loads for the type and location of each habitat.

1.3.11. Abnormal operating conditions were also considered in the study to take account of short-term abnormal conditions permitted under Article 46(6) of the IED.

1.3.12. Cumulative impacts were also considered as part of the study where data was made publicly available. Of the surrounding existing and proposed developments that were acknowledged as being potentially relevant for inclusion in the model, information was only readily available for Redcar Energy Centre ("REC").

1.3.13. REC, which will be situated at land formerly occupied by Redcar Bulk Terminal (approximately 4.8km to the north of the Installation), is due to be commissioned circa 2024 to 2025. Consequently, the emissions arising from the two stacks associated with its two process lines will be incorporated into the cumulative impact assessment undertaken as part of this study. This will be carried out making use of the emissions data disclosed in the air quality chapter submitted as part of the planning application documentation for REC.

2. METHOD STATEMENT

2.1. Choice of Model

2.1.1. The UK-ADMS model was developed jointly by Cambridge Environmental Research Consultants ("CERC"), Her Majesty's Inspectorate of Pollution (the EA's predecessor body), the Meteorological Office and National Power, with sponsorship from the UK Government and a number of commercial organisations. UK-ADMS is a computer-based model of dispersion from both point and non-point sources in the atmosphere and is one of the modelling packages that are suitable for this type of study. The current version is ADMS 5.2 (model version 5.2.4.0).

2.1.2. ADMS 5.2 has been validated against a number of data sets in order to assess various configurations of the model such as flat or complex terrain, line/area/volume sources, buildings, dry deposition fluctuations and visible plumes. The model results have been compared to observational data or other model results if available.

2.1.3. ADMS 5.2 is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by two parameters:

- the boundary layer depth, and
- the Monin-Obukhov length,

rather than in terms of the single parameter Pasquill-Gifford class.

2.1.4. Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetrical Gaussian expression).

2.1.5. ADMS 5.2 is therefore considered to be suitable for use in this assessment.

2.2. Key Assumptions

2.2.1. The study will be undertaken on the basis of a worst-case scenario. Consequently, the following assumptions have been made:

- the release concentrations of the pollutants will be at the permitted ELVs on a 24-hourly basis, 365 days of the year; in practice, when the plant is operating, the release concentrations will be below the ELVs, and, for most pollutants, considerably so; furthermore, taking shutdowns for planned maintenance into account, the plant will not operate for 365 days;
- the highest predicted pollutant GLCs for the six years of meteorological data for each averaging period (annual mean, hourly, etc.) have been used;
- concentrations of NO_2 in the emissions have been calculated assuming a long-term 70% NO_X to NO_2 conversion rate, and a short-term 35% NO_X to NO_2 as referenced in AQTAG06[5];
- all of the particulate releases will be present as $PM_{2.5}$ and also as PM_{10}; this enables direct comparison with the particle AQSs, which are expressed in terms of $PM_{2.5}$

[5] AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air (April 2014);

and PM_{10}; in practice, this will not be the case as some of the particles present will be larger than PM_{10}; and

- maximum predicted GLCs at any location, irrespective of whether a sensitive receptor is characteristic of public exposure, are compared against the relevant AQSs for each pollutant; in addition, the predicted maximum sensitive receptor GLC has also been assessed.

2.3. Sensitive Human Receptors

2.3.1. In addition to predicting concentrations over a 4km by 4km grid, there are sixteen potentially sensitive human receptors considered in the assessment (up to a distance of 1.8km from the main stacks). Details of these receptors are provided in Table 1 and a visual representation as Figure 2. All receptors are assumed to be at ground level.

Table 1: Potentially Sensitive Human Receptors

ADMS Ref.	Name	Easting (X)	Northing (Y)	Distance from Source (m)	Heading (degrees)
HSR1	Industrial activity off John Boyle Road	453979	521277	422	252
HSR2	Industrial activity off Stapylton Street	454699	520909	594	147
HSR3	Industrial activity off Eston Road	454299	520815	600	188
HSR4	Residential properties off Cheetham Street	454963	520759	875	138
HSR5	Residential properties off Elgin Avenue	454538	520528	896	170
HSR6	Residential properties off Passfield Crescent	453847	520674	908	216
HSR7	Golden Boy Green Community Centre	453574	520682	1085	228
HSR8	Residential properties off Lawson Close	453902	520378	1137	205
HSR9	Industrial activity NNW of Site	453756	522499	1255	330
HSR10	Grangetown Primary School	455105	520341	1292	146
HSR11	Large car park off Tees Dock Road	455114	522527	1337	33
HSR12	Saint Peter's Catholic College	453817	520136	1392	204
HSR13	Tesco Extra store entrance	454155	519997	1431	189
HSR14	Industrial activity off Tees Dock Road	454411	523108	1698	1
HSR15	Industrial activity ENE of Site	456030	521841	1706	75
HSR16	Allotments South Garden	453212	520097	1757	222

Notes to Table 1

(a) Distances are measured as the crow flies from the defined point of the receptor to the 'Source'. The 'Source' is the approximate halfway location between the two emission points associated with the incinerator – location coordinates: 454379 (X), 521410 (Y).

Figure 2: Location of the Potentially Sensitive Human Receptors Considered for the Assessment

<u>Notes to Figure 2</u>
The red circle is the approximate location of the proposed emission points (Line 1 and Line 2) at the Installation;
The neon green squares with the red outline and yellow highlighted annotations are the locations of the potentially sensitive human receptor locations specified in Table 1; and
The darker green shapes represent the buildings layout considered in the modelling assessment (refer to Section 2.16., for further details).

2.4. Sensitive Ecological Receptors

2.4.1. The impact of emissions to air on vegetation and ecosystems from the Installation has been assessed for the following sensitive environmental receptors within 10km of the proposed discharge stack:

- Special Areas of Conservation ("SACs") and candidate SACs ("cSACs") designated under the EC Habitats Directive[6];
- Special Protection Areas ("SPAs") and potential SPAs designated under the EC Birds Directive[7];
- SACs and SPAs are included in an EU-wide network of protected sites called Natura 2000[8]. The EC Habitats Directive and Wild Birds Directive have been transposed into UK law by the Habitats Regulations[9].
- Ramsar Sites designated under the Convention on Wetlands of International Importance[10];

2.4.2. In addition, the impact of emissions to air on vegetation and ecosystems from the Installation has been assessed for the following sensitive environmental receptors within 2km of the discharge stack:

- Sites of Special Scientific Interest ("SSSI") established by the 1981 Wildlife and Countryside Act;
- Ancient woodland; and
- local nature sites (ancient woodland, local wildlife sites and national and local nature reserves).

2.4.3. For dispersion modelling purposes, the specified habitat coordinates are a precautionary approach, and are those located at the boundary of the protected site / priority habitat approximately closest in distance to the proposed Installation. All receptors are assumed to be at ground level. The details of the habitat sites are provided in Table 2, and a visual representation provided in Figure 3.

[6] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
[7] Council Directive 79/409/EEC on the conservation of wild birds
[8] www.natura.org
[9] The Conservation (Natural Habitats, &c.) Regulations 1994. The Conservation (Natural Habitats, &c.) (Amendment) Regulations 1997 (Statutory Instrument 1997 No. 3055), The Conservation (Natural Habitats, &c.) (Amendment) (England) Regulations 2000 (Statutory Instrument 2000 No. 192)
[10] The Convention of Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, Iran,1971)

Table 2: Ecological Receptors Considered for the Assessment

ADMS Ref.	Name [(a)]	Designation [(a)]	Easting (X) [(a)]	Northing (Y) [(a)]	Distance from Source [(b)] (m)	Heading (degrees)
NYM1	North York Moors	SAC, SPA	458895	512978	9565	152
TCC1	Teesmouth and Cleveland Coast [(c)]	SPA, SSSI	453277	522462	1524	314
TCC2			454760	523212	1842	12
TCC3			454282	523483	2075	357
TCC4			452203	521269	2181	266
TCC5		SPA, Ramsar	453002	522482	1745	308
TCC6			452430	521870	2003	283
TCC7			451970	521355	2410	269
TCC8			454304	524213	2804	358
TCC9			455670	524302	3167	24
TCC10			450882	522960	3825	294
TCC11			453572	525627	4294	349
TCC12			451681	525099	4570	324
TCC13			456614	525978	5085	26
TCC14 [(d)]		SSSI	453880	526160	4776	354

Notes to Table 2

(a) The ecological sites included were identified using the Multi-Agency Geographic Information System for the Countryside ("MAGIC") portal and via the EA's pre-application advice Nature and Heritage Conservation Screening Report (reference EPR/ZP3309LW/A001).

(b) Distances are measured as the crow flies from the approximate nearest point of the boundary of the ecological receptor / priority habitat location to the 'Source'. The 'Source' is the approximate halfway location between the two emission points associated with the incinerator – location coordinates: 454379 (X), 521410 (Y).

(c) Please note that, as the Teesmouth and Cleveland Coast ecological site covers a large area and is broken up into many different segments, depending on the designation and coastal priority habitat, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(d) TCC14 was retrospectively added following discussions with Natural England to further assess the predicted impact of aerial emissions on the Seal Sands peninsula (specifically the SSSI).

Figure 3: Location of the Potentially Sensitive Ecological Receptors Considered for the Assessment

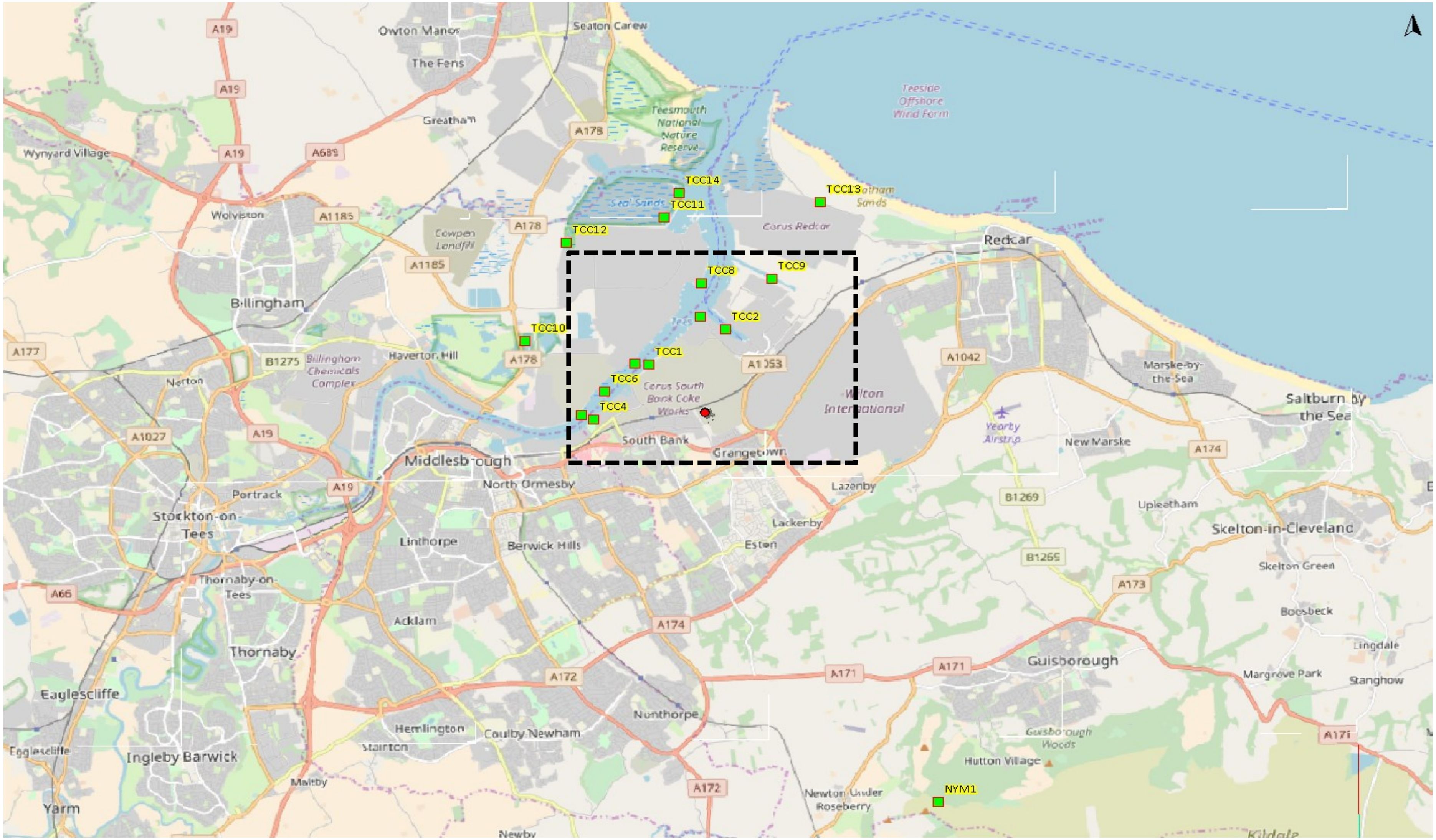


Figure 3: Location of the Potentially Sensitive Ecological Receptors Considered for the Assessment (cont.)

Notes to Figure 3

The red circle is the approximate location of the proposed emission points (Line 1 and Line 2) at the Installation;

The neon green squares with the red outline and yellow highlighted annotations are the locations of the ecological receptor locations specified in Table 2; and

The darker green shapes represent the buildings layout considered in the modelling assessment (refer to Section 2.16., for further details)

2.5. Air Quality Standards for the Protection of Human Health

2.5.1. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[11] details Air Quality Strategy Objectives for a range of pollutants, including a number that are directly relevant to this study. In addition, the Regulatory Authorities must ensure that the proposals do not exceed Ambient Air Direction ("AAD") limit values.

2.5.2. The 4th Air Quality Daughter Directive[12] ("AQDD") details Target Values for arsenic, cadmium and nickel. The Expert Panel on Air Quality Standards ("EPAQS"), which advises the UK Government on air quality, has set recommended Guideline Values for arsenic, chromium VI and nickel; the EPAQS Guideline Value for nickel is the same as the AQDD Target Value, but the EPAQS Guideline Value for arsenic is half that of the AQDD value. The lowest of these values have been taken into account in this study.

2.5.3. In the case of hydrogen chloride, hydrogen fluoride, chromium (VI) and arsenic, EPAQS has set recommended Guideline Values which have been taken into account in this study. Environmental Quality Standards ("EQSs") have been assigned by the EA (by the use of the EA's EQS) to a number of the other pollutants assessed in the modelling study; these are detailed (where assigned) in the EA's online guidance; these have been derived from a variety of published UK and international sources (including the World Health Organisation ("WHO")).

2.5.4. In this report, the generic term Air Quality Standard ("AQS") is used to refer to any of the above values. The various AQSs - Air Quality Objectives, Target Values, EPAQS Guideline Values and EALs - are intended to be used as guidelines for the protection of human health and the management of local air quality. The values relevant to this study are detailed in Table 3.

[11] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1), July 2007

[12] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, 15th December 2004.

Table 3: Air Quality Standards for the Protection of Human Health

Pollutant	Averaging Period	AQS ($\mu g/m^3$)	Comments
Nitrogen Dioxide (NO_2)	annual	40	UK Air Quality Objective (“AQO”) and Ambient Air Directive (“AAD”) Limit
	1-hour	200	UK AQO and AAD Limit, not to be exceeded more than 18 times per annum, equivalent to the 99.79th percentile of 1-hour means
Sulphur Dioxide (SO_2)	24-hour	125	UK AQO, not to be exceeded more than 3 times per annum, equivalent to the 99.18th percentile of 24-hour means
	1-hour	350	UK AQO, not to be exceeded more than 24 times per annum, equivalent to the 99.73rd percentile of 1-hour means
	15-minute	266	UK AQO, not to be exceeded more than 35 times per annum, equivalent to the 99.90th percentile of 15-minute means
Particulate Matter, as PM_{10}	annual	40	UK AQO
	24-hour	50	UK AQO, not to be exceeded more than 35 times per annum, equivalent to the 90.41st percentile of 24 hour means
Particulate Matter, as $PM_{2.5}$	annual	20	AAD Limit
Carbon Monoxide (CO)	8-hour	10,000	UK AQO and AAD Limit
VOC (as benzene)	Annual	5	AAD Limit and AQS Objective
Ammonia	Annual	180	EAL derived from long-term occupational exposure limits
	1-hour	2,500	EAL derived from long-term occupational exposure limits as no short-term limit exists
Hydrogen chloride	1-hour	750	EPAQS Guideline Value
Hydrogen Fluoride (HF)	Annual	16	EPAQS Guideline Values
	1-hour	160	

Table 3: Air Quality Standards for the Protection of Human Health (Cont.)

Pollutant	Averaging Period	AQS (µg/m^3)	Comments
Antimony (Sb)	annual	5	EAL derived from long-term occupational exposure limits
	1-hour	150	EAL derived from long-term occupational exposure limits as no short-term limit exists
Arsenic (As)	annual	0.003	EPAQS Guideline Value
Cadmium (Cd)	annual	0.005	AQDD Target Value/EPAQS Guideline Value
Chromium III (CrIII)	annual	5	EAL derived from long-term occupational exposure limits
	1-hour	150	EAL derived from long-term occupational exposure limits as no short-term limit exists
Chromium VI (Cr VI)	annual	0.0002	EPAQS Guideline Value
Cobalt (Co)	annual	0.2	EAL derived from long-term occupational exposure limits
	1-hour	6	EAL derived from short-term occupational exposure limits
Copper (Cu)	annual	10	EAL derived from short-term occupational exposure limits
	1-hour	200	EAL derived from long-term occupational exposure limits
Lead (Pb)	annual	0.25	UK AQO
Manganese (Mn)	annual	1	WHO Guideline Value
	1-hour	1,500	EAL derived from long-term occupational exposure limits as no short-term limit exists
Mercury (Hg)	annual	0.25	EAL derived from long-term occupational exposure limits
	1-hour	7.5	EAL derived from long-term occupational exposure limits as no short-term limit exists

Table 3: Air Quality Standards for the Protection of Human Health (Cont.)

Pollutant	Averaging Period	AQS ($\mu g/m^3$)	Comments
Nickel (Ni)	annual	0.02	AQDD Target Value/EPAQS Guideline Value
Thallium (Tl)	Annual	1	EAL derived from long-term occupational exposure limits
	1-hour	30	EAL derived from short-term occupational exposure limits
Vanadium (V)	annual	5	EAL derived from long-term occupational exposure limits
	24-hour	1	WHO Guideline Value
PAH (as Benzo[a]pyrene)	annual	0.00025	UK AQO
PCBs	annual	0.2	EAL
	1-hour	6	EAL
Dioxins and Furans	No Standard Applies		

2.6. Assessment Criteria for the Protection of Sensitive Habitat Sites and Ecosystems - Critical Levels

2.6.1. Critical levels are thresholds of airborne pollutant concentrations above which damage may be sustained to sensitive plants and animals. High concentrations of pollutants in ambient air directly cause harm to leaves and needles of forests and other plant communities. Oxidised nitrogen can have both a toxic effect on vegetation and an impact on nutrient nitrogen.

2.6.2. The 2008 Air Quality Directive[13] set limit values for the protection of vegetation and ecosystems and these have been adopted by the Air Quality Strategy but are not currently set in Regulations. The current objectives are summarised in Table 4.

[13] Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, 21st May 2008

Table 4: Assessment Criteria for the Protection of Sensitive Habitats and Ecosystems

Pollutant	Averaging Period	Critical Level (µg/m³)	Comments
Nitrogen Oxides (as NO_2)	annual	30	Air Quality Objective
	daily	75	(a)
Sulphur Dioxide (SO_2)	annual	10	Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity (a)
	annual	20	Air Quality Objective
	winter mean	20	Air Quality Objective
Ammonia (NH_3)	annual	1	Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity (b)
	annual	3	All other ecosystems (b)
Hydrogen Fluoride (HF)	daily	5	(c)
	weekly	0.5	(c)

Notes to Table 4

(a) WHO (2000) Air Quality Guidelines for Europe; 2nd Edition. WHO Regional Publications, European Series, No. 91.

(b) UN Economic & Social Council, Executive Body for the Convention on Long-Range Transboundary Air Pollution, ECE/EB.AIR/WG.5/2007/3.

(c) Mc Cune, DC (1969a): Fluoride criteria for vegetation reflect the diversity of the plant kingdom. In a symposium: The technical significance of air quality standards. Environmental Science & Technology. 3: 720-735.

2.7. Assessment Criteria for the Protection of Sensitive Habitat Sites and Ecosystems - Critical Loads

2.7.1. Critical Loads are defined as:

"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"[14].

2.7.2. Critical loads for nutrient nitrogen are set under the Convention on Long-Range Transboundary Air Pollution based on empirical evidence, mainly observations from experiments and gradient studies. Critical loads[15] are assigned to habitat classes of the European Nature Information System[16] in units of kgN/ha/yr.

2.7.3. Predicted NO_x deposition rates in units of µg m^{-2} s^{-1} are converted to units of kg/ha/yr as nitrogen for direct comparison with critical loads as follows:

$$kgN/ha/yr = \mu g/m^2/s \times (14/46)^{17} \times 315.36^{18}$$

[14] From http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.htm
[15] From http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm
[16] See http://eunis.eea.europa.eu/ for details
[17] Ratio of atomic weight of nitrogen to molecular weight of nitrogen dioxide
[18] Conversion factor from µg/m² to kg/ha.

2.7.4. Exceedance of critical loads for nitrogen deposition can result in significant terrestrial and freshwater impacts due to changes in species composition, reduction in species richness, increase in nitrate leaching, increases in plant production, changes in algal productivity and increases in the rate of succession[19].

2.7.5. In the UK, an empirical approach is applied to critical loads for acidity for non-woodland habitats; and the simple mass balance equation is applied to both managed and unmanaged woodland habitats. For freshwater ecosystems, national critical load maps are currently based on the First-order Acidity Balance model. All of these methods provide critical loads for systems at steady-state[15] in units of keq/ha/yr.

2.7.6. The unit kiloequivalent (keq) is the molar equivalent of potential acidity resulting from sulphur or oxidised and reduced nitrogen. Predicted acid deposition rates in units of $\mu g/m^2/s$ are converted to units of keq/ha/yr) as hydrogen for direct comparison with critical loads as follows:

- nitrogen from NO_x (keq) =([NO_x]$\mu g/m^2/s \times (14/46) \times 315.36) \div 14$[20]
- sulphur (keq) =([SO_2]$\mu g/m^2/s \times (32/64) \times 315.36) \div 16$[21].

2.7.7. Emissions of ammonia ("NH_3") and hydrogen chloride ("HCl") from the Installation will also contribute to the total acidification rate.

2.7.8. Exceedance of the critical loads for acid deposition can result in significant terrestrial and freshwater impacts due to leaching and subsequent increase in availability of potentially toxic metal ions.

2.7.9. Table 5 list the site-specific critical loads for nutrient nitrogen deposition and acid deposition. Features are as indicated on the Air Pollution Information System ("APIS") website (for SAC's) or directly from the SSSI citation. Where a primary feature identified in the SSSI citation was not listed on the APIS website, an equivalent feature was used to derive critical loads as indicated in the Habitats Table on the APIS website[22]. The Critical Load values for acidification were based on the grid reference for the ecological receptor as stated in Table 2.

2.7.10. A summary of site-specific baseline nutrient nitrogen and acid deposition rates, as provided by APIS, is also presented in Table 5. Again, the specific deposition rates for each ecological receptor have been obtained from the same point as listed in Table 2, i.e., the closest grid square to the point of the site used in the assessment.

[19] From http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm#_Toc279788052
[20] 14kg nitrogen/ha/yr = 1keq nitrogen/ha/yr
[21] 16kg sulphur/ha/yr= 1keq sulphur/ha/yr
[22] http:/www.apis.ac.uk/habitat_table.html

Table 5: Critical Loads for Deposition

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acid Deposition (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
NYM1	North York Moors - SAC	Blanket Bogs - Raised and blanket bogs	5	10	0.321	0.504	0.183
		Northern Atlantic wet heaths with Erica tetralix - Erica tetralix dominated wet heath	10	20	0.499	0.792	0.15
		European dry heaths - Dry heaths	10	20	0.499	0.792	0.15
NYM1	North York Moors - SPA	European Golden Plover - Reproducing - Montane habitats	5	10	0.178	0.471	0.15
		European Golden Plover - Reproducing - Bogs	5	10	0.321	0.504	0.183
		European Golden Plover - Reproducing - Dwarf shrub heath	10	20	0.499	0.792	0.15
		Merlin - Reproducing - Dwarf shrub heath	10	20	0.499	0.792	0.15
TCC1 – TCC13 [(a)]	Teesmouth and Cleveland Coast - SPA	Sandwich Tern - Concentration - Supralittoral sediment - Coastal stable dune grasslands (acid type)	8	10	0.223	1.998	1.56
		Sandwich Tern - Concentration - Supralittoral sediment - Shifting coastal dunes	10	20	Species not sensitive due to acidity impacts on broad habitat		

Table 5: Critical Loads for Deposition (cont.)

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acidity Critical Loads (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
TCC1 – TCC13 [a]	Teesmouth and Cleveland Coast - SPA (cont.)	Sandwich Tern - Concentration - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.856	4.856	4
		Little Tern - Reproducing - Supralittoral sediment - Coastal stable dune grasslands (acid type)	8	10	0.223	1.998	1.56
		Little Tern - Reproducing - Supralittoral sediment - Shifting coastal dunes	10	20	Species not sensitive due to acidity impacts on broad habitat		
		Little Tern - Reproducing - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.856	4.856	4
		Common Shelduck - Wintering - Littoral sediment - Pioneer, low-mid, mid-upper saltmarshes	20	30	Species not sensitive due to acidity impacts on broad habitat		
		Eurasian teal - Wintering - Littoral sediment - Pioneer, low-mid, mid-upper saltmarshes	20	30	Species not sensitive to acidity impacts		
		Eurasian teal - Wintering - Standing open water and canals	No comparable habitat with established critical load estimates available				
		Red Knot - Wintering - Littoral sediment - Pioneer, low-mid, mid-upper saltmarshes	20	30	Habitat / species not sensitive due to acidity impacts on broad habitat		

Table 5: Critical Loads for Deposition (cont.)

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acidity Critical Loads (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
TCC1 – TCC13 [(a)]	Teesmouth and Cleveland Coast – SPA (cont.)	Sanderling - Wintering - Littoral sediment - Pioneer, low-mid, mid-upper saltmarshes	20	30	Habitat / species not sensitive due to acidity impacts on broad habitat		
		Common Redshank - Concentration - Littoral sediment - Pioneer, low-mid, mid-upper saltmarshes	20	30	Habitat / species not sensitive due to acidity impacts on broad habitat		
		Great Cormorant - Wintering - Standing open water and canals	No comparable habitat with established critical load estimates available		No values given by APIS		
		Northern Shoveler - Wintering - Standing open water and canals			Species not sensitive due to acidity impacts on broad habitat		
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast – SSSI	Supralittoral sediment (Ammophila arenaria - arrhenatherum elatius dune grassland)	8	15	No information currently published by APIS		
		Supralittoral sediment (Ammophila arenaria - Festuca rubra semi-fixed dune community)	8	15			
		Supralittoral sediment (Festuca rubra - Galium verum fixed dune grassland)	8	15			
		Supralittoral sediment (Phleum arenarium - Arenaria serpyllifolia dune annual community)	8	15			

Table 5: Critical Loads for Deposition (cont.)

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acidity Critical Loads (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast – SSSI (cont.)	Supralittoral sediment (Ammophila arenaria mobile dune community)	10	20	No information currently published by APIS		
		Supralittoral sediment (Elymus farctus ssp. Boreali-atlanticus foredune community)	10	20			
		Supralittoral sediment (Leymus arenarius mobile dune community)	10	20			
		Supralittoral sediment (Salix repens - Holcus Lanatus dune slack community)	10	20			
		Littoral sediment (Annual Salicornia Saltmarsh)	20	30			
		Littoral sediment (Elytrigia atherica saltmarsh)	20	30			
		Littoral sediment (Elytrigia repens saltmarsh)	20	30			
		Littoral sediment (Puccinellia maritima saltmarsh, Limonium vulgare - Armeria maritima sub-community)	20	30			
		Littoral sediment (Puccinellia maritima saltmarsh, Puccinellia maritima dominant sub-community)	20	30			
		Littoral sediment (Suaeda Maritima Saltmarsh)	20	30			

Table 5: Critical Loads for Deposition (cont.)

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acidity Critical Loads (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast – SSSI (cont.)	Littoral sediment (Transitional low marsh vegetation with Puccinellia maritima, annual Salicornia species and Suaeda maritima.)	20	30	No information currently published by APIS		
		Supralittoral sediment (Honkenya peploides - Cakile maritima strandline community)	Not assessed for this feature				
		Coastal stable dune grasslands (calcareous type)	10	15			
		Sterna albifrons - Little Tern / Common Tern / Sandwich Tern – Bird – Breeding – Supralittoral sediment (acidic type)	8	10			
		Calidris alba – Sanderling – Bird – Nonbreeding – Littoral sediment	20	30			
		Calidris canutus - Knot– Bird – Nonbreeding – Littoral sediment	20	30			
		Charadrius hiaticula - Ringed Plover – Bird – Nonbreeding – Littoral sediment	20	30			
		Philomachus pugnax – Ruff – Bird – Nonbreeding – Neutral grassland and Littoral sediment	20	30			
		Recurvirostra avosetta – Avocet – Bird – Breeding – Littoral sediment	20	30			

Table 5: Critical Loads for Deposition (cont.)

ADMS Receptor Reference	Site Name and Designation	Habitat Interest and Habitat Feature	Nutrient Nitrogen - Empirical Critical Load (kgN/ha/yr)		Acidity Critical Loads (keq/ha/yr)		
			Lower Critical Load (N)	Upper Critical Load (N)	CL MinN	CL MaxN	CL MaxS
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast – SSSI (cont.)	Tadorna tadorna – Shelduck – Bird – Nonbreeding – Littoral sediment	20	30	No information currently published by APIS		
		Tringa totanus - Redshank – Bird – Nonbreeding – Littoral sediment	20	30			
		>20,000 Non-breeding waterbirds - >20,000 Non-Breeding Waterbirds – Standing open water and canals	No comparable habitat with established critical load estimates available				
		Anas clypeata – Shoveler – Bird – Nonbreeding – Standing open water and canals					
		Anas strepera – Gadwall – Bird – Nonbreeding – Standing open water and canals					
		Calidris maritima - Purple Sandpiper – Bird – Nonbreeding – Littoral rock	Species' broad habitat not sensitive to Nitrogen				
		Phoca vitulina - Common Seal – Inshore sublittoral rock					
TCC5 – TCC13 [(a)]	Teesmouth and Cleveland Coast - Ramsar [(b)]	Coastal stable dune grasslands (calcareous type)	10	15	0.856	4.856	4.00

Notes to Table 5

(a) Please note that, as the Teesmouth and Cleveland Coast ecological site covers a large area and is broken up into many different segments, depending on the designation / coastal priority habitat, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(b) APIS does not provide data for the Ramsar site – however, as the Ramsar site is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, and in the interest of being conservative, the SPA habitat interest and feature with the lowest lower critical load assigned to it, has been selected.

2.8. Habitat Site Specific Baseline Concentrations and Deposition Rates

2.8.1. Airborne NO_X, SO_2 and NH_3 Concentrations

2.8.1.1. A summary of site-specific baseline concentrations of NO_X, SO_2 and NH_3, as provided by APIS, is presented in Table 6. Background concentrations for each ecological receptor have been obtained at the same point as listed in Table 2 i.e., the closest grid square to the point of the site used in the assessment.

Table 6: Baseline Concentrations of NO_X, SO_2 and NH_3

ADMS Receptor Reference	Name and Designation(s)	Background Concentration [(a)]			
		NO_X (µg/m^3)		SO_2 (µg/m^3)	NH_3 (µg/m^3)
		Annual Mean	24 Hour Mean [(b)]	Annual Mean	Annual Mean
NYM1	North York Moors – SAC, SPA	8.67	10.23	0.91	1.95
TCC1	Teesmouth and Cleveland Coast – SPA, SSSI [(c)]	25.65	30.27	3.05	1.6
TCC2		35.78	42.22		
TCC3					
TCC4		28.89	34.09		
TCC5	Teesmouth and Cleveland Coast – SPA and Ramsar [(c)]	25.65	30.27	3.05	1.6
TCC6		28.89	34.09		
TCC7		27.59	32.56		
TCC8		49.1	57.94		
TCC9		27.93	32.96	3.89	1.42
TCC10		21.62	25.51	3.05	1.6
TCC11		41.45	48.91	2.38	1.71
TCC12		19.51	23.02	2.38	1.71
TCC13		21.52	25.39	0 [(d)]	0.89
TCC14	Teesmouth and Cleveland Coast – SSSI [(c)]	24.14	28.49	2.38	1.71

Notes to Table 6

(a) Background concentrations for the relevant ecological habitats have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).

(b) The 24-hour mean baseline concentration is twice the annual mean multiplied by a factor of 0.59, in accordance with the H1 guidance.

(c) Please note that, as the Teesmouth and Cleveland Coast ecological site covers a large area and is broken up into many different segments, depending on the designation and coastal priority habitat, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(d) With APIS reporting a concentration of 0 µg/m^3, it is suspected this value is erroneous. In the interest of being conservative the SO_2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m^3 will be used for calculating the SO_2 PECs for TCC13.

2.8.2. Nutrient Nitrogen and Acid Deposition

1.8.2.3. A summary of site-specific baseline nutrient nitrogen and acid deposition rates, as provided by APIS, is presented in Table 7. Again, the specific deposition rates for each ecological receptor have been obtained from the same point as listed in Table 2, i.e., the closest grid square to the point of the site used in the assessment.

Table 7: Background Nutrient Nitrogen and Acid Deposition

<table>
<tr><th rowspan="2">ADMS Receptor Reference</th><th rowspan="2">Name and Designation(s)</th><th rowspan="2">Nutrient Nitrogen Background (kgN/ha/yr) [(a)]</th><th colspan="3">Acid Deposition Background - (keq/ha/yr) [(b)]</th></tr>
<tr><th>Total</th><th>Nitrogen</th><th>Sulphur</th></tr>
<tr><td>NYM1</td><td>North York Moors – SAC, SPA</td><td>14.98</td><td>1.46</td><td>1.36</td><td>0.18</td></tr>
<tr><td>TCC1</td><td rowspan="4">Teesmouth and Cleveland Coast – SPA, SSSI [(c)]</td><td rowspan="8">8.96</td><td rowspan="8">1.19</td><td rowspan="8">1.03</td><td rowspan="8">0.2</td></tr>
<tr><td>TCC2</td></tr>
<tr><td>TCC3</td></tr>
<tr><td>TCC4</td></tr>
<tr><td>TCC5</td><td rowspan="9">Teesmouth and Cleveland Coast – SPA and Ramsar [(c)]</td></tr>
<tr><td>TCC6</td></tr>
<tr><td>TCC7</td></tr>
<tr><td>TCC8</td></tr>
<tr><td>TCC9</td><td>8.4</td><td>1.2</td><td>1.01</td><td>0.23</td></tr>
<tr><td>TCC10</td><td>8.96</td><td>1.19</td><td>1.03</td><td>0.2</td></tr>
<tr><td>TCC11</td><td>10.78</td><td>1.31</td><td>1.07</td><td>0.28</td></tr>
<tr><td>TCC12</td><td>10.78</td><td>1.31</td><td>1.07</td><td>0.28</td></tr>
<tr><td>TCC13</td><td>9.1</td><td>0.95</td><td>0.75</td><td>0.25</td></tr>
<tr><td>TCC14</td><td>Teesmouth and Cleveland Coast – SSSI [(c)]</td><td>10.78</td><td>1.31</td><td>1.07</td><td>0.28</td></tr>
</table>

Notes to Table 7

(a) Background concentrations for nutrient nitrogen deposition have been taken from the APIS website (specifically the *APIS GIS map tool*) for the relevant grid square. The concentrations provided are the grid averages, with 2018 selected as the midyear for all sites with the exception of TCC13 (with 2016 being the latest available midyear).

(b) Background concentrations for acid deposition have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).

(c) Please note that, as the Teesmouth and Cleveland Coast ecological site covers a large area and is broken up into many different segments, depending on the designation, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

2.9. Deposition Parameters - Sensitive Habitats

2.9.1. Deposition of nitrogen and acids at designated habitats sites was also included in the assessment. This focused on sites within 10km of the Installation as detailed in Section 2.4.3. The pollutant deposition rates are presented in Table 8. These parameters are detailed in AQTAG06. Since woodland sites have a greater surface area, higher deposition velocities are adopted for these sites.

2.9.2. For acidification impacts, the deposition of oxides of nitrogen, ammonia, sulphur dioxide and hydrogen chloride are considered. For nutrient nitrogen, the deposition of the oxides of nitrogen and ammonia are included.

Table 8: Acid/Nitrogen Deposition Parameters [a]

Pollutant	Dry Deposition Velocity for Grassland (m/s)	Dry Deposition Velocity for Woodland (m/s)
Sulphur Dioxide	0.012	0.024
Oxides of Nitrogen (as NO_2)	0.0015	0.003
Ammonia	0.02	0.03
Hydrogen Chloride	0.025	0.06

Note to Table 8
(a) As detailed in AQTAG06.

2.10. Background Air Quality

2.10.1. Background air quality data has been obtained for all pollutants, where relevant, so that the PECs can be calculated. Where background concentrations were needed, the source and concentrations used are discussed in the relevant sections of this report.

2.11. Stack Emission Parameters

2.11.1. The stack emission parameters used in the study are presented in Table 9 for the two main stacks (designated A1 and A2). Emissions parameters were provided by Hitachi Zosen Inova ("HZI").

Table 9: Stack Emission Parameters

Parameter	Line 1 (A1)	Line 2 (A2)
Stack Height (m)	TBC (45-110m)	TBC (45-110m)
Stack Exit Diameter (m)	1.90	1.90
Stack Gas Discharge Velocity (actual) (m/s)	18.44	18.44
Stack Gas Discharge Temperature (°C)	135	135
Stack Centre Coordinates	454379 (X) 521412 (Y)	454381 (X) 521408 (Y)
Oxygen Concentration in Stack Emission (%)	5.9	5.9
Moisture Concentration in Stack Emission (%)	20.4	20.4
Actual Volumetric Flowrate (m^3/s)	52.28	52.28
Normalised Volumetric Flowrate (Nm^3/s) [a]	42.19	42.19

Notes to Table 9
(a) Referenced to 273K, 1 atm, dry and 11% O_2.

2.11.2. The ELVs assumed for each pollutant and the pollutant mass emission rate for the study are presented in Table 10a for the daily ELVs. Similarly, Tables 10b and 10c display the pollutants where ELVs have been assigned for abnormal emissions – both for half-hourly emission limits and for abnormal operating conditions, respectively. These are the assumed ELVs used for the modelling assessment.

Table 10a: Pollutant Emission Rates – Daily ELVs

Pollutant	ELV [(a) (b)] (mg/Nm^3)	A1 & A2 (g/s)
NO_x as NO_2 [(c)]	100	4.22
SO_2	30	1.27
CO	50	2.11
PM_{10} [(d)]	5	0.211
$PM_{2.5}$ [(d)]	5	0.211
VOCs (as Benzene)	10	0.422
HCl	6	0.253
HF	1	0.0422
Cd/Tl	0.02	0.000844
Hg	0.02	0.000844
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	0.3	0.0127
NH_3	10	0.422
Dioxins and Furans	0.00000004	0.00000000169
PAH (as benzo[a]pyrene) [(e)]	0.0001	0.0000422
PCBs	0.00000008	0.00000000337

Notes to Table 10a

(a) Concentrations are at reference conditions i.e., 273K, 1 atmosphere, 11% oxygen, dry.

(b) Unless stated otherwise, the BAT-AELs have been used (new plant, high end).

(c) A lower NO_x BAT-AEL of 100 mg/Nm^3 is being proposed (as opposed to the high end BAT-AEL for NO_x of 120 mg/Nm^3) to improve the Installation's NO_x emissions. It has been considered that this, in turn, should reduce the environmental impact associated with the Installation's NO_x emissions, as well as helping to future proof the plant.

(d) It has been assumed that all particulate matter can be present as PM_{10} or $PM_{2.5}$.

(e) There is no ELV for B[a]P. Consequently, an appropriate ELV for the purposes of the modelling study was required. The BREF for the waste incineration sector quotes emission levels for B[a]P ranging from 0.004ng/Nm^3 to 1µg/Nm^3. Actual emissions testing from another plant (FCC Millerhill) using the same HZI technology gave results of between 0.0147 µg/m^3 and 0.0179 µg/m^3. As the BREF document uses data from older as well as more modern incineration plant, it is considered that a limit of 1 µg/Nm^3 would be overly conservative and would not provide realistic results. It is also approximately 70 times that of the actual emissions observed. Consequently, for the purposes of this modelling study a value of 0.1 µg/Nm^3 has been used for emissions of B[a]P. This is still some 7 times greater than the actual emissions observed, however still retains a degree of conservatism for the assessment.

Table 10b: Pollutant Emission Rates – Half-Hourly Emission Limits

Pollutant	ELV [(a) (b)] (mg/Nm^3)	A1 & A2 (g/s)
NO_x as NO_2	400	16.9
SO_2	200	8.44
PM_{10}	30	1.27

Table 10b: Pollutant Emission Rates – Half-Hourly Emission Limits (cont.)

Pollutant	ELV [(a) (b)] (mg/Nm^3)	A1 & A2 (g/s)
VOCs (as Benzene)	20	0.844
HCl	60	2.53
HF	4	0.169

Notes to Table 10b

(a) Concentrations are at reference conditions i.e., 273K, 1 atmosphere, 11% oxygen, dry.

(b) Half-hourly emission limits as prescribed in Annex VI of the IED.

Table 10c: Pollutant Emission Rates – Abnormal Releases

Pollutant	ELV [(a) (b)] (mg/Nm^3)	A1 & A2 (g/s)
NOx as NO_2 – Long-term	102.05	4.31
NOx as NO_2 – Short-term	400	16.87
SO_2	200	8.44
CO	100	4.22
PM_{10} – Long-term	5.99	0.253
PM_{10} – Short-term	29.2	1.23
HCl	60	2.53
HF (annual)	1.02	0.0431
HF – Short-term	4	0.169

Notes to Table 10c

(a) Concentrations are at reference conditions i.e., 273K, 1 atmosphere, 11% oxygen, dry.

(b) ELVs as per Article (6) of the IED – when taking account of short-term abnormal operating conditions.

2.12. Meteorological (Met) Data

2.12.1. ADMS has a meteorological pre-processing capability, which calculates the required boundary layer parameters from a variety of data. Meteorological data ("met data") can be utilised in its sequentially analysed form, which estimates the pattern of dispersion through 10° sectors from the source or as raw data.

2.12.2. The Meteorological Office ("Met Office") were contacted to query the location of the nearest appropriate meteorological station ("met station") for the purposes of providing data for an air dispersion modelling assessment utilising ADMS.

2.12.3. The met station option presented by the Met Office was Loftus, which is located approximately 19 km to the east of the Installation. Further to pre-application discussions with the EA, the EA's Air Quality Modelling and Assessment Unit ("AQMAU") commented that Loftus met station is in a hilly environment, compared to the relatively flat topography in the vicinity of the proposed Installation, and therefore might not provide representative met data. Taking this into consideration, a years' worth of site-specific Numerical Weather

Prediction ("NWP") data has also been used in the modelling study to allow for sensitivity testing and comparisons between observed met data and modelled met data.

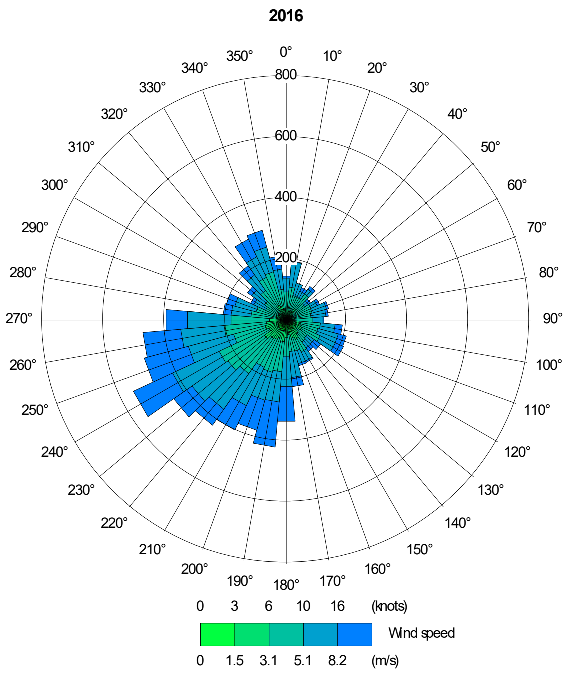
2.12.4. Consequently, the assessment utilises five years (2016 – 2020, inclusive) of observed data from Loftus met station and one year (2020) of modelled (NWP) data (all hourly sequentially analysed in sectors of 10°).

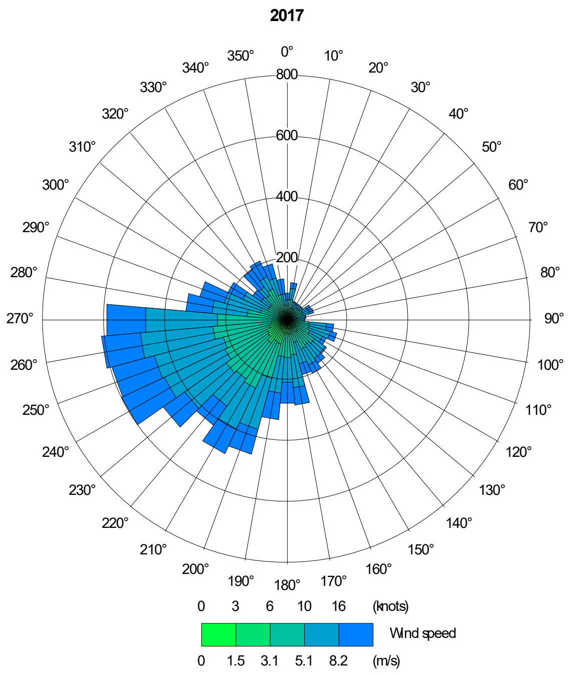
2.12.5. Over the five years (43,848 hours) of meteorological data used from Loftus, ADMS reported that 17 hours were calm, 263 hours contained inadequate data and 394 hours were non-calm met data lines with a wind speed less than the minimum value (0.75 m/s). These represent 0.04%, 0.60% and 0.90% of the data, respectively.

2.12.6. Of the one year (8,784 hours) of 2020 NWP data, ADMS reported that 0 hours were calm, 0 hours contained inadequate data and 211 hours were non-calm met data lines with a wind speed less than the minimum value (0.75 m/s). The non-calm met data lines represent 2.40% of the data, with the remaining 97.60% of the met data used.

2.12.7. Wind roses for the data are presented as Figure 4.

Figure 4: Wind Roses - Met Years 2016-2020 (Loftus) + 2020 NWP





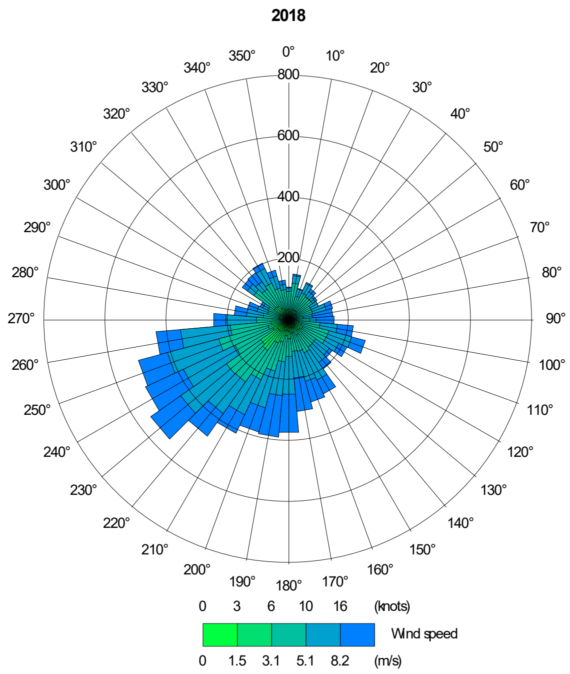
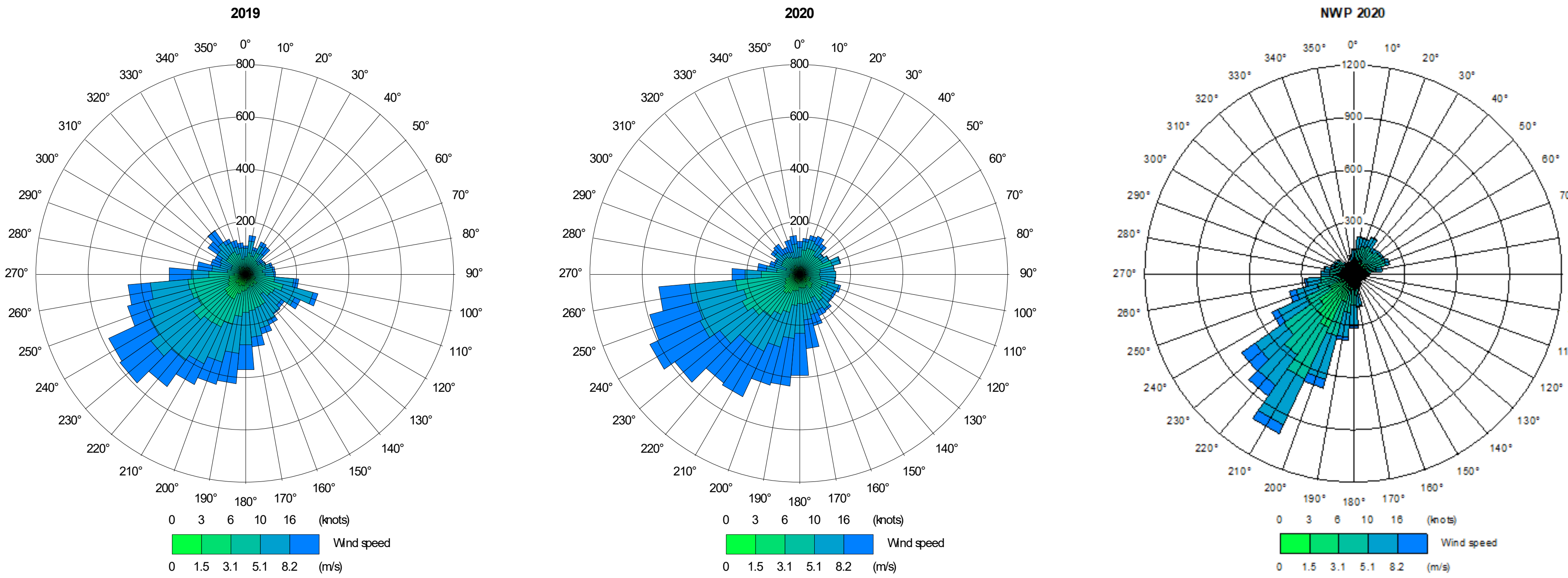


Figure 4: Wind Roses - Met Years 2016-2020 (Loftus) + 2020 NWP (cont.)



2.12.8. It is apparent, from the wind roses shown in Figure 4, that the prevailing winds are predominantly south-westerly for all the met data considered.

2.12.9. The wind rose for the NWP data, compared to the observed data from Loftus recording station, appears to demonstrate a more significant and focused south-westerly wind. Differences in the prevailing wind direction, as well as the other meteorological effects accounted for, will have an impact on dispersion modelling. Consequently, all six years of met data will be used in the modelling assessment and impacts will be based on the worst case met year regardless of observed or NWP.

2.13. Surface Albedo

2.13.1. The surface albedo is the ratio of reflected to incident shortwave solar radiation at the surface of the earth[23]. ADMS allows the user to set this value between 0 and 1. A value of 0.40-0.95 would be considered representative of snow-covered ground where a large proportion of the light is reflected, soils from 0.05-0.40, agricultural crops 0.18-0.25, and grass would be 0.16 – 0.26 depending on length[24]. A value of 0.23 is an average value for non-snow-covered surfaces and is the default value used in the model. This value is considered appropriate for the rural setting of the dispersion site.

2.14. Priestley-Taylor Parameter

2.14.1. The Priestly Taylor parameter is a parameter representing the surface moisture available for evaporation[27]. This parameter must be set between 0 and 3 where 0 would be classed as dry bare earth, 0.45 as dry grassland, 1 as moist grassland and a value of 3 is suggested for a saturated forest surrounded by forest[25]. The value of 1 was considered to be appropriate for the rural setting of the dispersion site.

2.15. Minimum Monin-Obukhov Length

2.15.1. The Monin-Obukhov length provides a measure of the stability of the atmosphere. For example, in urban areas the air is affected by heat generated from buildings and traffic which prevents the atmosphere from becoming stable. In rural areas the atmosphere would be more stable. The minimum Monin-Obukhov length can be set between 1 and 200m. Typical values would be[27]:

- large conurbations >1 million = 100m;
- cities and large towns = 30m;
- mixed urban/industrial = 30m;
- small towns <50,000 = 10m; and
- rural areas = 1m.

[23] ADMS5 User Guide, CERC, V5, Nov 2012
[24] TR Oke, Buondary Layer Climates, 2nd Edition 1987
[25] J P Lhomme, A Theorestivl Basis for the Priestley-Taylor Coefficient, February 1997.

2.15.2. A value of 30m was used as this value is considered appropriate for the combination of residential and industrial land use experienced in the vicinity of the dispersion site.

2.16. Buildings Data

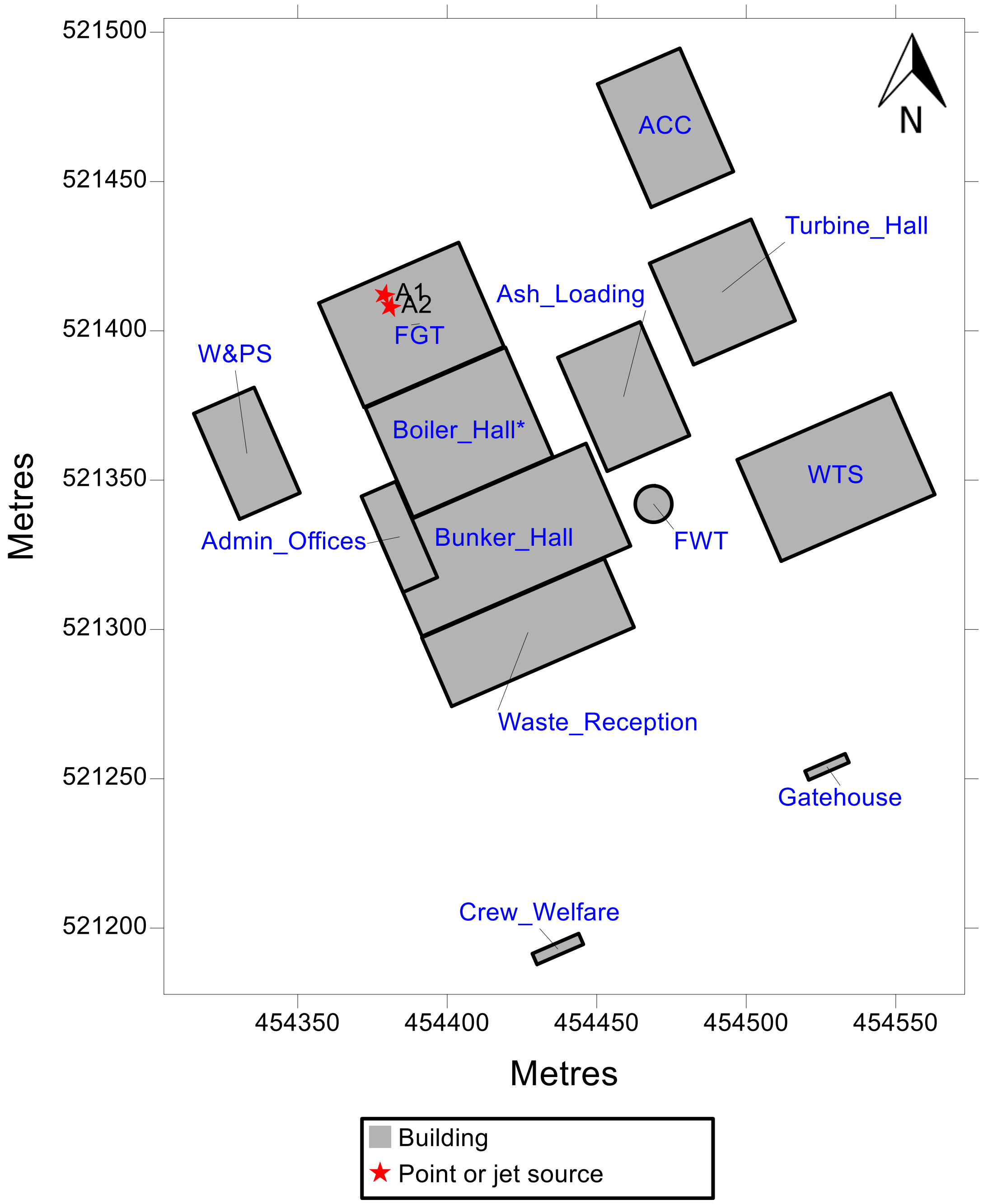
2.16.1. The building parameters utilised for the study are detailed in Table 11 and a plan view is provided as Figure 5.

Table 11: On-Site Building Parameters

Building	X [(a)]	Y [(a)]	Angle (°) [(b)]	Height (m) [(c)]	Length/ Diameter (m) [(c)]	Width (m) [(c)]
Boiler Hall	454403	521366	-23.5°	46.00	39.96	51.00
FGT	454388	521402	-23.5°	32.95	38.02	51.00
Bunker Hall	454419	521330	-23.5°	40.15	37.43	76.00
Waste Reception	454427	521299	-23.5°	21.65	25.10	66.50
Admin Offices	454384	521331	-23.5°	40.15	35.00	12.50
Ash Loading	454459	521378	-23.5°	16.00	41.50	30.00
Turbine Hall	454492	521413	-23.5°	27.00	37.00	37.00
Air Cooled Condensers (ACC)	454473	521468	-23.5°	24.25	45.00	30.00
Waste Transfer Station (WTS)	454530	521351	-23.5°	11.00	37.00	56.00
Workshop and Parts Store (W&PS)	454333	521359	-23.5°	11.00	38.54	22.00
Gatehouse	454527	521254	-23.5°	4.25	3.20	14.65
Crew Welfare	454437	521193	-23.5°	3.98	3.95	16.90
Fire Water Tank (FWT)	454469	521342	n/a	12.05	12.23	
Boiler Hall	454404	521366	-23.5°	46.00	39.96	51.00
FGT	454388	521402	-23.5°	32.95	38.02	51.00
Bunker Hall	454419	521330	-23.5°	40.15	37.43	76.00
Waste Reception	454427	521299	-23.5°	21.65	25.10	66.50
Admin Offices	454384	521331	-23.5°	40.15	35.00	12.50

Notes to Table 11
(a) X(m), Y(m) denote the grid reference coordinates of the centre of the building.
(b) Angle denotes the angle between north and the side designated as length in the ADMS model.
(c) Building dimensions confirmed by Garry Stewart Design Associates Limited (GSDA).

Figure 5: Buildings Layout – Plan View



2.17. Terrain Data – Grid Resolution

2.17.1. ADMS has a terrain pre-processing capability, which calculates the required boundary layer parameters from a variety of data. Three terrain files were created for the purposes of this study by compiling the data from the relevant Ordnance Survey tiles and using an ADMS terrain grid resolution of 64 x 64.

2.17.2. Terrain File One - Firstly, for modelling the pollutant PCs from the Installation at the maximum point of impact and at sensitive receptors up to a distance of 5.5km from A1 and A2 (i.e., all potentially sensitive human receptors specified in Table 1 of Section 2.3., and all ecological sites specified in Table 2 of Section 2.4., bar NYM1 – North York Moors SAC / SPA), terrain data was used for an area 5.5km north by 5km east, south and west. For ease of reference, this terrain file will be referred to as ‘terrain file one’.

2.17.3. Terrain File Two - Secondly, for modelling the relevant pollutant PCs from the Installation on ecological receptor NYM1, terrain data was used for an area 5.5km north, 5.5km east, 9km south and 0.75km west of the proposed emission points A1 and A2. For ease of reference, this terrain file will be referred to as ‘terrain file two’.

2.17.4. Terrain File Three – Thirdly, for modelling the relevant pollutant PCs arising from the simultaneous operation of the Installation and REC (i.e., to account for any cumulative impacts) at both the maximum point of impact and at potentially sensitive human and ecological receptor locations, terrain data was used for an area 5km north, east and west and 11.5km south of the approximate centre point between the Installation and REC (i.e., 454945 (X), 523669 (Y)). For ease of reference, this terrain file will be referred to as ‘terrain file three’.

2.17.5. Figures 6, 7 and 8 show visual representations of terrain files one to three, respectively. The location of the Installation’s stacks are shown by the red circle in Figures 6 and 7. In Figure 8 the locations of the Installation and REC are shown by the annotated red circles. The arrows on each figure represent north, with north off set.

Figure 6: Terrain File One

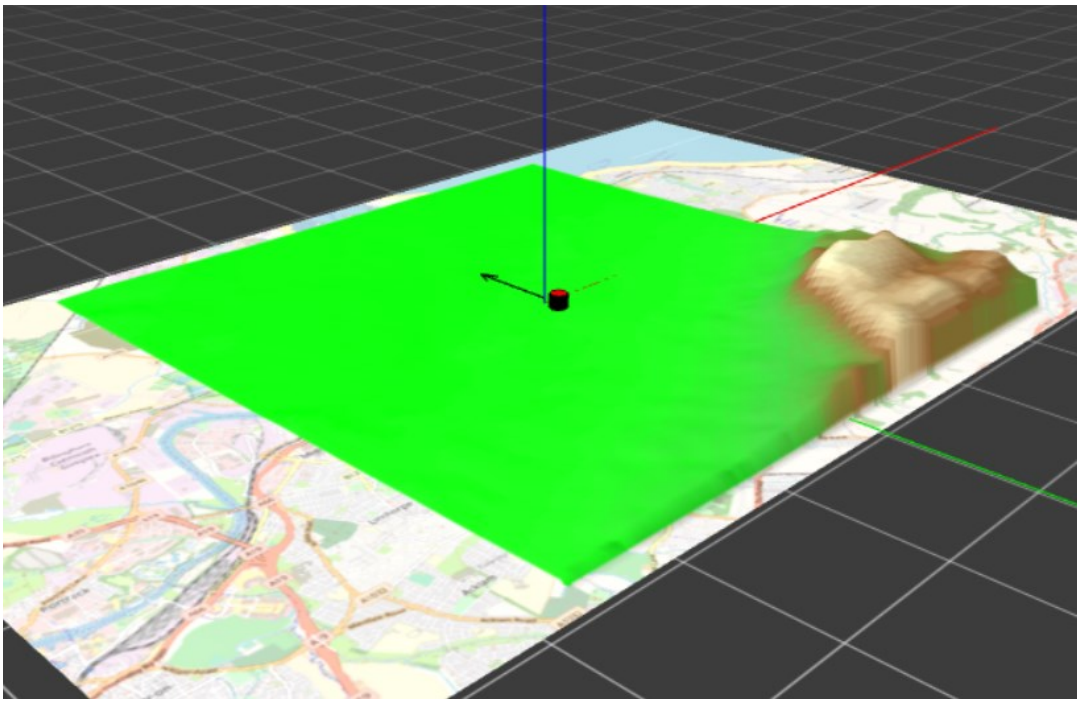


Figure 7: Terrain File Two

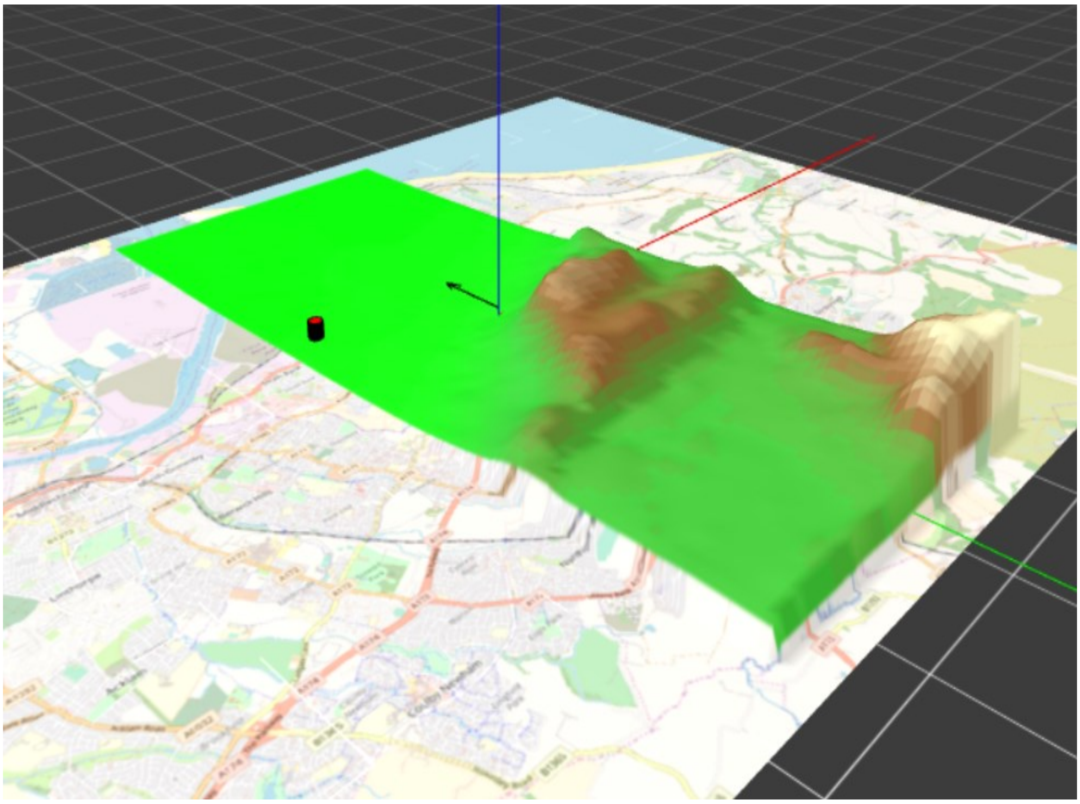
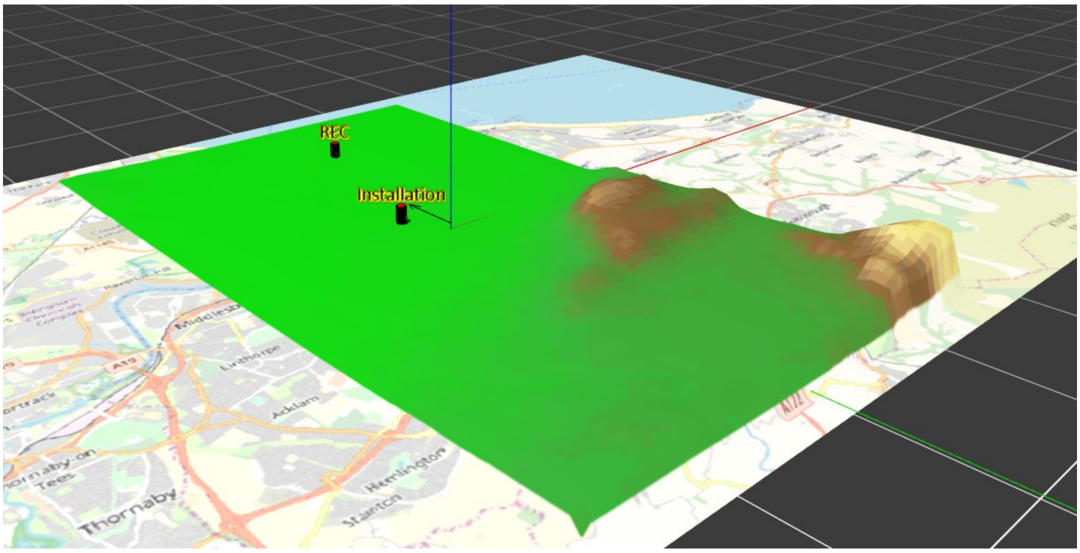


Figure 8: Terrain File Three



2.18. Roughness Length

2.18.1. The surface nature of the terrain is defined in terms of Roughness Length (Z_o). The roughness length is dependent on the type of terrain and its physical properties. The ADMS model gives values to various types of terrain, for example, agricultural areas are classed as 0.2-0.3m, parkland and open suburbia is classed as 0.5m and cities and woodlands are classed as 1.0m.

2.18.2. Based on a review of the terrain, the most appropriate surface roughness was considered to be 0.5m and was used for the 'Dispersion site' (indicative of parkland and open suburbia e.g. a combination of residential and industrial land use is experienced in the vicinity of the dispersion site) and a value of 0.3m was used for the 'met measurement site' (indicative of agricultural crops). The met measurement site is located in a corner of a field in Loftus and is encapsulated by agricultural land. From a review of Google Earth satellite and street view imagery, the higher surface roughness value for agricultural areas (i.e., 'agricultural areas max' (0.3m)) was selected to account for periods in which there is substantial crop growth.

2.18.3. When the model was run with the NWP data the roughness length was again set to 0.5m for both the dispersion site and the met site.

2.19. Model Output Parameters

2.19.1. The ADMS model calculates the likely pollutant GLCs at locations within a definable grid system pre-determined by a user. Output grids may be determined in terms of a Cartesian or Polar coordinate system. For the purposes of this study the Cartesian system was used.

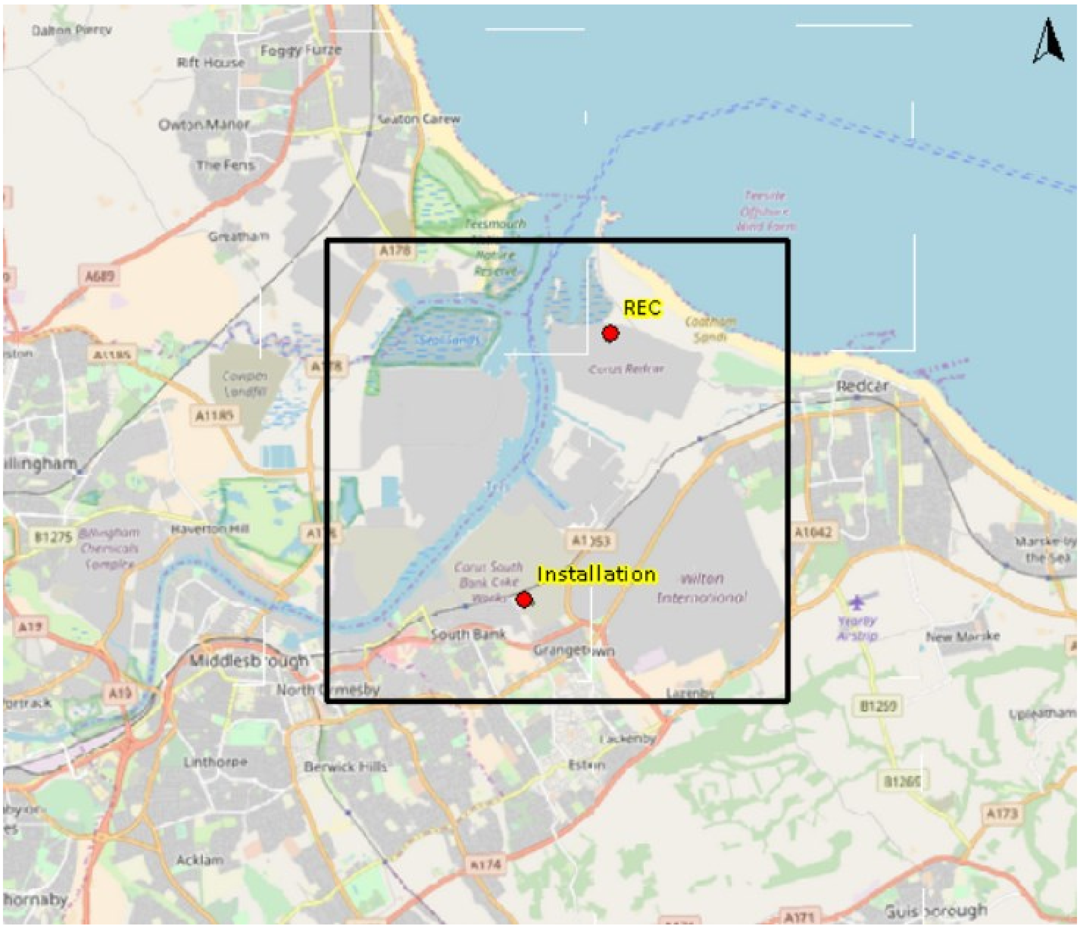
2.19.2. A Cartesian grid is constructed with reference to an initial origin, which is taken to be the bottom left corner of the grid. The lines of the grid are inserted at regular pre-defined increments in both northerly and easterly directions. Pollutant GLCs are calculated at the intersection of these grid lines; they are calculated in this manner primarily to aid in the generation of pollutant contours.

2.19.3. For assessing the maximum point of impact from the Installation, a grid sizing of 4km x 4km was utilised in order to capture values of the predicted pollutant GLCs arising from the model. The grid coordinates were X = 452379 to 456379 and Y = 519410 to 523410, with 101 nodes along each axis i.e., a grid spacing of 40m. The extent of the output grid is outlined in black on Figure 9.

2.19.4. For assessing the maximum point of impact from the cumulative scenario (i.e., the Installation and REC both operating simultaneously), a grid sizing of 8km x 8km was utilised in order to capture values of the predicted pollutant GLCs arising from the model. The grid coordinates were X = 450945 to 458945 and Y = 519669 to 527669, with 201 nodes along each axis i.e., a grid spacing of 40m. The extent of the output grid is outlined in black on Figure 10.

Figure 9: Extent of Output File for Maximum GLC – Installation Only

Figure 10: Extent of Output File for Maximum GLC – Cumulative Impact



2.19.5. For assessing the impact of emissions on human health the grid references of each were included as specified points within the ADMS model. Also, for assessing ecological sites, the grid reference of the ecological sites' boundary closest to the stack location was used.

2.20. Scenarios Modelled

2.20.1. The modelling study assessed the following scenarios:

- emissions from the Installation for all pollutants at the maximum GLC for a range of stack heights. The results of the stack height screening assessment informed the stack height to adopt for the remaining following scenarios;
- emissions from the Installation for all pollutants at the potentially sensitive human receptor locations;
- emissions from the Installation for NO_x, SO_2, NH_3 and HF at the ecological habitat sites;
- modelled deposition rates (acid and nitrogen) at the ecological habitat sites;
- plume visibility from the Installation;
- abnormal emissions from the Installation, as detailed in IED; and
- cumulative impacts of the emissions associated with the Installation and REC operating simultaneously.

2.21. Assessment of Significance of Impact Guidelines – Maximum GLC and Human Receptors

2.21.1. Both the EA online guidance and IAQM[26] guidance has been used for the purposes of significance assessment, and this guidance details the guidelines upon which the assessment of the significance of impact can be established.

2.21.2. In the first instance, the EA online guidance indicates that PCs can be considered insignificant if:

- the long-term PC is <1% of the long-term environmental standard; and
- the short-term PC is <10% of the short-term environmental standard.

2.21.3. As outlined in the EA online guidance, there are no criteria to determine whether:

- PCs are significant; and
- PECs are insignificant or significant.

2.21.4. Consequently, significance will be judged based on the site-specific circumstances and on the EPUK and IAQM methodology as described in Sections 2.21.5 to 2.21.12.

Long-Term Impacts

2.21.5. If the PCs exceed the long-term criteria outlined in the EA online guidance, the potential long-term effects on human receptors from the operation of the two scrubber stacks will be assessed in accordance with the latest guidance produced by EPUK and IAQM in January 2017.

2.21.6. The guidance provides a basis for a consistent approach that could be used by all parties to professionally judge the overall significance of the air quality effects based on the severity of air quality impacts.

2.21.7. The following rationale is used in determining the severity of the air quality impacts at individual human receptors:

- the effects are provided as a percentage of the AQAL;
- the absolute concentrations are also considered in terms of the AQAL and are divided into categories for long-term concentrations. The categories are based on the sensitivity of the individual receptor in terms of harmful potential. The degree of potential to change increases as absolute concentrations are close to or above the AQAL;
- severity of the effect is described as qualitative descriptors; negligible, slight, moderate or substantial by taking into account in combination the harm potential and air quality effect. This means that a small increase at a receptor which is already close to or above the AQAL will have higher severity compared to a relatively large change at a receptor which is significantly below the AQAL, >75% AQAL;
- the effects can be adverse when the air quality concentration increases or beneficial when the concentration decreases as a result of development; and
- the judgement of overall significance of the effects is then based on severity of effects on all the individual receptors considered.

[26] IAQM guidance, January 2017 (Land-Use Planning & Development Control: Planning for Air Quality')

2.21.8. The impact descriptors for individual receptors are presented in Table 12.

Table 12: Impact Descriptors for Individual Receptors – Long-Term Concentrations

Long-term average concentration at receptor in assessment year	% Change in concentration relative to AQAL			
	1	2-5	6-10	>10
≤75% of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
≥ 110% of AQAL	Moderate	Substantial	Substantial	Substantial

Short-Term Impacts

2.21.9. As stated in EPUK / IAQM guidance, January 2017 (Land-Use Planning & Development Control: Planning for Air Quality') in Section 6.36, Page 27: *"For any point source, some consideration must also be given to the impacts resulting from short term, peak concentrations of those pollutants that can affect health through inhalation. The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short-term impact. This is a reasonable value to take and this guidance also adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect. Background concentrations are less important in determining the severity of impact for short term concentrations, not least because the peak concentrations attributable to the source and the background are not additive."*

2.21.10. Short-term concentrations, in the context laid out in the IAQM guidance, are those averaged over periods of an hour or less. These exposures would be regarded as acute and occur when a plume from an elevated source affects airborne concentrations experienced by a receptor over an hour or less.

2.21.11. The IAQM guidance offers the following severity of impact descriptors for peak short-term concentrations from an elevated source:

- 11-20% of the relevant AQAL – the magnitude can be regarded as 'small';
- 21-50% of the relevant AQAL – the magnitude can be regarded as 'medium'; and
- 51% or more of the relevant AQAL – the magnitude can be regarded as 'large'.

2.21.12. It is argued that this approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity.

2.22. Assessment of Significance of Impact Guidelines – Ecological Receptors, Critical Levels and/or Loads

2.22.1. EA Operational Instruction 67_12[27] states that a detailed assessment is required where modelling predicts that the long-term PC is greater than:

- 1% for European sites and SSSIs; or
- 100% for NNR, LNR, LWS and ancient woodlands.

And, the PEC is greater than:

- 70% for European sites and SSSIs; or
- 100% for NNR, LNR, LWS and ancient woodlands.

2.22.2. For short-term emissions, modelling is required at European site and SSSI's where the PC is greater than 10% of the critical level, or 100% for NNR, LNR, LWS and ancient woodland.

2.22.3. Following detailed assessment, if the PEC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no adverse effect for European Sites and SSSI's.

2.22.4. However, for NNR, LNR, LWS or ancient woodland, if the PC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no significant pollution.

2.23. Assessment of Significance Guidelines for Trace Metals

2.23.1. For the Group 3 metals there is an additional guideline indicated in the EA Guidance for Group 3 metals (see below) that states that the environmental standard is unlikely to be exceeded if:

- the long-term and short-term PEC is <100% of the long-term and short-term environmental standard (as appropriate)

(where the short-term PEC is the sum of the short-term PC and twice the long-term pollutant background concentration).

2.23.2. For trace metals, Annex VI of the IED assigns ELVs for three groups. Group 1 comprises cadmium (Cd) and thallium (Tl), Group 2 comprises mercury (Hg) and Group 3 comprises antimony (Sb), arsenic (As), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), lead (Pb), nickel (Ni) and vanadium (V). The ELVs are the total for the combined emissions, and it would not be reasonable to assume that each metal emits at the maximum ELV for the group. In this regard, the EA has provided guidance on the steps required for assessing the impact of such metal emissions, namely Releases from Waste Incinerators[28].

2.23.3. Step 1 of the guidance is to assume that all emissions are at the maximum ELV for the group. For example, all of the Group 3 metals would be assumed to be emitted at a concentration of 0.3mg/Nm^3 (i.e., as per the BAT-AEL).

[27] EA Operational Instruction 67_12 Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation, V2, 27.3.15

[28] Releases from Waste Incinerators, Environment Agency, V4

2.23.4. Where the release is considered potentially significant, Step 2 of the guidance allows the applicant to use the maximum emissions data listed in Appendix A of the guidance to revise predictions and consider each pollutant as a percentage of the Group 3 ELVs.

2.24. NO_x to NO_2 conversion Rates

2.24.1. EA online guidance states that emissions of NO_x should be recorded as NO_2 as follows:

- for the long-term PCs and PECs, assume 100% of the emissions of NO_x convert to NO_2; and
- for the short-term PCs and PECs assume 50% of the emissions of NO_x convert to NO_2.

2.24.2. However, further to detailed discussion with both NRW and the EA on previous studies, a long-term 70% NO to NO_2 conversion rate, and a short-term 35% NO to NO_2 as required by guidance on NO_X and NO_2 Conversion Ratios as referenced in AQTAG06 should be used in all detailed modelling assessments. The conversion rates, as provided in section 2.24.1., should only be used for screening assessments.

3. ASSESSMENT OF AIR QUALITY IMPACTS AT THE MAXIMUM GROUND LEVEL CONCENTRATIONS

3.1. Model Setup

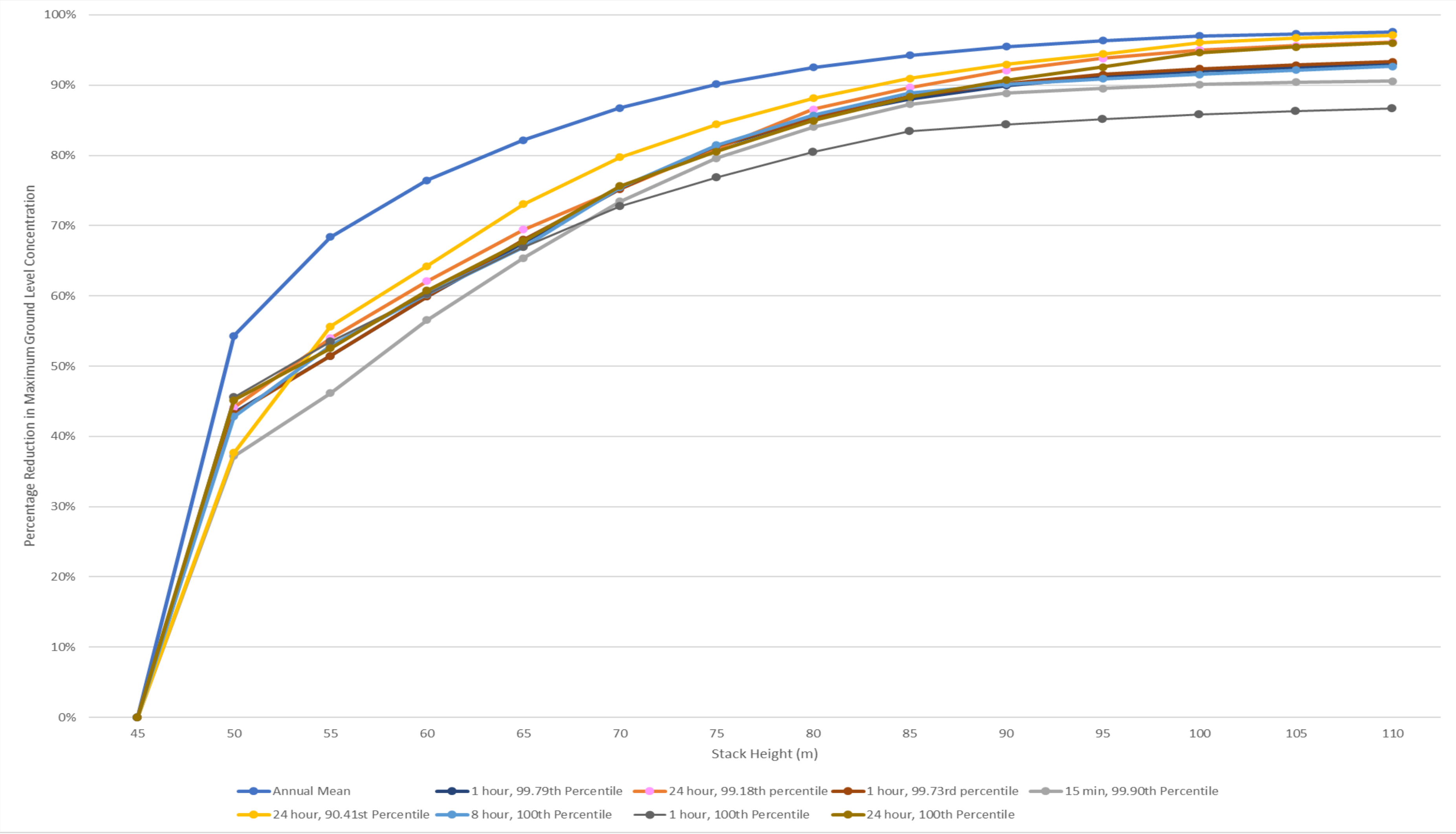
3.1.1. This assessment considered the effect of stack height on all relevant averaging periods required to complete the main modelling assessment. For the screening study, the modelling was undertaken with the following settings:

- buildings effects were included;
- the modelled grid was as specified in Section 2.19.3;
- complex terrain was included (Terrain File One - see Section 2.17);
- emission rates for pollutants were as outlined in Table 10a of Section 2.11.;
- NO_x to NO_2 conversion rates were taken into account (refer to Section 2.24.);
- stack heights from 45m – 110m were considered;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data);
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used;
- only the maximum GLC was considered for the stack height screening.

3.2. Identification of Appropriate Stack Heights

3.2.1. A graph summarising the results of the stack height screening assessment, for the worst case met year for each pollutant and averaging period, is presented as Figure 11.

Figure 11: Effect of Stack Height on Ground Level Concentrations



3.2.2. Figure 11 clearly indicate that increasing the stack heights has the effect of decreasing the modelled maximum ground level concentrations (GLCs), for all of the averaging periods considered. There is a substantial reduction in GLCs up to 70m, (for most percentiles at least a 70% reduction). However, at heights of 85m and greater it is evident that reductions in GLCs, for all averaging periods, start to level off and therefore do not offer much more environmental benefit.

3.2.3. In order to determine the optimum stack heights for the Installation's A1 and A2 emission points, and the impact of the emissions on the environment, all modelled stack heights and pollutants will be assessed for impact at maximum GLC. This will help to further assess the significance of the emissions arising from A1 and A2 in accordance with the criteria (see Section 2.21.)

3.3. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Air Quality Standards

3.3.1. The predicted PCs for each of the pollutants considered in the assessment at the maximum point of impact have been extracted and are presented in Table 13. The data is based on the worst case met data year. It should be noted that the location of the maximum impact may not be in an area where there is a relevant public exposure.

3.3.2. Maximum concentrations are considered potentially significant if the long-term prediction is greater than 1% of the long-term AQS. For short-term predictions, a potentially significant concentration would be greater than 10% of the short-term AQS. In Table 13, any PCs that are above these significance criteria are indicated in bold type.

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
NO_2 (annual mean)	45	2018	**13.28**	40	**33.19%**
	50	NWP 2020	**6.06**		**15.16%**
	55	NWP 2020	**4.20**		**10.49%**
	60	2020	**3.13**		**7.82%**
	65	2020	**2.37**		**5.91%**
	70	2020	**1.76**		**4.40%**
	75	2020	**1.31**		**3.27%**
	80	2020	**0.99**		**2.47%**
	85	2020	**0.77**		**1.91%**
	90	2020	**0.60**		**1.51%**
	95	2020	**0.49**		**1.21%**
	100	NWP 2020	0.39		0.99%
	105	NWP 2020	0.36		0.89%
	110	NWP 2020	0.32		0.81%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
NO_2 (1 hour, 99.79th percentile)	45	2018	**51.87**	200	**25.94%**
	50	2019	**29.40**		**14.70%**
	55	2017	**25.18**		**12.59%**
	60	2018	**20.80**		**10.40%**
	65	2016	16.82		8.41%
	70	2016	12.83		6.42%
	75	2019	9.80		4.90%
	80	2019	7.60		3.80%
	85	2018	6.21		3.11%
	90	2018	5.21		2.61%
	95	2018	4.58		2.29%
	100	2018	4.16		2.08%
	105	2018	3.88		1.94%
	110	2018	3.64		1.82%
SO_2 (24 hour, 99.18th percentile)	45	2018	**32.60**	125	**26.08%**
	50	2016	**18.22**		**14.57%**
	55	2018	**15.01**		**12.00%**
	60	2018	12.36		9.89%
	65	2016	9.96		7.97%
	70	2016	8.09		6.47%
	75	2016	6.20		4.96%
	80	2016	4.38		3.51%
	85	2016	3.36		2.69%
	90	2016	2.58		2.06%
	95	2016	2.02		1.62%
	100	2016	1.63		1.31%
	105	2016	1.42		1.14%
	110	2016	1.26		1.01%
SO_2 (1 hour, (99.73rd percentile)	45	2018	**44.35**	350	**12.67%**
	50	2017	25.19		7.20%
	55	2017	21.53		6.15%
	60	2017	17.78		5.08%
	65	2018	14.19		4.05%
	70	2019	11.00		3.14%
	75	2019	8.29		2.37%
	80	2019	6.51		1.86%
	85	2018	5.14		1.47%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
SO_2 (1 hour, (99.73rd percentile)	90	2018	4.36	350	1.25%
	95	2018	3.76		1.07%
	100	2018	3.39		0.97%
	105	2018	3.17		0.91%
	110	2018	2.96		0.85%
SO_2 (15min, 99.90th Percentile)	45	2018	**45.42**	266	**17.07%**
	50	2017	**28.53**		**10.72%**
	55	2017	24.45		9.19%
	60	2017	19.74		7.42%
	65	2019	15.72		5.91%
	70	2016	12.07		4.54%
	75	2018	9.27		3.49%
	80	2018	7.25		2.72%
	85	2018	5.79		2.18%
	90	2018	5.06		1.90%
	95	2018	4.75		1.79%
	100	NWP 2020	4.50		1.69%
	105	NWP 2020	4.35		1.64%
	110	NWP 2020	4.27		1.61%
PM_{10} (annual mean)	45	2018	**0.95**	40	**2.37%**
	50	NWP 2020	**0.43**		**1.08%**
	55	NWP 2020	0.30		0.75%
	60	2020	0.22		0.56%
	65	2020	0.17		0.42%
	70	2020	0.13		0.31%
	75	2020	0.09		0.23%
	80	2020	0.07		0.18%
	85	2020	0.05		0.14%
	90	2020	0.04		0.11%
	95	2020	0.03		0.09%
	100	NWP 2020	0.03		0.07%
	105	NWP 2020	0.03		0.06%
	110	NWP 2020	0.02		0.06%
PM_{10} (24 hour, 90.41st Percentile)	45	2020	2.50	50	4.99%
	50	NWP 2020	1.55		3.11%
	55	2020	1.11		2.21%
	60	2020	0.89		1.79%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
PM_{10} (24 hour, 90.41st Percentile)	65	2020	0.67	50	1.34%
	70	2020	0.51		1.01%
	75	2020	0.39		0.78%
	80	2020	0.30		0.59%
	85	2020	0.23		0.45%
	90	2020	0.18		0.35%
	95	2020	0.14		0.28%
	100	2020	0.10		0.20%
	105	2020	0.08		0.16%
	110	NWP 2020	0.07		0.14%
$PM_{2.5}$ (annual mean)	45	2018	**0.95**	20	**4.74%**
	50	NWP 2020	**0.43**		**2.17%**
	55	NWP 2020	**0.30**		**1.50%**
	60	2020	**0.22**		**1.12%**
	65	2020	0.17		0.85%
	70	2020	0.13		0.63%
	75	2020	0.09		0.47%
	80	2020	0.07		0.35%
	85	2020	0.05		0.27%
	90	2020	0.04		0.22%
	95	2020	0.03		0.17%
	100	NWP 2020	0.03		0.14%
	105	NWP 2020	0.03		0.13%
	110	NWP 2020	0.02		0.12%
CO (8 hour, 100th percentile)	45	2018	72.61	10,000	0.73%
	50	2016	41.52		0.42%
	55	2016	34.22		0.34%
	60	2016	28.87		0.29%
	65	2016	23.98		0.24%
	70	2016	17.82		0.18%
	75	2016	13.46		0.13%
	80	2019	10.37		0.10%
	85	2017	8.10		0.08%
	90	2018	7.16		0.07%
	95	2018	6.62		0.07%
	100	2018	6.15		0.06%
	105	2018	5.71		0.06%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
CO (8 hour, 100th percentile)	110	2018	5.33	10,000	0.05%
VOC (annual mean)	45	2018	**1.90**	5	**37.93%**
	50	NWP 2020	**0.866**		**17.32%**
	55	NWP 2020	**0.599**		**11.99%**
	60	2020	**0.447**		**8.93%**
	65	2020	**0.338**		**6.76%**
	70	2020	**0.251**		**5.02%**
	75	2020	**0.187**		**3.73%**
	80	2020	**0.141**		**2.83%**
	85	2020	**0.109**		**2.19%**
	90	2020	**0.0861**		**1.72%**
	95	2020	**0.0694**		**1.39%**
	100	NWP 2020	**0.0564**		**1.13%**
	105	NWP 2020	**0.0510**		**1.02%**
	110	NWP 2020	0.0462		0.92%
NH_3 (annual mean)	45	2018	**1.90**	180	**1.05%**
	50	NWP 2020	0.866		0.48%
	55	NWP 2020	0.599		0.33%
	60	2020	0.447		0.25%
	65	2020	0.338		0.19%
	70	2020	0.251		0.14%
	75	2020	0.187		0.10%
	80	2020	0.141		0.08%
	85	2020	0.109		0.06%
	90	2020	0.0861		0.05%
	95	2020	0.0694		0.04%
	100	NWP 2020	0.0564		0.03%
	105	NWP 2020	0.0510		0.03%
	110	NWP 2020	0.0462		0.03%
NH_3 (1-hour)	45	2018	16.39	2,500	0.66%
	50	2018	8.93		0.36%
	55	2018	7.63		0.31%
	60	NWP 2020	6.52		0.26%
	65	NWP 2020	5.41		0.22%
	70	2020	4.47		0.18%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
NH_3 (1-hour)	75	2020	3.80	2,500	0.15%
	80	2020	3.20		0.13%
	85	NWP 2020	2.72		0.11%
	90	2018	2.56		0.10%
	95	2018	2.43		0.10%
	100	2019	2.32		0.09%
	105	2018	2.24		0.09%
	110	NWP 2020	2.19		0.09%
HCl (1-hour)	45	2018	9.83	750	1.31%
	50	2018	5.35		0.71%
	55	2018	4.57		0.61%
	60	NWP 2020	3.91		0.52%
	65	NWP 2020	3.25		0.43%
	70	2020	2.68		0.36%
	75	2020	2.28		0.30%
	80	2020	1.92		0.26%
	85	NWP 2020	1.63		0.22%
	90	2018	1.53		0.20%
	95	2018	1.46		0.19%
	100	2019	1.39		0.19%
	105	2018	1.34		0.18%
	110	NWP 2020	1.31		0.17%
HF (annual mean)	45	2018	**0.190**	16	**1.19%**
	50	NWP 2020	0.0866		0.54%
	55	NWP 2020	0.0599		0.37%
	60	2020	0.0447		0.28%
	65	2020	0.0338		0.21%
	70	2020	0.0251		0.16%
	75	2020	0.0187		0.12%
	80	2020	0.0141		0.09%
	85	2020	0.0109		0.07%
	90	2020	0.00861		0.05%
	95	2020	0.00694		0.04%
	100	NWP 2020	0.00564		0.04%
	105	NWP 2020	0.00510		0.03%
	110	NWP 2020	0.00462		0.03%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m^3)	AQS (µg/m^3)	PC as a % of AQS
HF (1-hour)	45	2018	1.64	160	1.02%
	50	2018	0.89		0.56%
	55	2018	0.76		0.48%
	60	NWP 2020	0.65		0.41%
	65	NWP 2020	0.54		0.34%
	70	2020	0.45		0.28%
	75	2020	0.38		0.24%
	80	2020	0.32		0.20%
	85	NWP 2020	0.27		0.17%
	90	2018	0.26		0.16%
	95	2018	0.24		0.15%
	100	2019	0.23		0.15%
	105	2018	0.22		0.14%
	110	NWP 2020	0.22		0.14%
Sb (annual mean)	45	2018	**0.057**	5	**1.14%**
	50	NWP 2020	0.026		0.52%
	55	NWP 2020	0.018		0.36%
	60	2020	0.013		0.27%
	65	2020	0.010		0.20%
	70	2020	0.0076		0.15%
	75	2020	0.0056		0.11%
	80	2020	0.0043		0.09%
	85	2020	0.0033		0.07%
	90	2020	0.0026		0.05%
	95	2020	0.0021		0.04%
	100	NWP 2020	0.0017		0.03%
	105	NWP 2020	0.0015		0.03%
	110	NWP 2020	0.0014		0.03%
Sb (1-hour)	45	2018	0.493	150	0.33%
	50	2018	0.269		0.18%
	55	2018	0.230		0.15%
	60	NWP 2020	0.196		0.13%
	65	NWP 2020	0.163		0.11%
	70	2020	0.135		0.09%
	75	2020	0.114		0.08%
	80	2020	0.0964		0.06%
	85	NWP 2020	0.0819		0.05%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Sb (1-hour)	90	2018	0.0769	150	0.05%
	95	2018	0.0731		0.05%
	100	2019	0.0699		0.05%
	105	2018	0.0674		0.04%
	110	NWP 2020	0.0659		0.04%
As (annual mean)	45	2018	**0.0571**	0.003	**1902.53%**
	50	NWP 2020	**0.0261**		**868.93%**
	55	NWP 2020	**0.0180**		**601.20%**
	60	2020	**0.0134**		**448.00%**
	65	2020	**0.0102**		**339.07%**
	70	2020	**0.00756**		**251.97%**
	75	2020	**0.00562**		**187.23%**
	80	2020	**0.00425**		**141.78%**
	85	2020	**0.00329**		**109.69%**
	90	2020	**0.00259**		**86.35%**
	95	2020	**0.00209**		**69.61%**
	100	NWP 2020	**0.00170**		**56.56%**
	105	NWP 2020	**0.00153**		**51.14%**
	110	NWP 2020	**0.00139**		**46.33%**
Cd (annual mean)	45	2018	**0.00379**	0.005	**75.86%**
	50	NWP 2020	**0.00173**		**34.65%**
	55	NWP 2020	**0.00120**		**23.97%**
	60	2020	**0.000893**		**17.86%**
	65	2020	**0.000676**		**13.52%**
	70	2020	**0.000502**		**10.05%**
	75	2020	0.000373		7.47%
	80	2020	0.000283		5.65%
	85	2020	0.000219		4.37%
	90	2020	0.000172		3.44%
	95	2020	0.000139		2.78%
	100	NWP 2020	0.000113		2.26%
	105	NWP 2020	0.000102		2.04%
	110	NWP 2020	0.0000924		1.85%
Cr (annual mean)	45	2018	**0.0571**	5	**1.14%**
	50	NWP 2020	0.0261		0.52%
	55	NWP 2020	0.0180		0.36%
	60	2020	0.0134		0.27%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Cr (annual mean)	65	2020	0.0102	5	0.20%
	70	2020	0.00756		0.15%
	75	2020	0.00562		0.11%
	80	2020	0.00425		0.09%
	85	2020	0.00329		0.07%
	90	2020	0.00259		0.05%
	95	2020	0.00209		0.04%
	100	NWP 2020	0.00170		0.03%
	105	NWP 2020	0.00153		0.03%
	110	NWP 2020	0.00139		0.03%
Cr (1-hour)	45	2018	0.493	150	0.33%
	50	2018	0.269		0.18%
	55	2018	0.230		0.15%
	60	NWP 2020	0.196		0.13%
	65	NWP 2020	0.163		0.11%
	70	2020	0.135		0.09%
	75	2020	0.114		0.08%
	80	2020	0.0964		0.06%
	85	NWP 2020	0.0819		0.05%
	90	2018	0.0769		0.05%
	95	2018	0.0731		0.05%
	100	2019	0.0699		0.05%
	105	2018	0.0674		0.04%
	110	NWP 2020	0.0659		0.04%
Cr(VI) (annual mean)	45	2018	**0.0571**	0.0002	**28538.00%**
	50	NWP 2020	**0.0261**		**13034.00%**
	55	NWP 2020	**0.0180**		**9018.00%**
	60	2020	**0.0134**		**6720.00%**
	65	2020	**0.0102**		**5086.00%**
	70	2020	**0.00756**		**3779.60%**
	75	2020	**0.00562**		**2808.50%**
	80	2020	**0.00425**		**2126.65%**
	85	2020	**0.00329**		**1645.30%**
	90	2020	**0.00259**		**1295.20%**
	95	2020	**0.00209**		**1044.20%**
	100	NWP 2020	**0.00170**		**848.35%**
	105	NWP 2020	**0.00153**		**767.05%**

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Cr(VI) (annual mean)	110	NWP 2020	**0.00139**	0.0002	**695.00%**
Co (annual mean)	45	2018	**0.0571**	0.2	**28.54%**
	50	NWP 2020	**0.0261**		**13.03%**
	55	NWP 2020	**0.0180**		**9.02%**
	60	2020	**0.0134**		**6.72%**
	65	2020	**0.0102**		**5.09%**
	70	2020	**0.00756**		**3.78%**
	75	2020	**0.00562**		**2.81%**
	80	2020	**0.00425**		**2.13%**
	85	2020	**0.00329**		**1.65%**
	90	2020	**0.00259**		**1.30%**
	95	2020	**0.00209**		**1.04%**
	100	NWP 2020	0.00170		0.85%
	105	NWP 2020	0.00153		0.77%
	110	NWP 2020	0.00139		0.70%
Co (1-hour)	45	2018	0.493	6	8.22%
	50	2018	0.269		4.48%
	55	2018	0.230		3.83%
	60	NWP 2020	0.196		3.27%
	65	NWP 2020	0.163		2.72%
	70	2020	0.135		2.24%
	75	2020	0.114		1.90%
	80	2020	0.0964		1.61%
	85	NWP 2020	0.0819		1.37%
	90	2018	0.0769		1.28%
	95	2018	0.0731		1.22%
	100	2019	0.0699		1.17%
	105	2018	0.0674		1.12%
	110	NWP 2020	0.0659		1.10%
Cu (annual mean)	45	2018	0.0571	10	0.57%
	50	NWP 2020	0.0261		0.26%
	55	NWP 2020	0.0180		0.18%
	60	2020	0.0134		0.13%
	65	2020	0.0102		0.10%
	70	2020	0.00756		0.08%
	75	2020	0.00562		0.06%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Cu (annual mean)	80	2020	0.00425	10	0.04%
	85	2020	0.00329		0.03%
	90	2020	0.00259		0.03%
	95	2020	0.00209		0.02%
	100	NWP 2020	0.00170		0.02%
	105	NWP 2020	0.00153		0.02%
	110	NWP 2020	0.00139		0.01%
Cu (1-hour)	45	2018	0.493	200	0.25%
	50	2018	0.269		0.13%
	55	2018	0.230		0.11%
	60	NWP 2020	0.196		0.10%
	65	NWP 2020	0.163		0.08%
	70	2020	0.135		0.07%
	75	2020	0.114		0.06%
	80	2020	0.0964		0.05%
	85	NWP 2020	0.0819		0.04%
	90	2018	0.0769		0.04%
	95	2018	0.0731		0.04%
	100	2019	0.0699		0.03%
	105	2018	0.0674		0.03%
	110	NWP 2020	0.0659		0.03%
Pb (annual mean)	45	2018	**0.0571**	0.25	**22.83%**
	50	NWP 2020	**0.0261**		**10.43%**
	55	NWP 2020	**0.0180**		**7.21%**
	60	2020	**0.0134**		**5.38%**
	65	2020	**0.0102**		**4.07%**
	70	2020	**0.00756**		**3.02%**
	75	2020	**0.00562**		**2.25%**
	80	2020	**0.00425**		**1.70%**
	85	2020	**0.00329**		**1.32%**
	90	2020	**0.00259**		**1.04%**
	95	2020	0.00209		0.84%
	100	NWP 2020	0.00170		0.68%
	105	NWP 2020	0.00153		0.61%
	110	NWP 2020	0.00139		0.56%
Mn (annual mean)	45	2018	**0.0571**	1	**5.71%**
	50	NWP 2020	**0.0261**		**2.61%**

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Mn (annual mean)	55	NWP 2020	**0.0180**	1	**1.80%**
	60	2020	**0.0134**		**1.34%**
	65	2020	**0.0102**		**1.02%**
	70	2020	0.00756		0.76%
	75	2020	0.00562		0.56%
	80	2020	0.00425		0.43%
	85	2020	0.00329		0.33%
	90	2020	0.00259		0.26%
	95	2020	0.00209		0.21%
	100	NWP 2020	0.00170		0.17%
	105	NWP 2020	0.00153		0.15%
	110	NWP 2020	0.00139		0.14%
Mn (1-hour)	45	2018	0.493	1,500	0.03%
	50	2018	0.269		0.02%
	55	2018	0.230		0.02%
	60	NWP 2020	0.196		0.01%
	65	NWP 2020	0.163		0.01%
	70	2020	0.135		0.01%
	75	2020	0.114		0.01%
	80	2020	0.0964		0.01%
	85	NWP 2020	0.0819		0.01%
	90	2018	0.0769		0.01%
	95	2018	0.0731		0.005%
	100	2019	0.0699		0.005%
	105	2018	0.0674		0.004%
	110	NWP 2020	0.0659		0.004%
Hg (annual mean)	45	2018	**0.00379**	0.25	**1.52%**
	50	NWP 2020	0.00173		0.69%
	55	NWP 2020	0.00120		0.48%
	60	2020	0.000893		0.36%
	65	2020	0.000676		0.27%
	70	2020	0.000502		0.20%
	75	2020	0.000373		0.15%
	80	2020	0.000283		0.11%
	85	2020	0.000219		0.09%
	90	2020	0.000172		0.07%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Hg (annual mean)	95	2020	0.000139	0.25	0.06%
	100	NWP 2020	0.000113		0.05%
	105	NWP 2020	0.000102		0.04%
	110	NWP 2020	0.0000924		0.04%
Hg (1-hour)	45	2018	0.0328	7.5	0.44%
	50	2018	0.0179		0.24%
	55	2018	0.0153		0.20%
	60	NWP 2020	0.0130		0.17%
	65	NWP 2020	0.0108		0.14%
	70	2020	0.00894		0.12%
	75	2020	0.00759		0.10%
	80	2020	0.00641		0.09%
	85	NWP 2020	0.00544		0.07%
	90	2018	0.00511		0.07%
	95	2018	0.00486		0.06%
	100	2019	0.00465		0.06%
	105	2018	0.00448		0.06%
	110	NWP 2020	0.00438		0.06%
Ni (annual mean)	45	2018	0.0571	0.02	**285.38%**
	50	NWP 2020	0.0261		**130.34%**
	55	NWP 2020	0.0180		**90.18%**
	60	2020	0.0134		**67.20%**
	65	2020	0.0102		**50.86%**
	70	2020	0.00756		**37.80%**
	75	2020	0.00562		**28.09%**
	80	2020	0.00425		**21.27%**
	85	2020	0.00329		**16.45%**
	90	2020	0.00259		**12.95%**
	95	2020	0.00209		**10.44%**
	100	NWP 2020	0.00170		**8.48%**
	105	NWP 2020	0.00153		**7.67%**
	110	NWP 2020	0.00139		**6.95%**
Tl (annual mean)	45	2018	0.00379	1	0.38%
	50	NWP 2020	0.00173		0.17%
	55	NWP 2020	0.00120		0.12%
	60	2020	0.000893		0.09%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Tl (annual mean)	65	2020	0.000676	1	0.07%
	70	2020	0.000502		0.05%
	75	2020	0.000373		0.04%
	80	2020	0.000283		0.03%
	85	2020	0.000219		0.02%
	90	2020	0.000172		0.02%
	95	2020	0.000139		0.01%
	100	NWP 2020	0.000113		0.01%
	105	NWP 2020	0.000102		0.01%
	110	NWP 2020	0.0000924		0.01%
Tl (1-hour)	45	2018	0.0328	30	0.11%
	50	2018	0.0179		0.06%
	55	2018	0.0153		0.05%
	60	NWP 2020	0.0130		0.04%
	65	NWP 2020	0.0108		0.04%
	70	2020	0.00894		0.03%
	75	2020	0.00759		0.03%
	80	2020	0.00641		0.02%
	85	NWP 2020	0.00544		0.02%
	90	2018	0.00511		0.02%
	95	2018	0.00486		0.02%
	100	2019	0.00465		0.02%
	105	2018	0.00448		0.01%
	110	NWP 2020	0.00438		0.01%
V (annual mean)	45	2018	0.0571	5	1.14%
	50	NWP 2020	0.0261		0.52%
	55	NWP 2020	0.0180		0.36%
	60	2020	0.0134		0.27%
	65	2020	0.0102		0.20%
	70	2020	0.00756		0.15%
	75	2020	0.00562		0.11%
	80	2020	0.00425		0.09%
	85	2020	0.00329		0.07%
	90	2020	0.00259		0.05%
	95	2020	0.00209		0.04%
	100	NWP 2020	0.00170		0.03%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
V (annual mean)	105	NWP 2020	0.00153	5	0.03%
	110	NWP 2020	0.00139		0.03%
V (24-hour)	45	2018	0.366	1	**36.60%**
	50	2017	0.201		**20.07%**
	55	2017	0.174		**17.36%**
	60	2016	0.144		**14.36%**
	65	2016	0.118		**11.78%**
	70	2016	0.0891		8.91%
	75	2016	0.0712		7.12%
	80	2016	0.0552		5.52%
	85	2016	0.0428		4.28%
	90	2016	0.0340		3.40%
	95	2016	0.0273		2.73%
	100	2018	0.0197		1.97%
	105	2018	0.0167		1.67%
	110	2016	0.0147		1.47%
PAH (as B[a]P) (annual mean)	45	2018	**0.000190**	0.00025	**75.86%**
	50	NWP 2020	**0.0000866**		**34.65%**
	55	NWP 2020	**0.0000599**		**23.97%**
	60	2020	**0.0000447**		**17.86%**
	65	2020	**0.0000338**		**13.52%**
	70	2020	**0.0000251**		**10.05%**
	75	2020	**0.0000187**		**7.47%**
	80	2020	**0.0000141**		**5.65%**
	85	2020	**0.0000109**		**4.37%**
	90	2020	**0.00000861**		**3.44%**
	95	2020	**0.00000694**		**2.78%**
	100	NWP 2020	**0.00000564**		**2.26%**
	105	NWP 2020	**0.00000510**		**2.04%**
	110	NWP 2020	**0.00000462**		**1.85%**
PCBs (annual mean)	45	2018	0.0000000151	0.2	0.00001%
	50	NWP 2020	0.00000000692		0.000003%
	55	NWP 2020	0.00000000479		0.000002%
	60	2020	0.00000000357		0.000002%
	65	2020	0.00000000270		0.000001%
	70	2020	0.00000000201		0.000001%

Table 13: Comparison of Predicted Maximum Ground Level PCs with AQSs (cont.)

Pollutant	Stack Height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
PCBs (annual mean)	75	2020	0.00000000149	0.2	0.000001%
	80	2020	0.00000000113		0.000001%
	85	2020	0.000000000873		0.0000004%
	90	2020	0.000000000687		0.0000003%
	95	2020	0.000000000554		0.0000003%
	100	NWP 2020	0.000000000450		0.0000002%
	105	NWP 2020	0.000000000407		0.0000002%
	110	NWP 2020	0.000000000369		0.0000002%
PCBs (1-hour)	45	2018	0.000000131	6	0.000002%
	50	2018	0.0000000713		0.000001%
	55	2018	0.0000000609		0.000001%
	60	NWP 2020	0.0000000520		0.000001%
	65	NWP 2020	0.0000000432		0.000001%
	70	2020	0.0000000357		0.000001%
	75	2020	0.0000000303		0.000001%
	80	2020	0.0000000256		0.0000004%
	85	NWP 2020	0.0000000217		0.0000004%
	90	2018	0.0000000204		0.0000003%
	95	2018	0.0000000194		0.0000003%
	100	2019	0.0000000186		0.0000003%
	105	2018	0.0000000179		0.0000003%
	110	NWP 2020	0.0000000175		0.0000003%
Dioxins and Furans	45	2018	0.00000000760	No Standard Applies	
	50	NWP 2020	0.00000000347		
	55	NWP 2020	0.00000000240		
	60	2020	0.00000000179		
	65	2020	0.00000000135		
	70	2020	0.00000000101		
	75	2020	0.000000000747		
	80	2020	0.000000000566		
	85	2020	0.000000000438		
	90	2020	0.000000000345		
	95	2020	0.000000000278		
	100	NWP 2020	0.000000000226		
	105	NWP 2020	0.000000000204		
	110	NWP 2020	0.000000000185		

3.3.3. It can be seen from the data in Table 13, that the impact of the Installation varies depending on the pollutant considered. However, the stack height screening study demonstrated that there is significant environmental benefit of stack heights which are 85m or higher (see Section 3.2.1). Therefore, for stack heights of 85m and above, the potentially significant impacts are for long-term (annual):

- NO_2,
- VOC (as benzene),
- As,
- Cr(VI),
- Co,
- Pb,
- Ni, and
- PAH (as B[a]P)

3.3.4. It is important to note that the metals, at this step of the assessment, have each been modelled at their respective ELVs (see Section 2.11. of this report).

3.3.5. However, it would not be reasonable to assume that each Group 3 metal emits at the maximum ELV for the group. In this regard, the EA has provided guidance on the steps required for assessing the impact of metals emissions (see Section 2.23. of this report). If any of the Group 3 metals exceed 1% of a long-term standard, then the PEC should be compared against the AQS. If the PEC is greater than 100% of the AQS then case specific screening is required. Consequently, background concentrations for As, Cr(VI), Co, Pb and Ni are required.

3.4. Background Air Concentrations of Group 3 Metals

3.4.1. Monitoring of trace elements has been undertaken by DEFRA since 1976. Currently, monitoring of twelve metals is carried out at locations throughout the UK, predominantly in urban locations. In addition, concentrations of As and Ni are monitored at a further ten rural locations.

3.4.2. The closest location to the Installation is the urban industrial site at Scunthorpe Low Santon (492936 (X), 411943 (Y)) approximately 116km to the south-southeast of the Installation. Although this is some distance from the site, it is classed as an urban industrial monitoring site, and therefore is considered to be appropriate to be used in the assessment.

3.4.3. For CrVI, it has been assumed that the background concentration is 20% of the total Cr concentration (as indicated in the EPAQS report *Guidelines for metals and metalloids in ambient air for the protection of human health*, May 2009).

3.4.4. Background concentrations for 2019 are provided in Table 14.

Table 14: Annual Mean Trace Metal Concentrations

Metal	Annual Mean Concentration ($\mu g/m^3$)
Arsenic (As)	0.000788
Total Chromium (Cr)	0.00374
Hexavalent Chromium (Cr VI)	0.000749
Cobalt (Co)	0.000177
Lead (Pb)	0.0154
Nickel (Ni)	0.00124

Notes to Table 14

(a) Cr VI assumed to be 20% of total Cr

3.5. Step 1 and 2 Screening of Group 3 Metals

3.5.1. Using the background concentrations in Table 14, PECs for the potentially significant Group 3 metals are provided in Table 15. Any PECs greater than 100% of the AQS are highlighted in bold.

Table 15: PECs of Group 3 Metals – Step 1 Screening

Pollutant	Stack height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS
As (annual mean)	85	2020	**0.00329**	0.003	**109.69%**	0.000788	**0.00408**	**136%**
	90	2020	**0.00259**		**86.35%**		**0.00338**	**113%**
	95	2020	**0.00209**		**69.61%**		0.00288	96%
	100	NWP 2020	**0.00170**		**56.56%**		0.00248	83%
	105	NWP 2020	**0.00153**		**51.14%**		0.00232	77%
	110	NWP 2020	**0.00139**		**46.33%**		0.00218	73%
Cr(VI) (annual mean)	85	2020	**0.00329**	0.0002	**1645.30%**	0.000749	**0.00404**	**2020%**
	90	2020	**0.00259**		**1295.20%**		**0.00334**	**1669%**
	95	2020	**0.00209**		**1044.20%**		**0.00284**	**1418%**
	100	NWP 2020	**0.00170**		**848.35%**		**0.00245**	**1223%**
	105	NWP 2020	**0.00153**		**767.05%**		**0.00228**	**1141%**
	110	NWP 2020	**0.00139**		**695.00%**		**0.00214**	**1069%**
Co (annual mean)	85	2020	**0.00329**	0.2	**1.65%**	0.000177	0.00347	1.7%
	90	2020	**0.00259**		**1.30%**		0.00277	1.4%
	95	2020	**0.00209**		**1.04%**		0.00227	1.1%
	100	NWP 2020	0.00170		0.85%		0.00187	0.9%
	105	NWP 2020	0.00153		0.77%		0.00171	0.9%
	110	NWP 2020	0.00139		0.70%		0.00157	0.8%

Table 15: PECs of Group 3 Metals – Step 1 Screening (cont.)

Pollutant	Stack height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS
Pb (annual mean)	85	2020	**0.00329**	0.25	**1.32%**	0.0154	0.0186	7.5%
	90	2020	**0.00259**		**1.04%**		0.0179	7.2%
	95	2020	0.00209		0.84%		0.0174	7.0%
	100	NWP 2020	0.00170		0.68%		0.0170	6.8%
	105	NWP 2020	0.00153		0.61%		0.0169	6.8%
	110	NWP 2020	0.00139		0.56%		0.0167	6.7%
Ni (annual mean)	85	2020	**0.00329**	0.02	**16.45%**	0.00124	0.00453	23%
	90	2020	**0.00259**		**12.95%**		0.00383	19%
	95	2020	**0.00209**		**10.44%**		0.00332	17%
	100	NWP 2020	0.00170		**8.48%**		0.00293	15%
	105	NWP 2020	0.00153		**7.67%**		0.00277	14%
	110	NWP 2020	0.00139		**6.95%**		0.00263	13%

3.5.2. The data in Table 15 indicates that, although for the majority of pollutants the PECs can be screened out, further screening is required for long-term As at stack heights of 85m and 90m and for Cr(VI) at all stack heights listed.

3.5.3. Step 2 screening indicates that where the PC exceeds 1% of the long-term standard, the maximum emissions data in Appendix A of the EA's Group 3 metals assessment guidance can be used to revise the predictions, and the PEC then compared against the AQS. The guidance states that As comprises 5% of the Group 3 metals, and Cr(VI) 0.03%. Consequently, the emission rates for each have been recalculated based on these percentages. The results of the assessment may be found in Table 16.

Table 16: PECs of Group 3 Metals – Step 2 Screening

Pollutant	Stack height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS
As (annual mean)	85	2020	**0.000164**	0.003	**5.47%**	0.000788	0.000952	32%
	90	2020	**0.000129**		**4.30%**		0.000917	31%
Cr(VI) (annual mean)	85	2020	0.000000985	0.0002	0.49%	N/A – PCs all screen out (i.e., they are all less than 1% of the AQS)		
	90	2020	0.000000775		0.39%			
	95	2020	0.000000625		0.31%			
	100	NWP 2020	0.000000435		0.22%			
	105	NWP 2020	0.000000374		0.19%			
	110	NWP 2020	0.000000338		0.17%			

3.5.4. The data in Table 16 indicates that the PECs for As can be screened out. In addition, the PCs for Cr(VI) all screen out. Consequently, no further assessment is required for the metals.

3.5.5. The long-term impacts of NO_2, VOC and PAH still requires further assessment. The next stage of the Step 2 impact significance screening process is to compare the long-term pollutant PECs with the criteria outlined in Section 2.21. of this report. Consequently, the background concentrations of the pollutants are required.

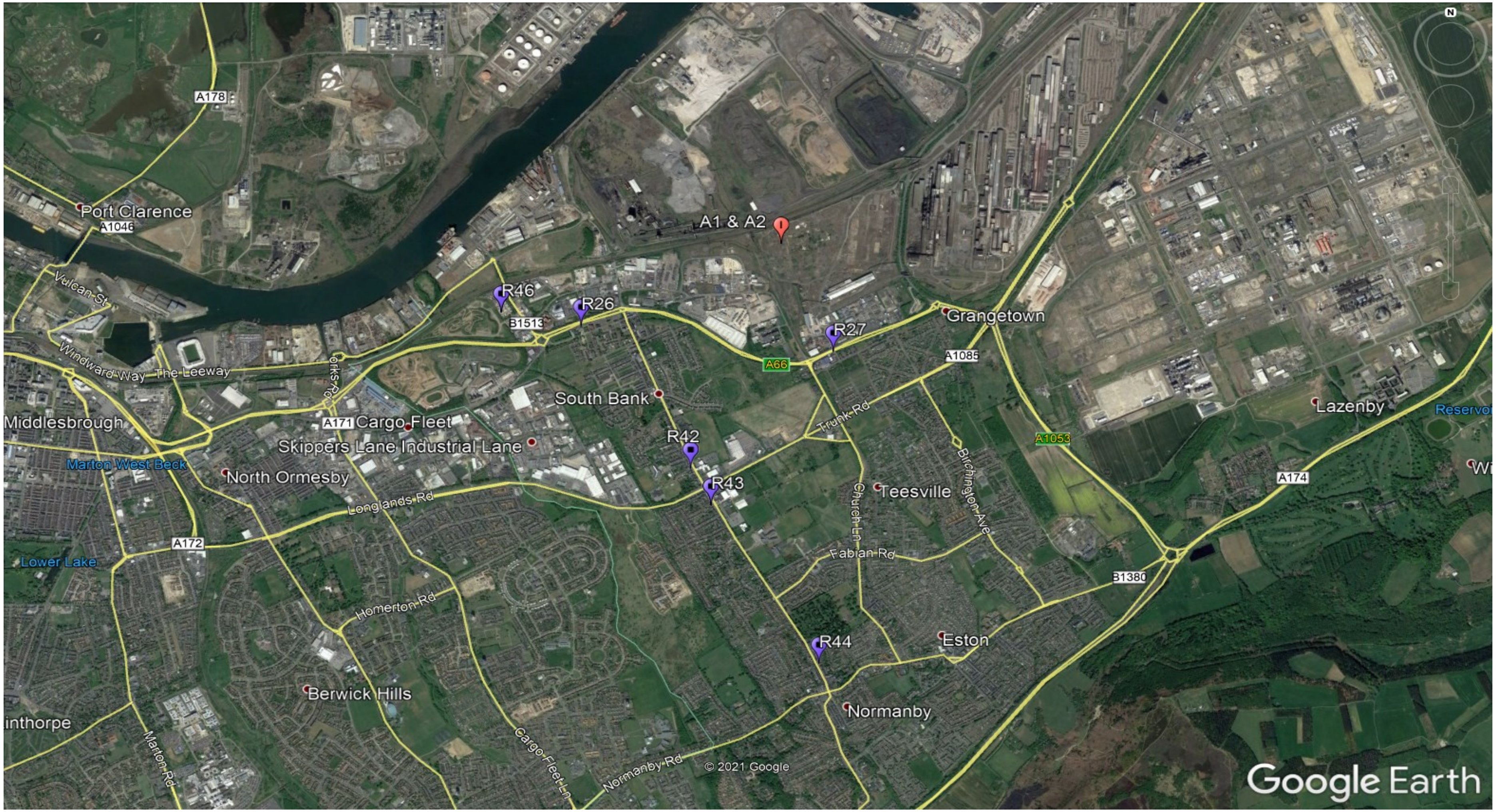
3.6. Background Concentrations of NO_2, VOC and PAH

Nitrogen Dioxide (NO_2)

3.6.1. RCBC undertake automatic and diffusion tube ("DT") monitoring for NO_2 throughout the county. Of these sites monitoring locations within a 3km radius of the Installation were considered.

3.6.2. The details of the specific DTs considered are shown on Figure 12 and the results of the monitoring are provided in Table 17.

Figure 12: Diffusion Tube Monitoring Locations



Notes to Figure 12
The red pin represents the approximate location of the A1 and A2 emissions points at the Installation; and
The blue pins represent the approximate locations of the DTs (refer to Table 17 for further details).

Table 17: Nearest DT Monitoring Site Locations to the Installation

ID / Name [(a)]	NO$_2$ Conc. (µg/m^3) 2019 [(a)] *	NO$_2$ Conc. (µg/m^3) 2020 [(b)] **	Eastings (X) [(a)]	Northings (Y) [(a)]	Distance from Source (m) [(b)]	Heading (degrees)
R27	24.8	21.0	454712	520678	804	156
R26	19.5	17.7	453142	520836	1364	245
R42	13.9	n/a	453834	519869	1635	199
R46	16.1	14.0	452644	520921	1803	254
R43	15.2	n/a	453964	519621	1837	193
R44	12.9	n/a	454648	518546	2877	175

Notes to Table 17

(a) Information obtained online from RCBC's 2020 Air Quality Annual Status Report ("ASR") (a copy of which may be found as Appendix I of this report).

(b) Information obtained online from RCBC's 2021 Air Quality ASR. Available online via: https://www.redcar-cleveland.gov.uk/resident/environmental-protection/air-quality/Documents/Air%20Quality%20Report.pdf.

(c) Distances are measured as the crow flies from the coordinates of the DT to the 'Source'. The 'Source' is the approximate halfway location between the two emission points associated with the incinerator – location coordinates: 454379 (X), 521410 (Y).

* RCBC applied a national bias adjustment factor of 0.87 to the 2019 monitoring data.

** RCBC applied a national bias adjustment factor of 0.82 to the 2020 monitoring data.

n/a: data not available.

3.6.3. It is worth noting that, as a result of the lockdown restrictions and societal behavioural changes resulting from the COVID-19 pandemic there have been implications to air quality at local, regional and national scales. The reduced activity experienced (particularly in regard to vehicle movements and their subsequent emissions) was most notable during the first national lockdown, which saw vehicle traffic reductions of up to 70% across the UK by mid-April (2020), relative to pre COVID-19 levels (Department for Transport data)[29].

3.6.4. RCBC have stated that there were no identifiable impacts as a consequence of COVID-19 upon air quality within Redcar and Cleveland. Although air quality monitoring was able to continue during the 2020 reporting year, it is apparent that there were less DT monitoring sites compared to the 2019 reporting year. Consequently, in the interest of a conservative assessment, NO$_2$ concentrations from 2019 will therefore be used for the purposes of PEC calculations.

3.6.5. In addition to monitored data, DEFRA modelled background maps are also available. These background pollution maps are at a resolution of 1x1km and are modelled each year under DEFRA's Modelling of Ambient Air Quality contract. Table 18 displays the nearest mapped NO$_2$ locations to the point of maximum GLC, for the stack heights assessed, and their concentrations for the year 2019 (the latest available year at the time of writing).

[29] Refer to Appendix F of the 2021 ASR report for further details.

Table 18: Nearest DEFRA Background NO_2 Data to the Point of Maximum GLC

Stack Height (m)	UK Grid Code [(a)]	2019 Annual Mean NO_2 Concentration ($\mu g/m^3$) [(a)]	Easting Coordinate of Max GLC (X)	Northing Coordinate of Max GLC (Y)	Distance from Max GLC [(b)] (m)	Heading (degrees)
85m	537285	13.78	454419	521930	438	169
90m	536595	16.20	454459	522050	452	5
95m	536595	16.20	454459	522130	372	6
100m	536596	16.27	455059	522450	444	84
105m	536596	16.27	455099	522490	401	89
110m	536596	16.27	455139	522530	362	95

Notes to Table 18

(a) Information from the latest (2019) DEFRA background pollution maps, available via: https://uk-air.defra.gov.uk/data/pcm-data.

(b) Distances are measured as the crow flies from the coordinates of the DEFRA grid square to the occurrence of the maximum GLC.

3.6.6. It can be seen from the data in Table 18, compared to the data in Table 17, that the DEFRA modelled NO_2 concentrations are similar in value to the majority of the DTs considered (for the year 2019) and closer to the Installation overall with the exception of R27 which has a higher concentration. Consequently, this location will be used to ensure a conservative assessment.

Volatile Organic Compounds (as Benzene)

3.6.7. As there is no suitable measured data for VOC as benzene, the DEFRA mapped data will be used. Table 19 displays the nearest mapped benzene locations to the point of maximum GLC, for the stack heights assessed, and their concentrations for the year 2019.

Table 19: Nearest DEFRA Background Benzene Data to the Point of Maximum GLC

Stack Height (m)	UK Grid Code [(a)]	2019 Annual Mean Benzene Concentration ($\mu g/m^3$) [(a)]	Easting Coordinate of Max GLC (X)	Northing Coordinate of Max GLC (Y)	Distance from Max GLC [(b)] (m)	Heading (degrees)
85m	537285	0.326	454419	521930	438	169
90m	536595	0.355	454459	522050	452	5
95m	536595	0.355	454459	522130	372	6
100m	536596	0.358	455059	522450	444	84
105m	536596	0.358	455099	522490	401	89
110m	536596	0.358	455139	522530	362	95

Notes to Table 19

(a) Information from the latest (2019) DEFRA background pollution maps, available via: https://uk-air.defra.gov.uk/data/pcm-data.

(b) Distances are measured as the crow flies from the coordinates of the DEFRA grid square to the occurrence of the maximum GLC.

3.6.8. For the purposes of calculating the VOC PECs, the closest DEFRA modelled data to the location of the maximum VOC GLCs, for the stack heights assessed, will be used.

PAH (as Benzo[a]pyrene)

3.6.9. Monitoring of PAH has been undertaken by DEFRA since 1991. Currently, the network consists of over 30 PAH measurement sites across England, Wales, Scotland and Northern Ireland measuring ambient concentrations of PAH in UK atmosphere[30].

3.6.10. The closest location to the Installation is the urban industrial site at Middlesbrough (450471 (X), 519621 (Y)), situated approximately 4.3km to the west-southwest of the Installation. The 2019 annual average PAH (as Benzo[a]pyrene, solid phase) concentration at this monitoring location was 0.000206 µg/m^3 and will therefore be used for the calculation of the PAH PECs.

3.7. Step 2 Screening of Remaining Pollutants

3.7.1. Using the background data discussed in section 3.6., PECs will now be calculated for the long-term impacts of NO_2, VOC and PAH. The criteria used to determine the significance of the impact of PECs is provided in Section 2.22 of this report. Table 20 displays the PEC assessment, with any potentially significant PCs indicated in bold.

[30] https://uk-air.defra.gov.uk/networks/network-info?view=pah.

Table 20: Long-term impacts of NO_2, VOC and PAH – Step 2 Screening

Pollutant	Stack height (m)	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS	Impact Descriptor
NO_2 (annual mean)	85	2020	**0.765**	40	**1.91%**	24.8	25.57	64%	Negligible
	90	2020	**0.603**		**1.51%**		25.40	64%	Negligible
	95	2020	**0.486**		**1.21%**		25.29	63%	Negligible
	100	NWP 2020	0.395		0.99%		25.19	63%	Screens out at Step 1
	105	NWP 2020	0.357		0.89%		25.16	63%	Screens out at Step 1
	110	NWP 2020	0.323		0.81%		25.12	63%	Screens out at Step 1
VOC (annual mean)	85	2020	**0.109**	5	**2.19%**	0.326	0.435	9%	Negligible
	90	2020	**0.0861**		**1.72%**	0.355	0.441	9%	Negligible
	95	2020	**0.0694**		**1.39%**	0.355	0.424	8%	Negligible
	100	NWP 2020	**0.0564**		**1.13%**	0.358	0.414	8%	Negligible
	105	NWP 2020	**0.0510**		**1.02%**	0.358	0.409	8%	Negligible
	110	NWP 2020	**0.0462**		0.92%	0.358	0.404	8%	Screens out at Step 1
PAH (as B[a]P) (annual mean)	85	2020	**0.0000109**	0.00025	**4.37%**	0.000206	0.000217	87%	Slight
	90	2020	**0.00000861**		**3.44%**		0.000215	86%	Slight
	95	2020	**0.00000694**		**2.78%**		0.000213	85%	Slight
	100	NWP 2020	**0.00000564**		**2.26%**		0.000212	85%	Slight
	105	NWP 2020	**0.00000510**		**2.04%**		0.000211	85%	Slight
	110	NWP 2020	**0.00000462**		**1.85%**		0.000211	84%	Negligible

3.7.2. The data in Table 20 indicates that, for annual NO_2, the impact on the environment can be classed as 'negligible' for stack heights of 85m to 95m (inclusive) and screens out at stack heights of 100m and taller. For VOC the impact on the environment can be classed as 'negligible' for stack heights of 85m to 105m (inclusive) and screens out at stack heights of 110m. For PAH (as B[a]P) the impact on the environment can be classed as 'slight' for stack heights of 85m to 105m (inclusive) and 'negligible' for stack heights of 110m.

3.7.3. Consequently, stack heights of 85m and taller are regarded as suitable heights. However, taking the overall results of the stack height screening assessment at the maximum point of impact into account, it has been considered that stack heights (for both A1 and A2) of 90m will provide slightly greater environmental protection (compared to stack heights of 85m and shorter) and should therefore allow for more flexibility when factoring in periods of abnormal emissions, as well as when accounting for any cumulative impacts (refer to Sections 8 and 9, respectively, for further details).

3.8. Proposed Stack Height

3.8.1. Based on the results of the stack height screening assessment detailed in the sections above, 90m discharge stack heights are proposed and will be used from this point forward.

3.9. Isopleths

3.9.1. Isopleths have been prepared for every pollutant with an AQS (with the exception of annual and 1-hour PCBs, as it has been considered that the predicted PCs for these pollutants are infinitesimal (refer to Table 13 for details) for the worst-case met year. These are provided as Figures 13-32.

3.9.2. The blue contour lines (as shown in Figures 13, 21 and 31 for annual NO_2, VOC and PAH (as B[a]P), respectively)) represent the extent to which the predicted PCs are 1% of the relevant AQS for these pollutants.

Figure 13: NO_2 - Annual Mean – Met Year 2020

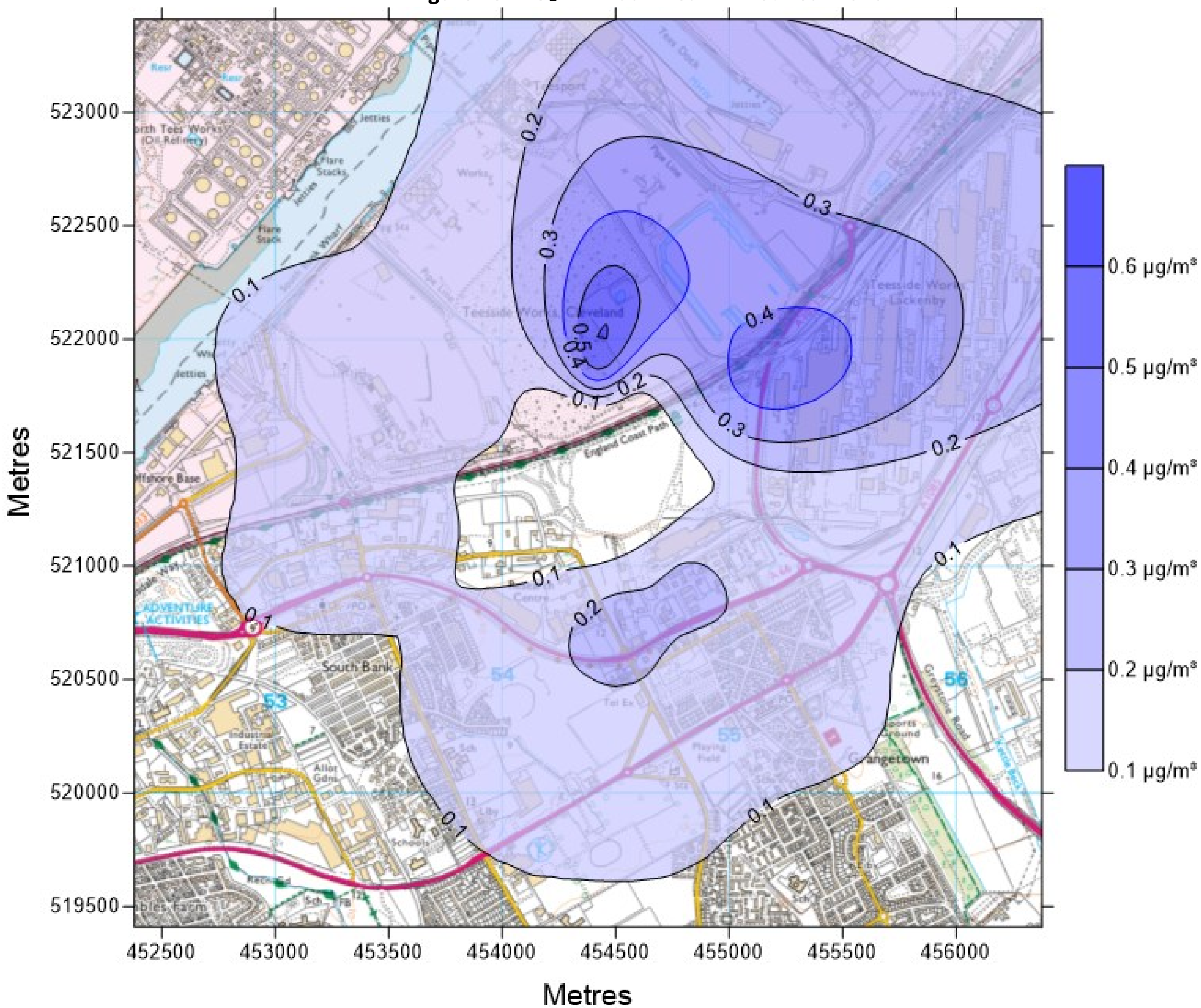


Figure 14: NO_2 - 99.79th Percentile – Met Year 2018

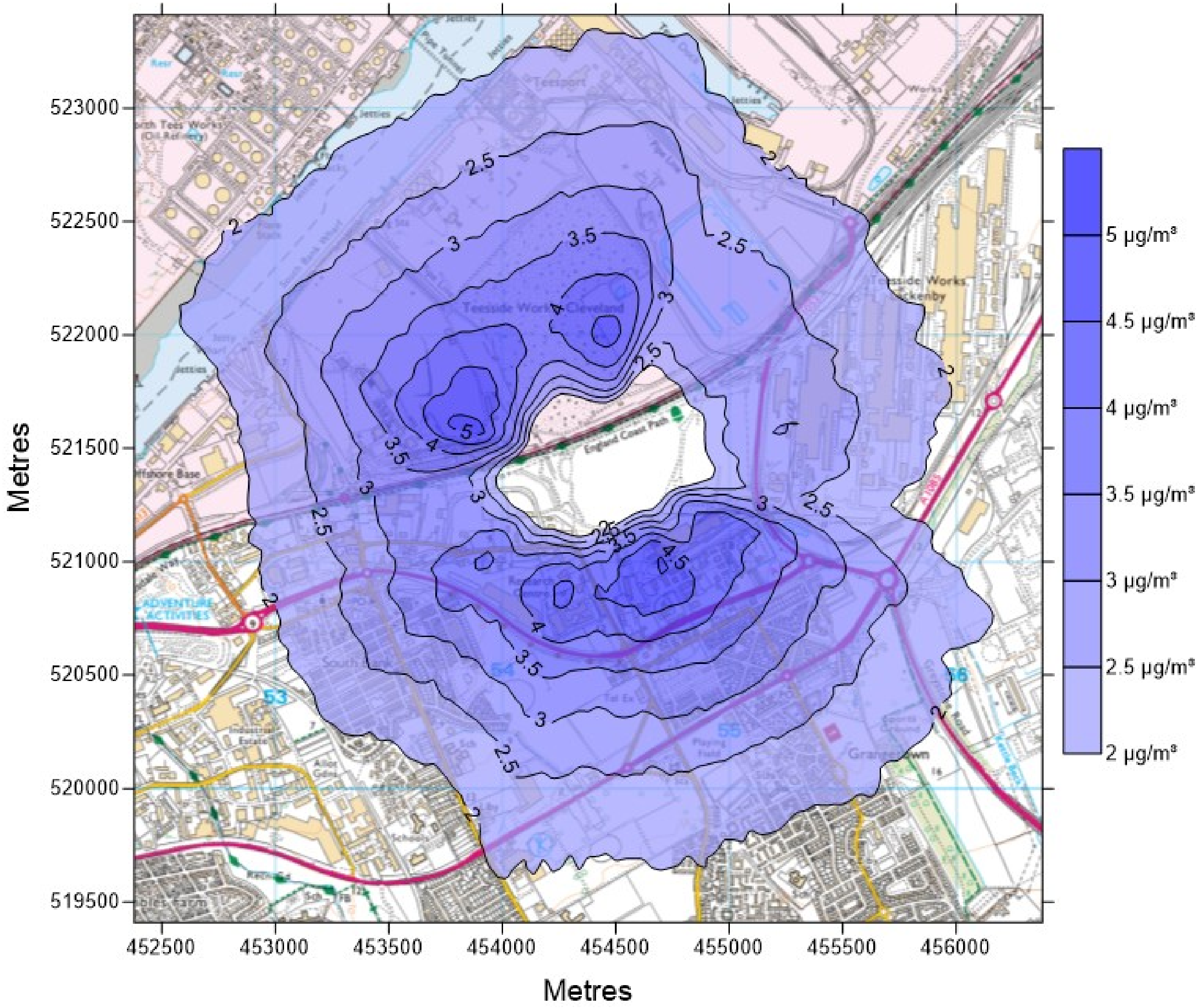


Figure 15: SO_2 - 99.18th Percentile – Met Year 2016

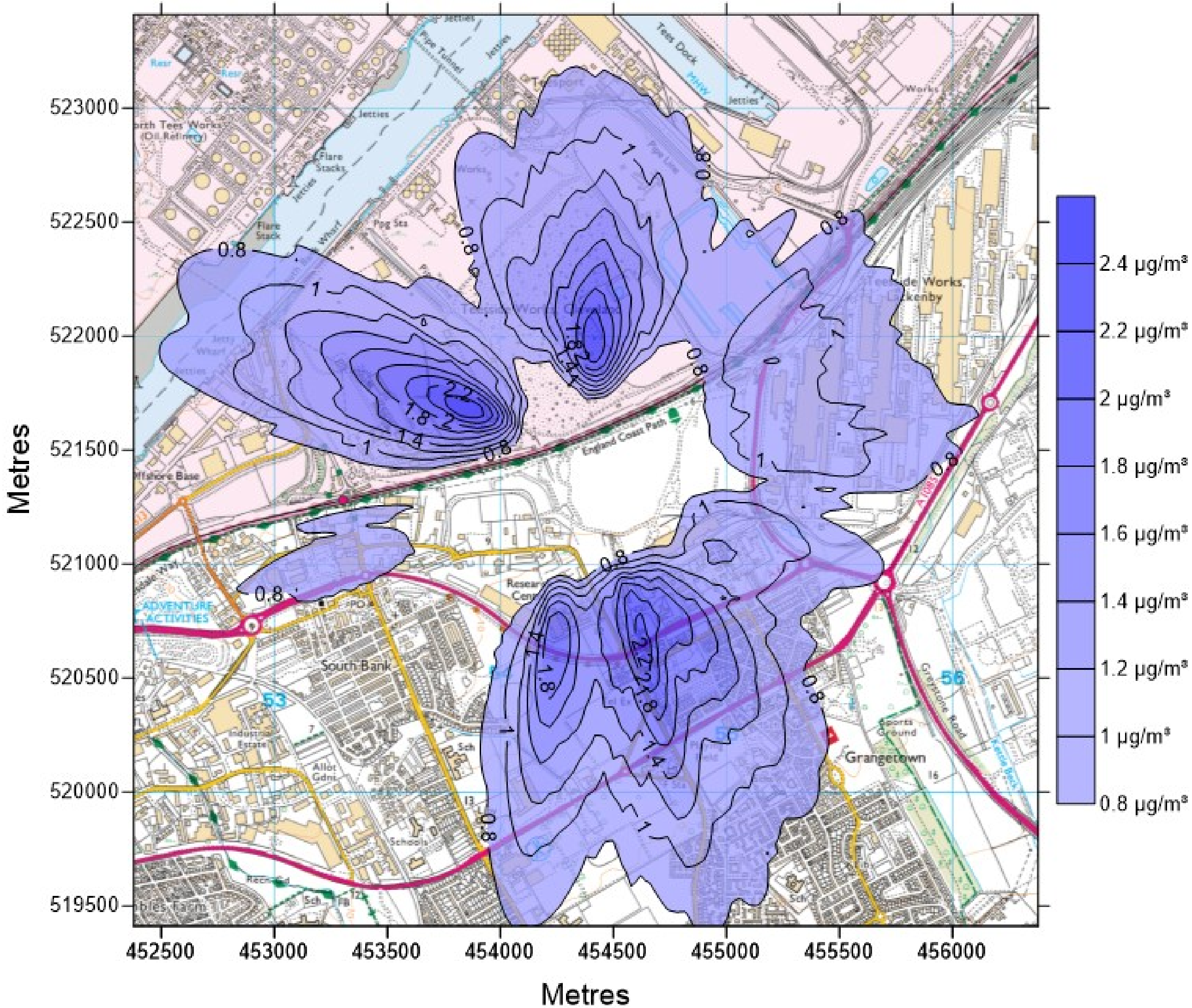


Figure 16: SO_2 - 99.73rd Percentile – Met Year 2018

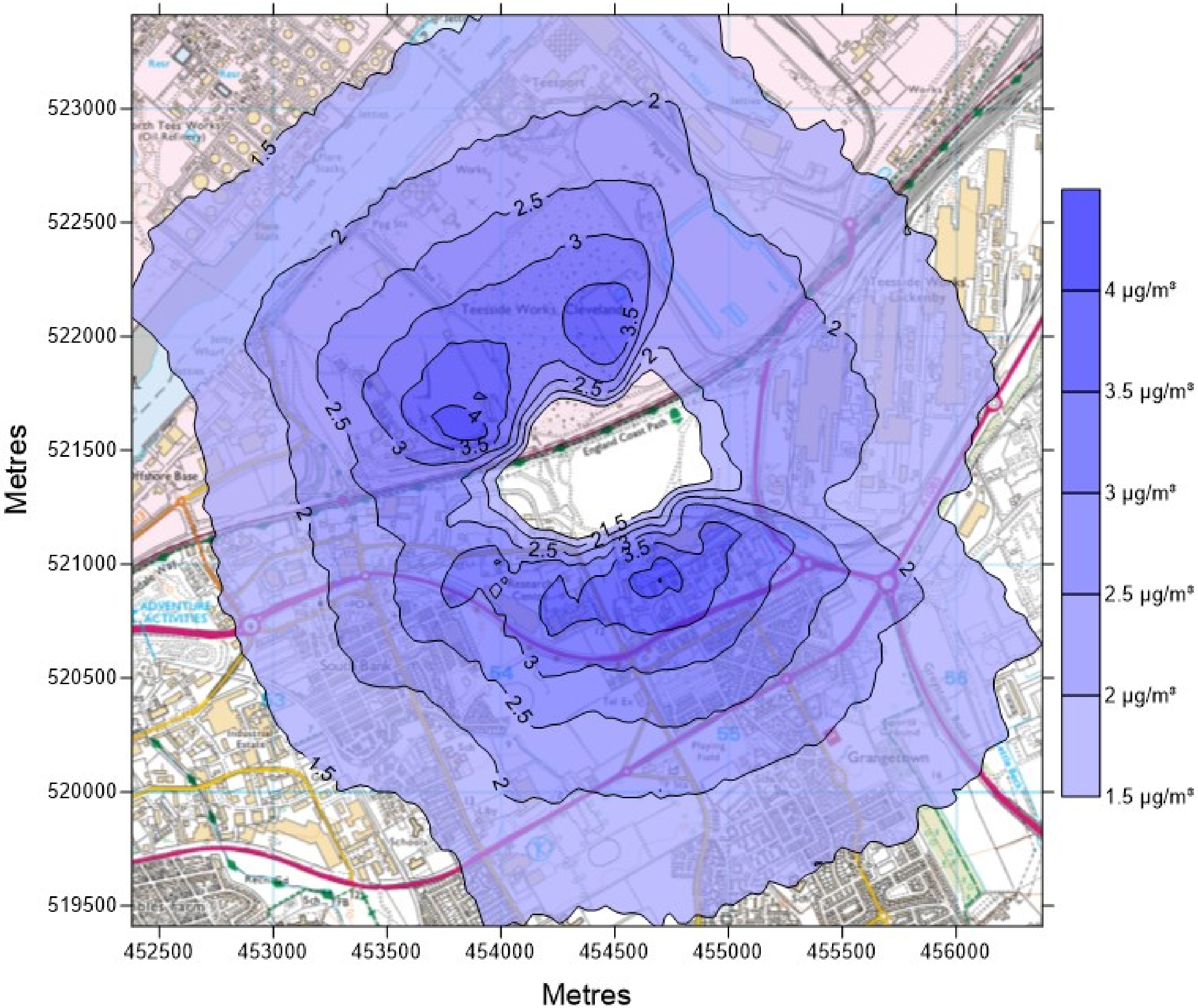


Figure 17: SO_2 - 99.90th Percentile – Met Year 2018

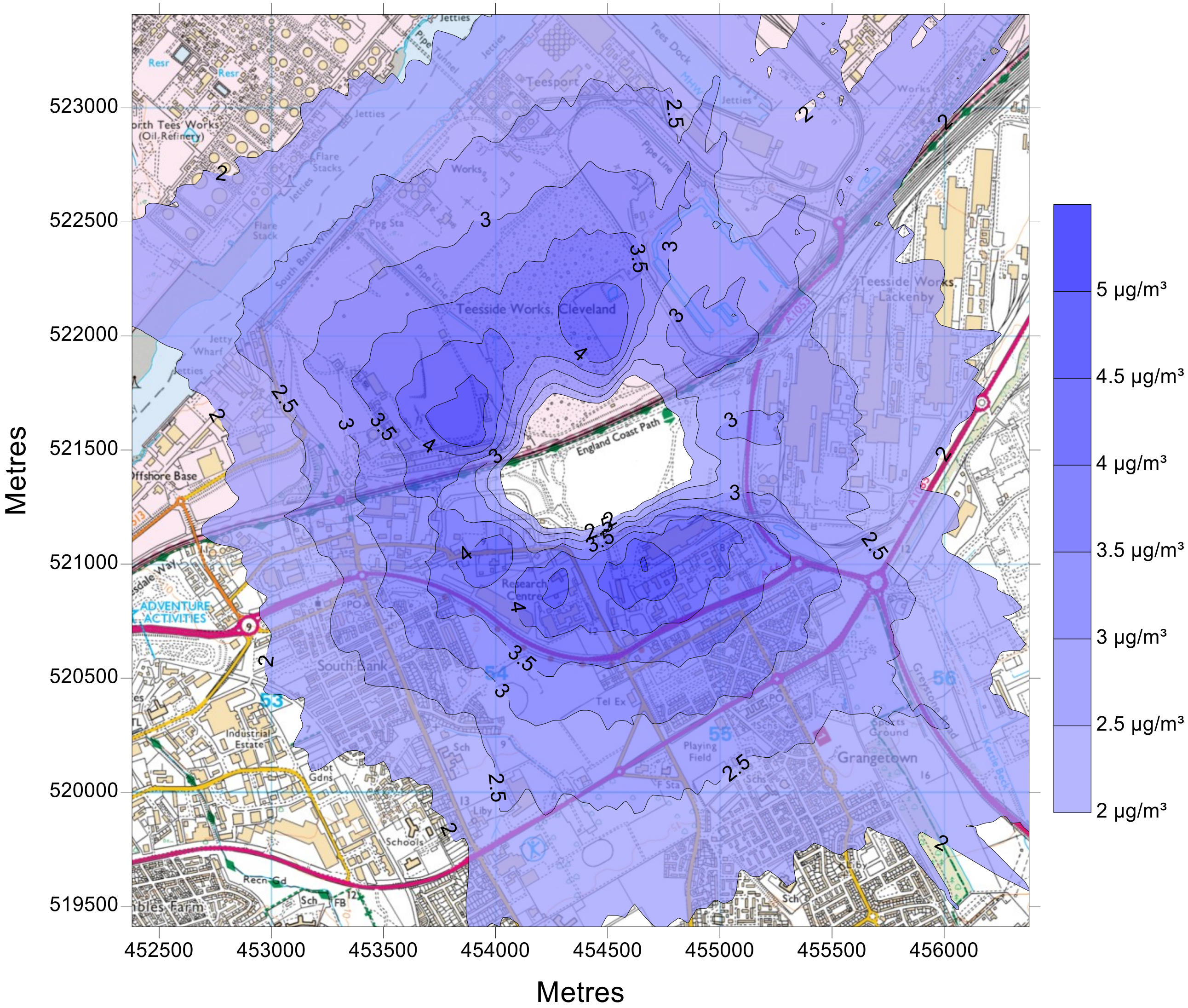


Figure 18: PM_{10} and $PM_{2.5}$ - Annual Mean – Met Year 2020

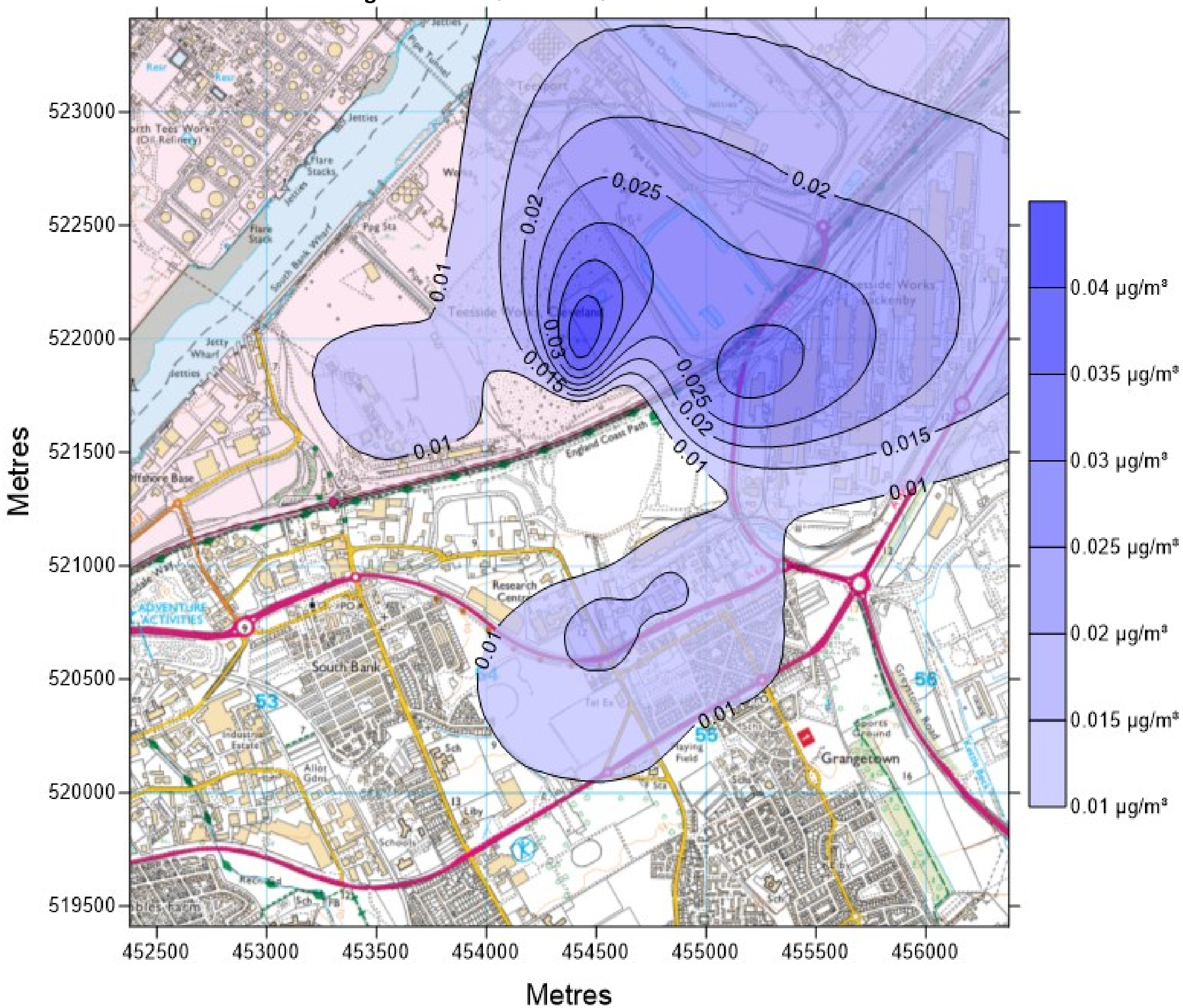


Figure 19: PM_{10} - 90.41st Percentile – Met Year 2020

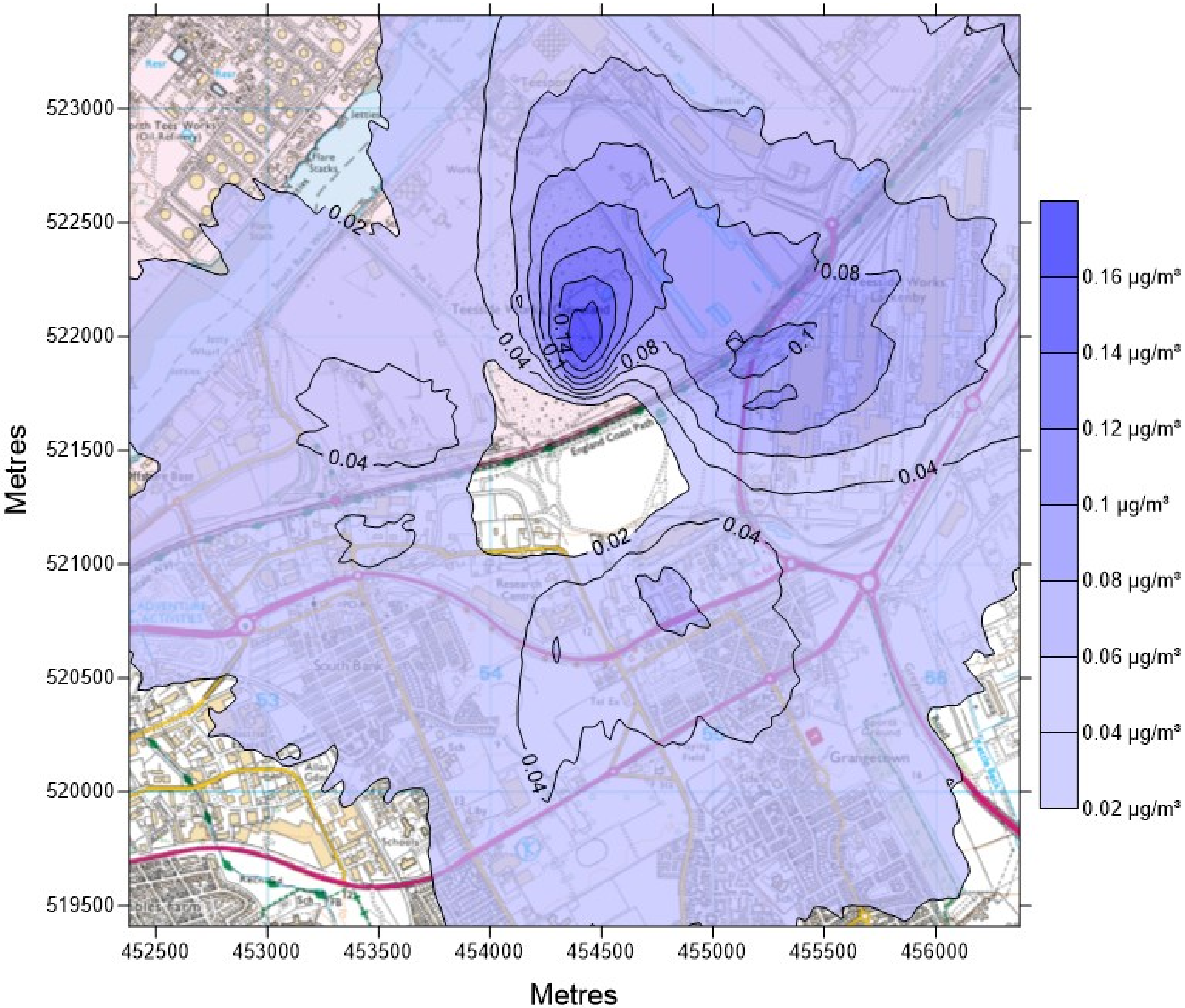


Figure 20: CO - 100th Percentile – Met Year 2018

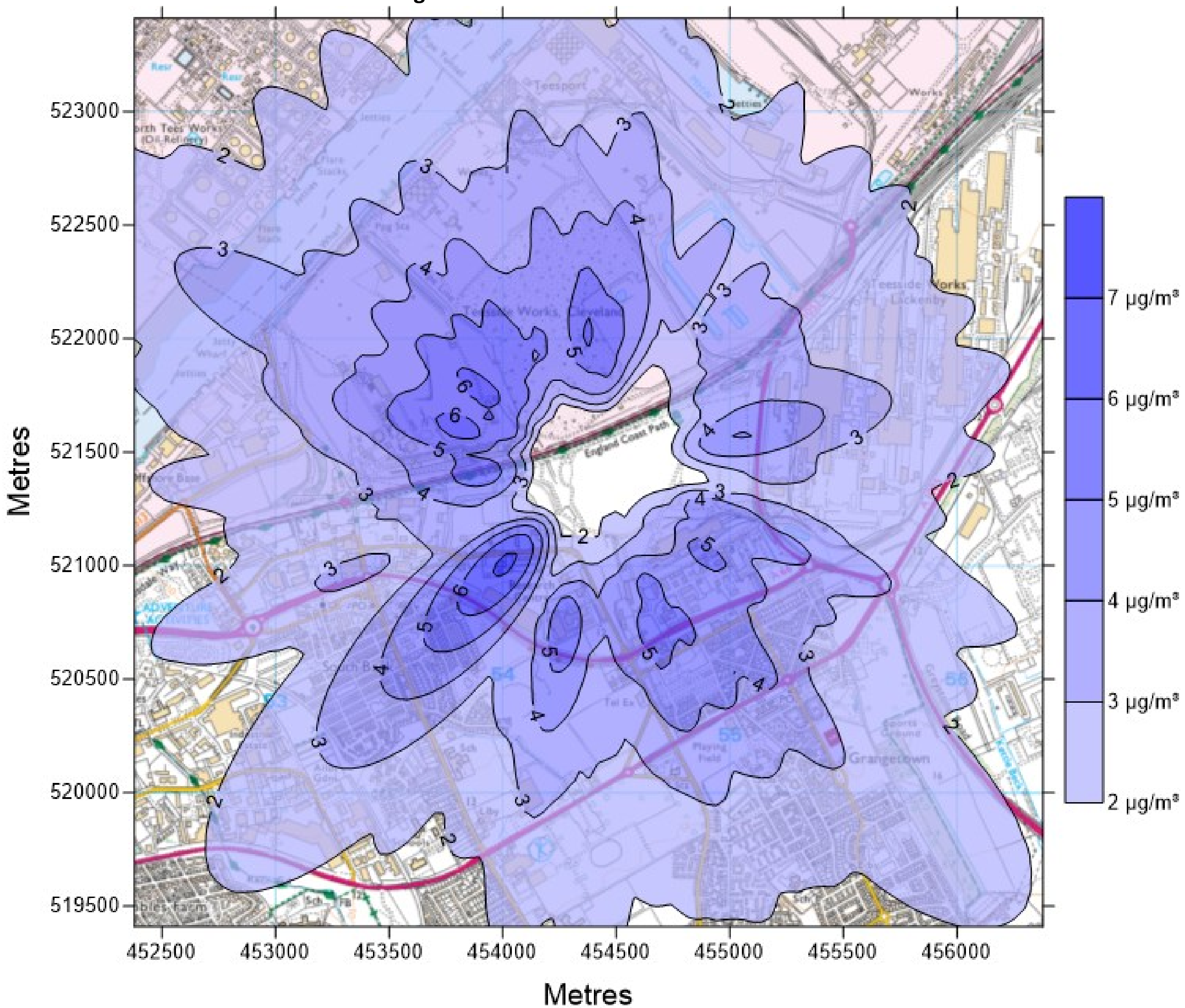


Figure 21: VOC - Annual Mean – Met Year 2020

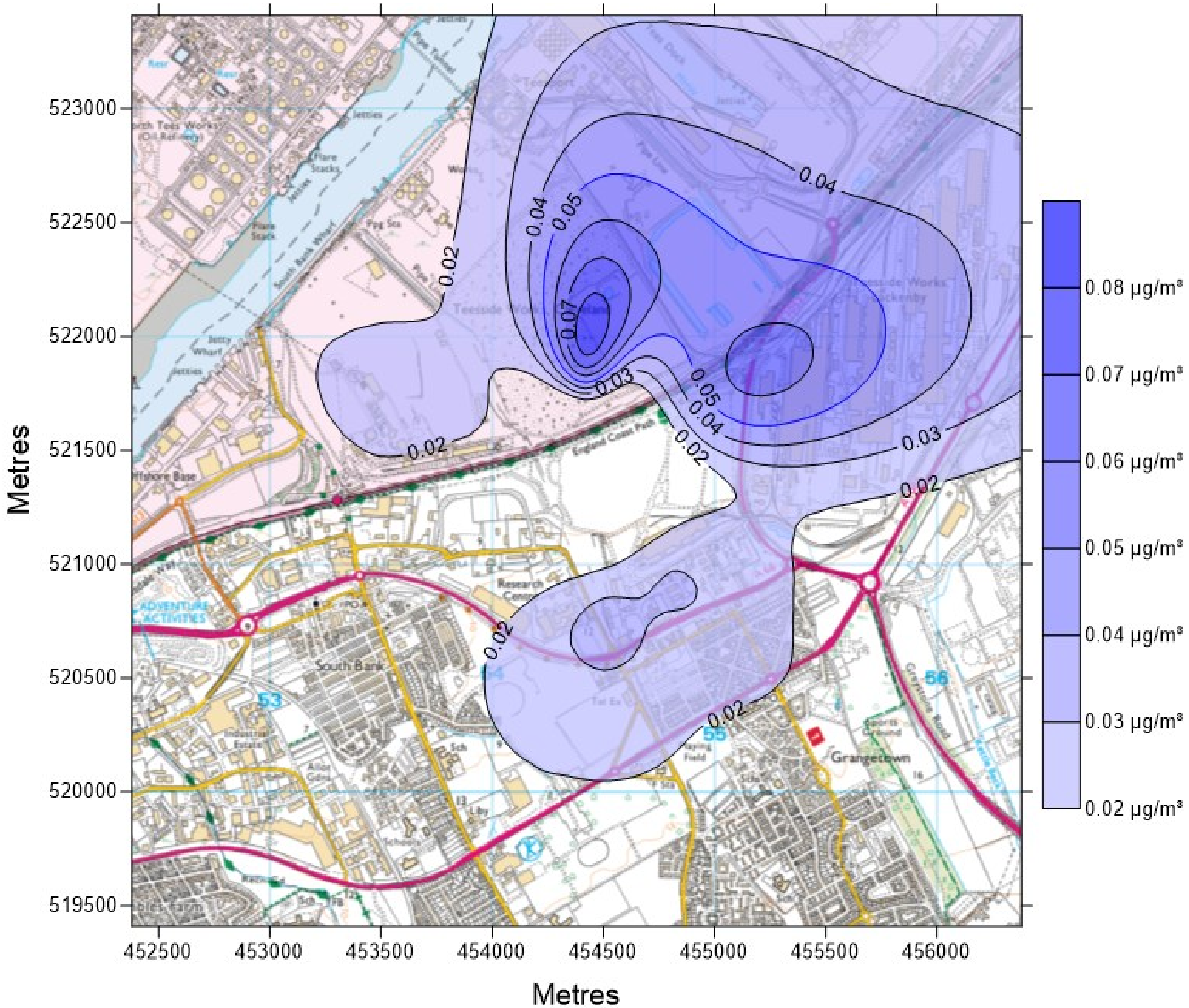


Figure 22: NH_3 – Annual Mean – Met Year 2020

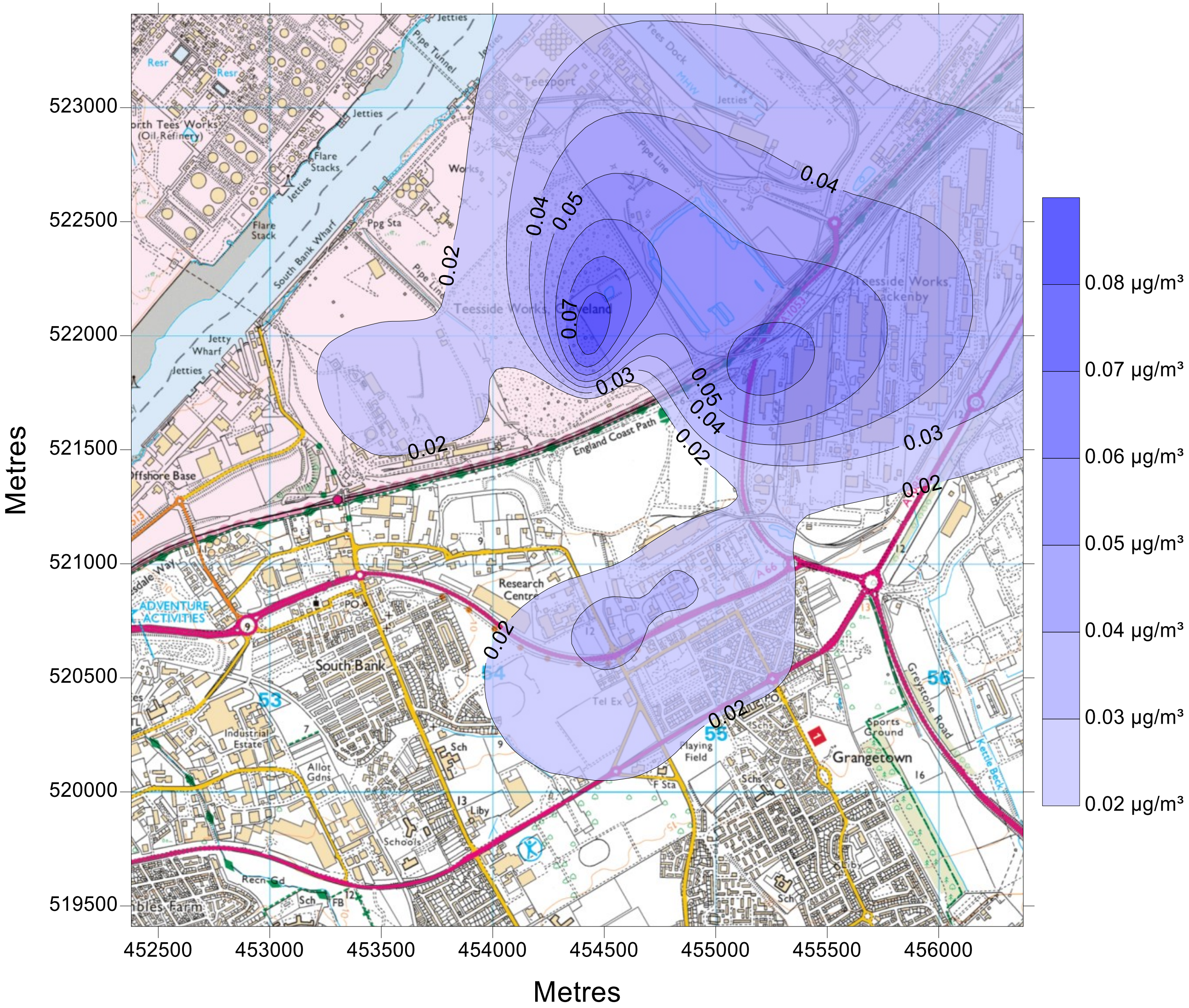


Figure 23: NH_3 – 100th Percentile – Met Year 2018

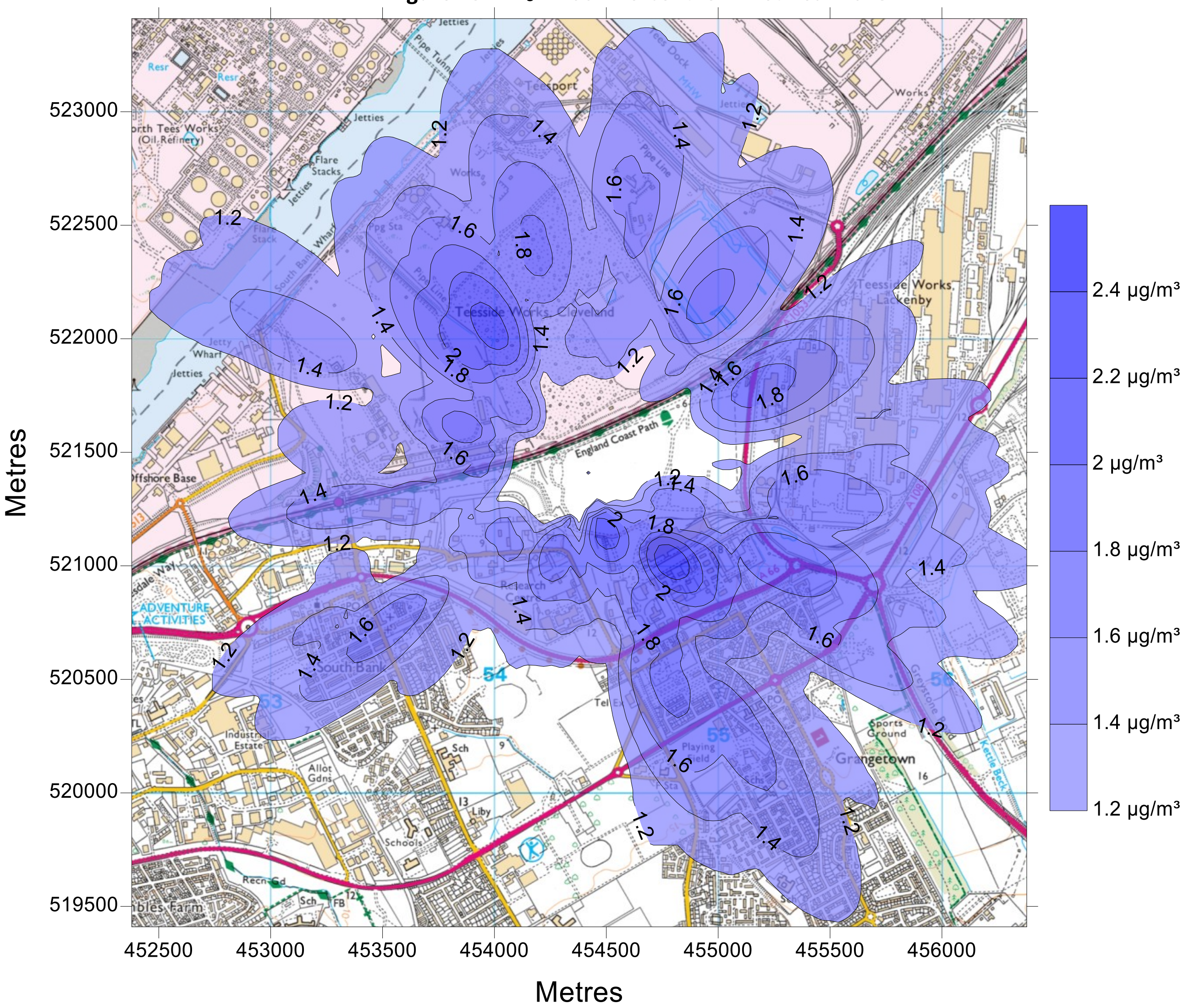


Figure 24: HCl – 100th Percentile – Met Year 2018

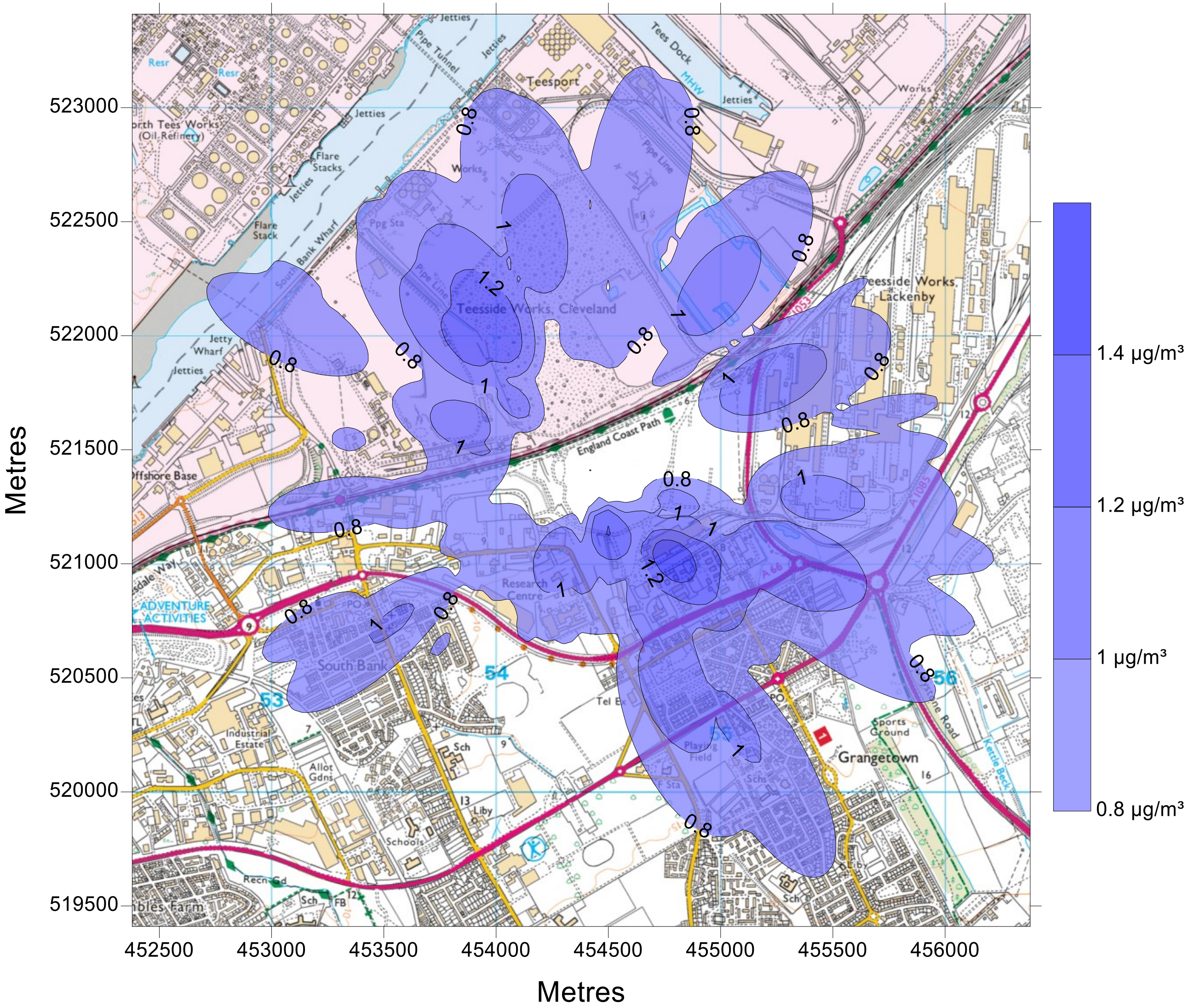


Figure 25: HF – Annual Mean – Met Year 2020

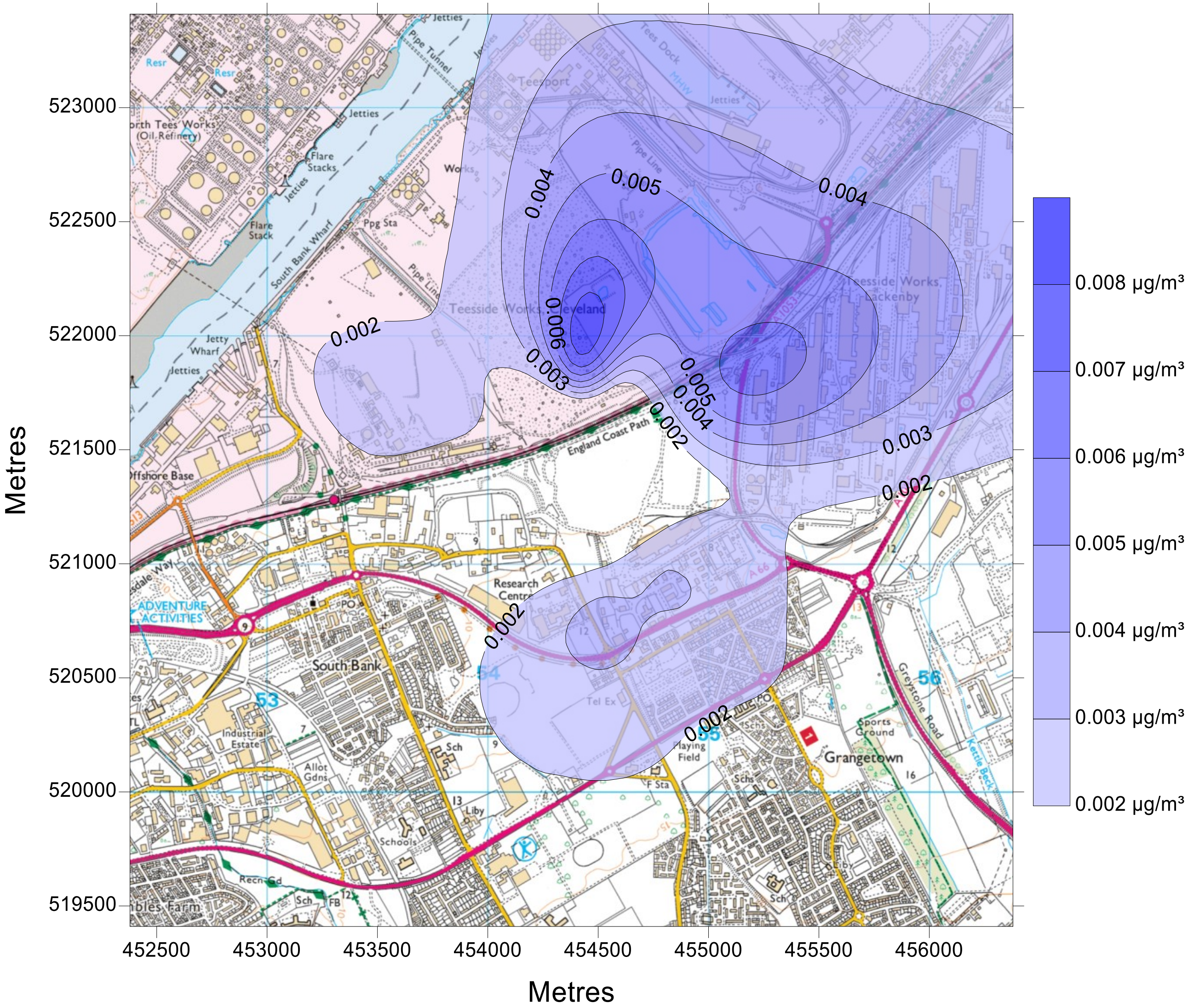


Figure 26: HF – 100th Percentile – Met Year 2018

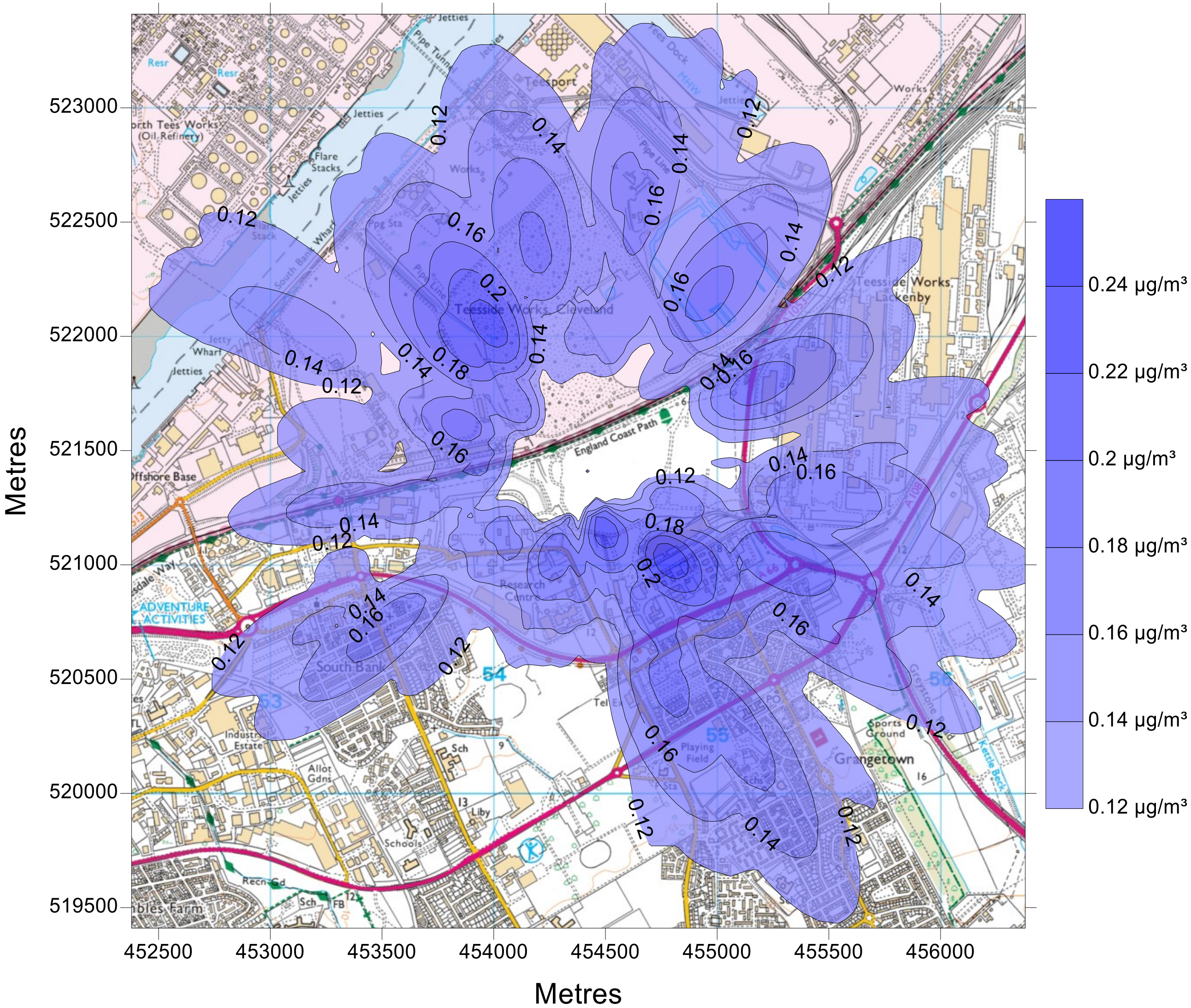


Figure 27: Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V – Annual Mean – Met Year 2020

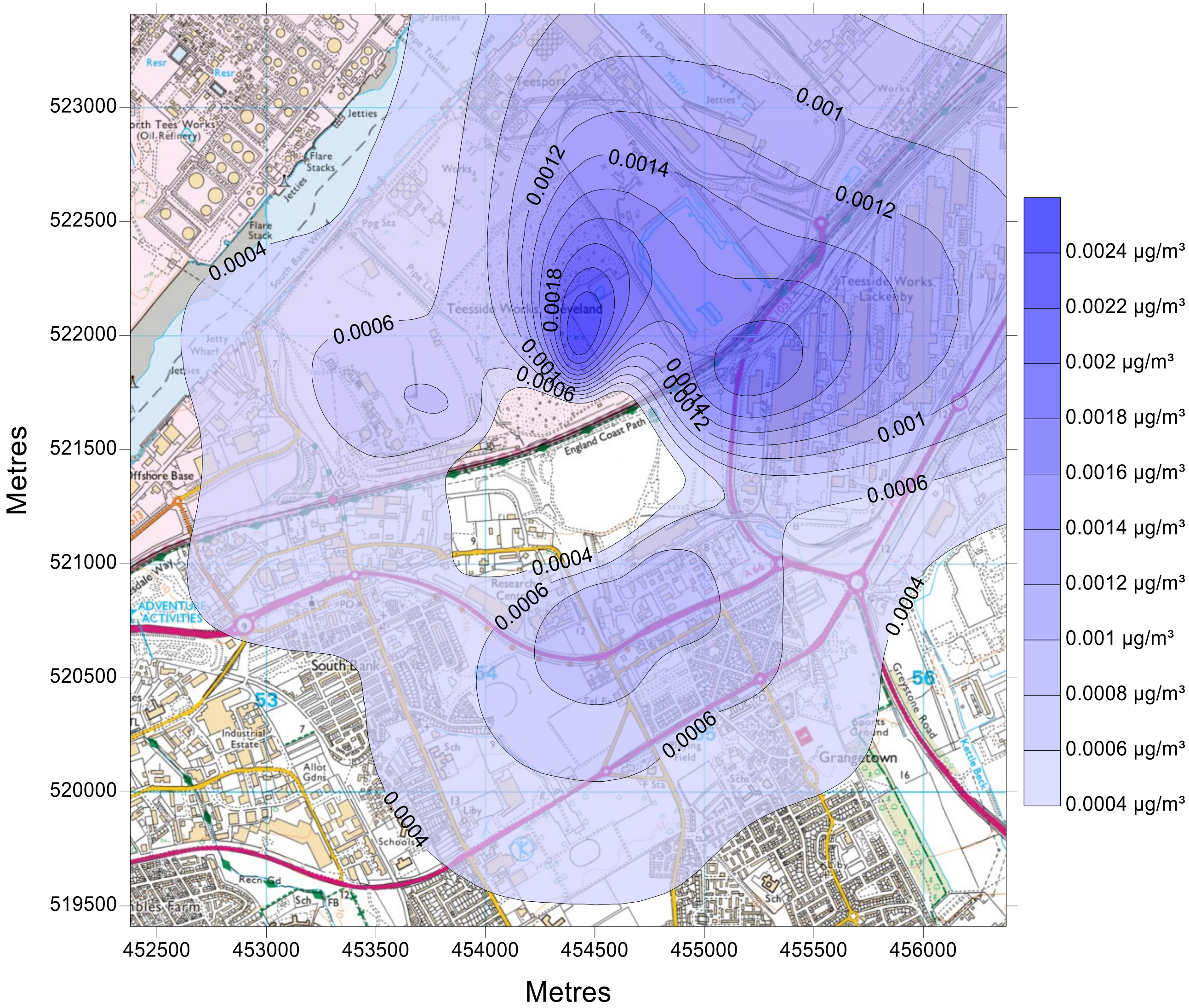


Figure 28: Sb, Cr, Co, Cu, Mn - 100th Percentile – Met Year 2018

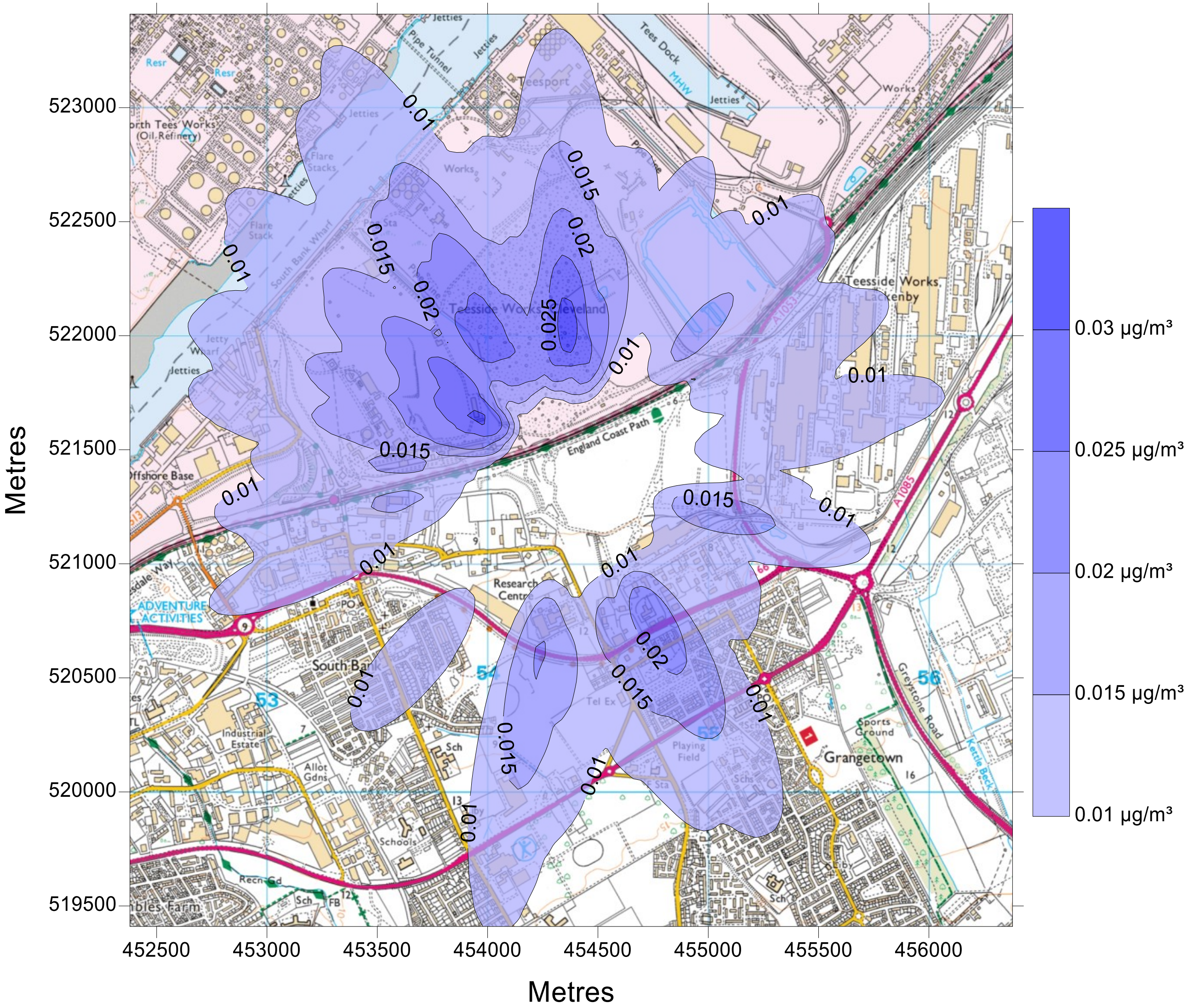


Figure 29: V – 24 hour, 100th Percentile – Met Year 2016

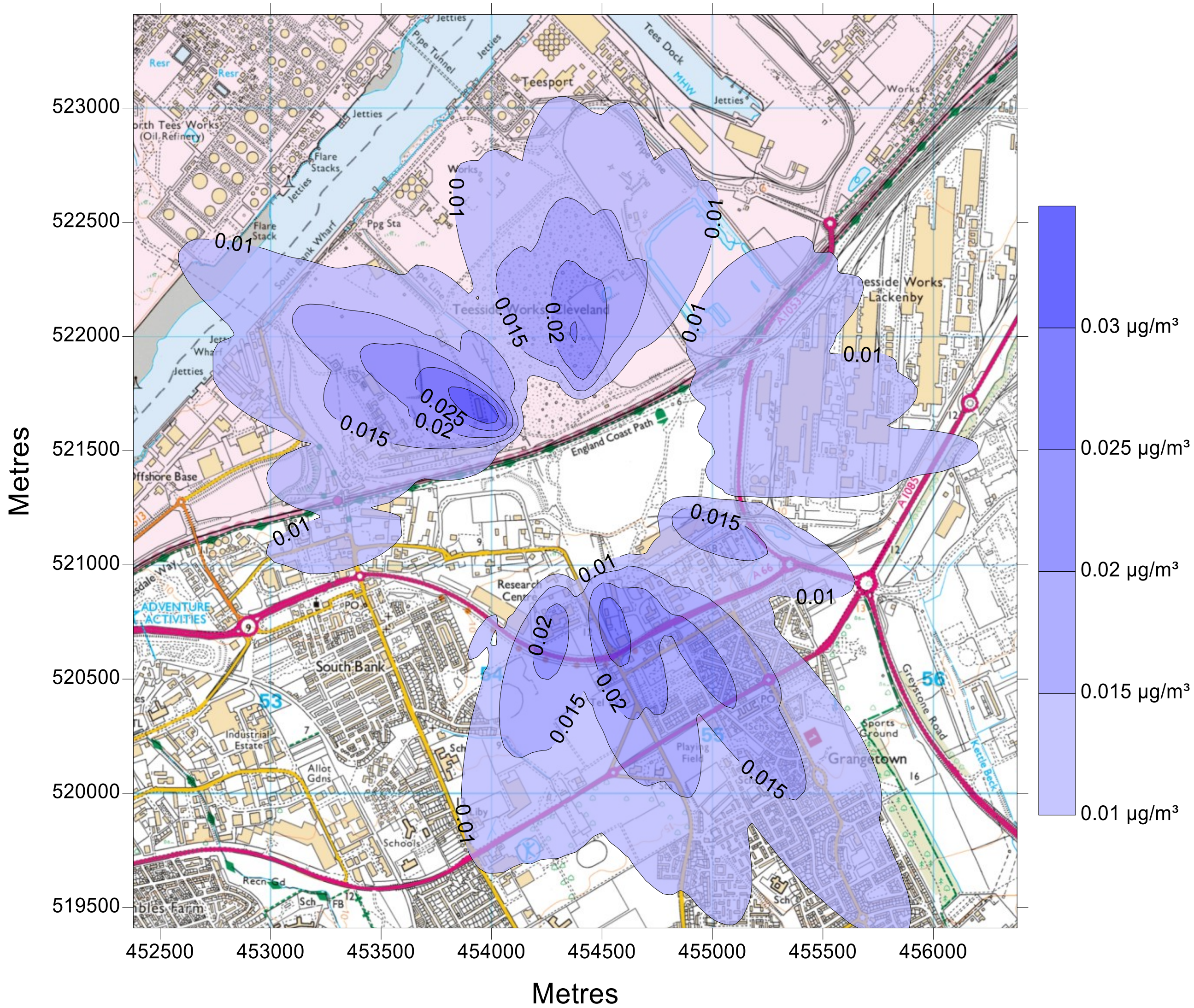


Figure 30: Cd, Tl and Hg – Annual Mean – Met Year 2020

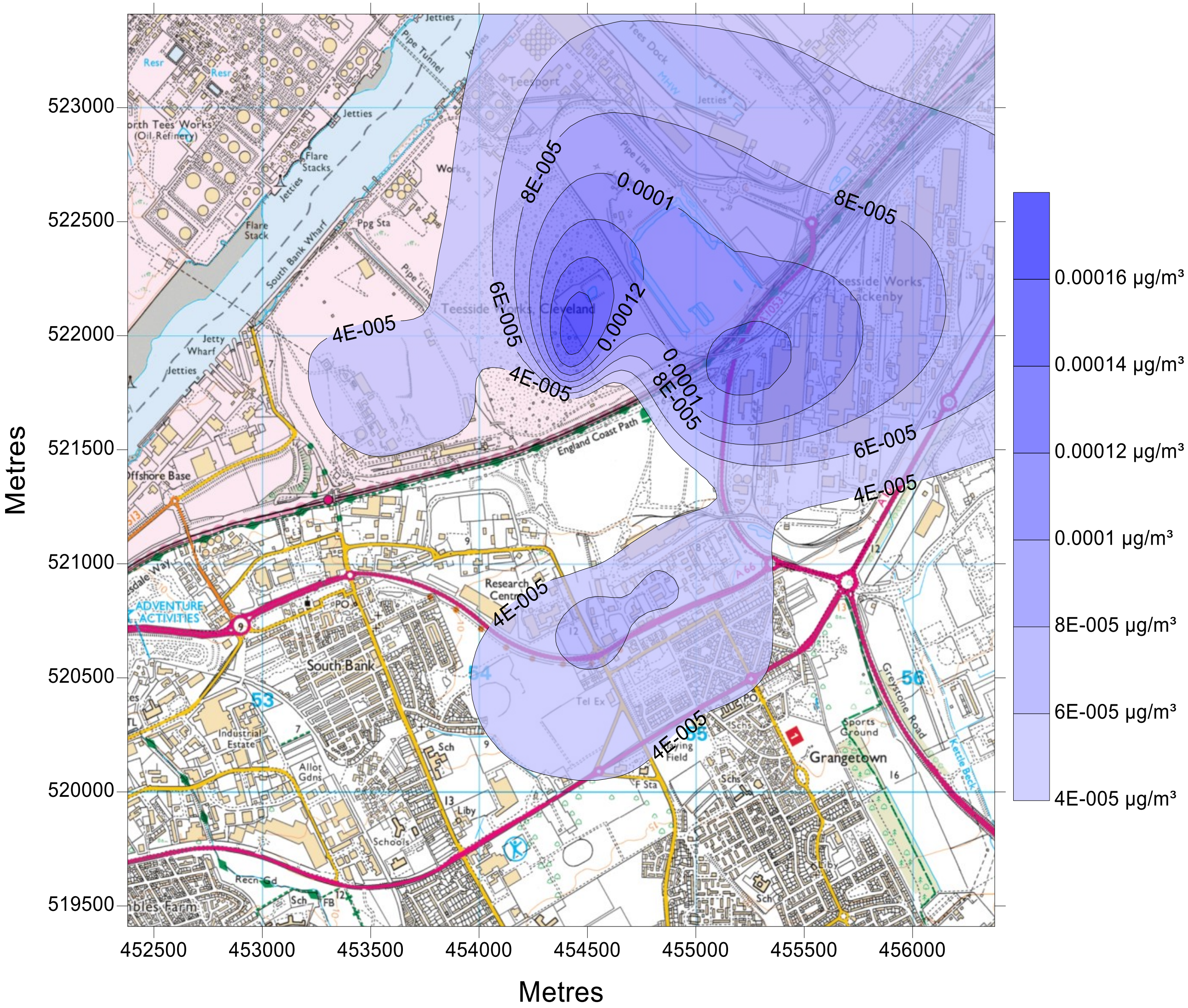


Figure 31: Hg and Tl - 100th Percentile – Met Year 2018

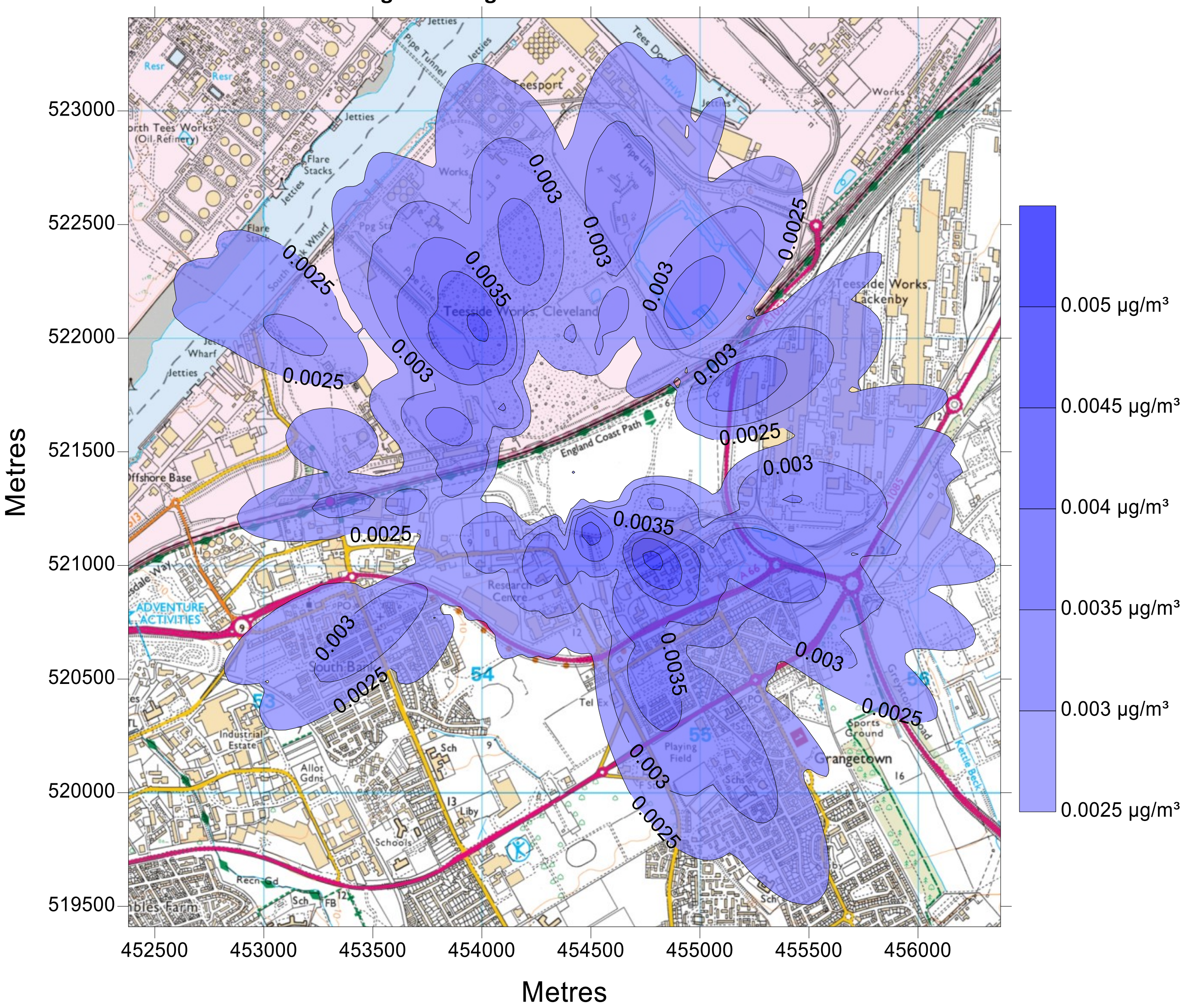
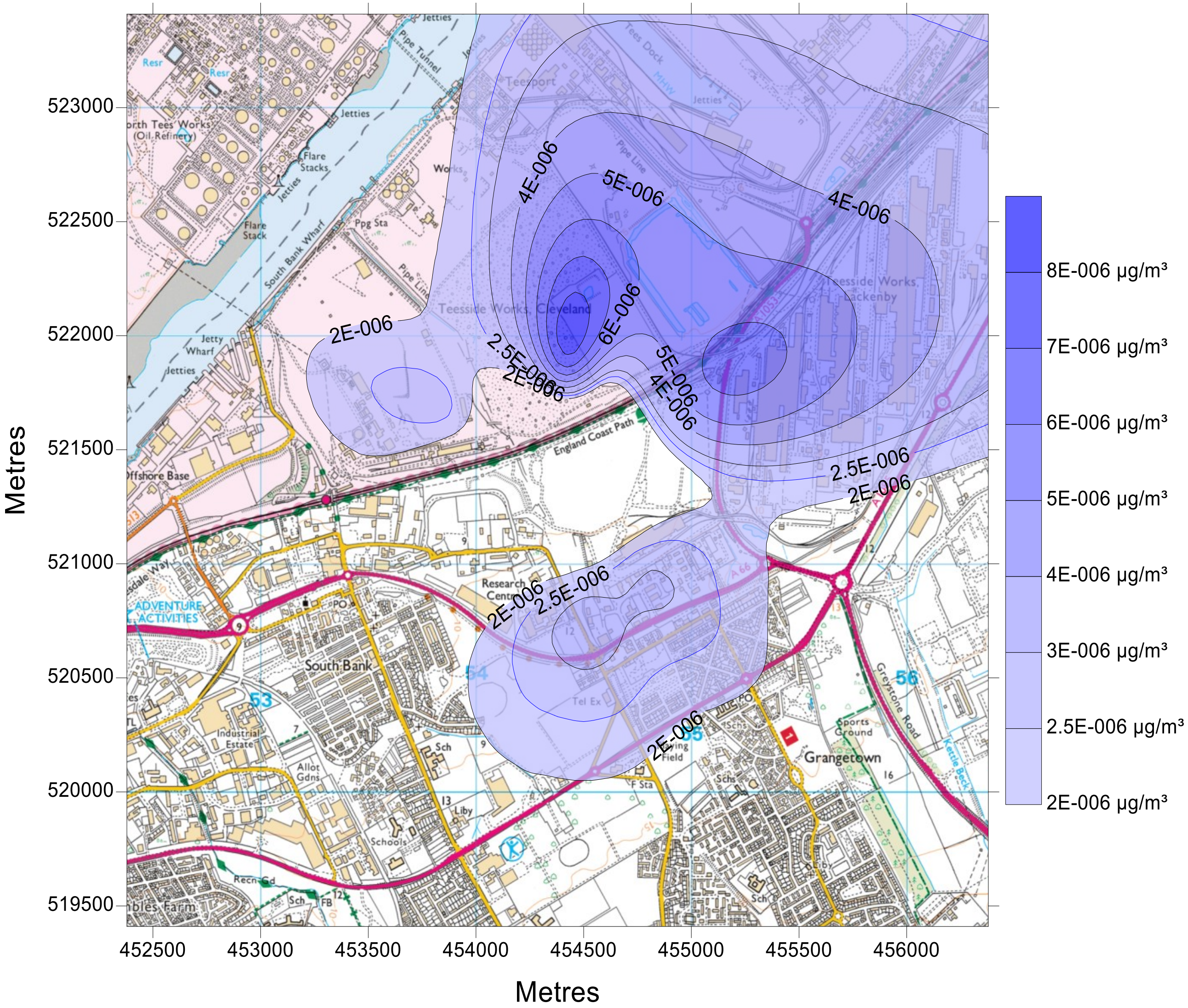


Figure 32: PAH (as B[a]P) – Annual Mean – Met Year 2020



4. ASSESSMENT OF AIR QUALITY IMPACTS – POTENTIALLY SENSITIVE HUMAN RECEPTOR LOCATIONS

4.1. Model Setup

4.1.1. This assessment considered the effect of emissions from the Installation on the potentially sensitive human receptors identified in Table 1. Modelling was undertaken with the following settings:

- buildings effects were included;
- complex terrain was included (Terrain File One (which was used for all receptors bar NYM1) and Terrain File Two (which was used for NYM1 only) - See Section 2.17);
- emission rates for pollutants were as outlined in Table 10a of Section 2.11.;
- NO_X to NO_2 conversion rates were taken into account (refer to Section 2.24.);
- stack heights of 90m were used;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data); and
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used.

4.2. Results – Group 1, 2 and 3 Metals

4.2.1. Due to the number of potentially sensitive human receptors, and the varying screening methodology, the results have been split into two sections. This section focuses on Group 1, 2 and 3 metals only, the remaining pollutants are discussed in Section 4.3.

4.2.2. Based on Stage 1 screening (i.e., long-term PCs greater than 1% of their AQS are potentially significant and short-term PCs greater than 10% of their AQS are potentially significant), all metals with short-term averaging periods screened out. The metals with potentially significant impacts were As, Cd, Cr(VI), Co and Ni (all annual mean). Consequently, PECs were considered for these metals.

4.2.3. Following calculation of the PECs, all metals with the exception of Cr(VI) screened out (i.e., the PECs were all less than 100% of their respective AQSs). Step 2 screening indicates that where the PC exceeds 1% of the long standard, the maximum emissions data in Appendix A of the EA's Group 3 metals assessment guidance can be used to revise the predictions, and the PEC then compared against the AQS. The guidance states that Cr(VI) comprises 0.03% of the Group 3 metals. Consequently, the emission rate for Cr(VI) has been recalculated based on these percentages.

4.2.4. Following Step 2 screening for Cr(VI), all Group 1, 2 and 3 metals screen out as being not significant at all potentially sensitive human receptors for stack heights of 90m (for the Installation's A1 and A2 emission points).

4.2.5. The results of the screening assessments for Group 1, 2 and 3 metals may be found in Table 21, with any potentially significant impacts highlighted in bold.

Table 21: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for Group 1, 2 and 3 Metals

	Pollutant	Sb (annual)	Sb (1-hour)	As (annual)	Cd (annual)	Cr (annual)	Cr (1-hour)	Cr VI (annual) [(a)]	Co (annual)	Co (1-hour)	Cu (annual)	Cu (1-hour)
	AQS (µg/m³)	5	150	0.003	0.005	5	150	0.0002	0.2	6	10	200
	Maximum PC (µg/m³)	0.00212	0.0570	**0.00212**	**0.000141**	0.00212	0.0570	0.000000609	**0.00212**	0.0570	0.00212	0.0570
	Max PC as % of AQS	0.042%	0.038%	**71%** [(b)]	**2.82%**	0.042%	0.038%	0.30%	**1.06%**	0.95%	0.021%	0.029%
	Background Concentration (µg/m³)	n/a	n/a	0.000788 [(c)]	0.000647 [(c)]	n/a	n/a	n/a	0.000177 [(c)]	n/a	n/a	n/a
	Max PEC as % of AQS	n/a	n/a	97%	16%	n/a	n/a	n/a	1.15%	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.000249	0.0560	**0.000249**	**0.0000166**	0.000249	0.0560	0.0000000872	0.000249	0.0560	0.000249	0.0560
HSR2	Industrial activity off Stapylton Street	0.00152	0.0570	**0.00152**	0.000101	0.00152	0.0570	0.000000456	0.00152	0.0570	0.00152	0.0570
HSR3	Industrial activity off Eston Road	0.000895	0.0553	**0.000895**	0.0000595	0.000895	0.0553	0.000000261	0.000895	0.0553	0.000895	0.0553
HSR4	Residential properties off Cheetham Street	0.00135	0.0546	**0.00135**	0.0000900	0.00135	0.0546	0.000000405	0.00135	0.0546	0.00135	0.0546
HSR5	Residential properties off Elgin Avenue	0.00126	0.0434	**0.00126**	0.0000836	0.00126	0.0434	0.000000377	0.00126	0.0434	0.00126	0.0434
HSR6	Residential properties off Passfield Crescent	0.000816	0.0440	**0.000816**	0.0000542	0.000816	0.0440	0.000000243	0.000816	0.0440	0.000816	0.0440
HSR7	Golden Boy Green Community Centre	0.000730	0.0486	**0.000730**	**0.0000485**	0.000730	0.0486	0.000000216	0.000730	0.0486	0.000730	0.0486
HSR8	Residential properties off Lawson Close	0.000841	0.0504	**0.000841**	0.0000559	0.000841	0.0504	0.000000248	0.000841	0.0504	0.000841	0.0504
HSR9	Industrial activity NNW of Site	0.000897	0.0499	**0.000897**	0.0000596	0.000897	0.0499	0.000000268	0.000897	0.0499	0.000897	0.0499
HSR10	Grangetown Primary School	0.00113	0.0541	**0.00113**	0.0000749	0.00113	0.0541	0.000000337	0.00113	0.0541	0.00113	0.0541
HSR11	Large car park off Tees Dock Road	0.00212	0.0469	**0.00212**	0.000141	0.00212	0.0469	0.000000609	**0.00212**	0.0469	0.00212	0.0469
HSR12	Saint Peter's Catholic College	0.000738	0.0448	**0.000738**	**0.0000490**	0.000738	0.0448	0.000000219	0.000738	0.0448	0.000738	0.0448
HSR13	Tesco Extra store entrance	0.000704	0.0470	**0.000704**	**0.0000468**	0.000704	0.0470	0.000000215	0.000704	0.0470	0.000704	0.0470
HSR14	Industrial activity off Tees Dock Road	0.00103	0.0414	**0.00103**	0.0000687	0.00103	0.0414	0.000000309	0.00103	0.0414	0.00103	0.0414
HSR15	Industrial activity ENE of Site	0.00140	0.0352	**0.00140**	0.0000930	0.00140	0.0352	0.000000419	0.00140	0.0352	0.00140	0.0352
HSR16	Allotments South Garden	0.000523	0.0351	**0.000523**	**0.0000347**	0.000523	0.0351	0.000000154	0.000523	0.0351	0.000523	0.0351

Table 21: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for Group 1, 2 and 3 Metals (cont.)

	Pollutant	**Pb (annual)**	**Mn (annual)**	**Mn (1-hour)**	**Hg (annual)**	**Hg (1-hour)**	**Ni (annual)**	**Tl (annual)**	**Tl (1-hour)**	**V (annual)**	**V (24-hour)**
	AQS (µg/m³)	0.25	1	1,500	0.25	7.5	0.02	1	30	5	1
	Maximum PC (µg/m³)	0.00212	0.00212	0.0570	0.000141	0.00379	**0.00212**	0.000141	0.00379	0.00212	0.0233
	Max PC as % of AQS	0.85%	0.21%	0.0038%	0.056%	0.051%	**11%**	0.014%	0.013%	0.042%	2.33%
	Background Concentration (µg/m³)	n/a	n/a	n/a	n/a	n/a	0.00124 (c)	n/a	n/a	n/a	n/a
	Max PEC as % of AQS	n/a	n/a	n/a	n/a	n/a	17%	n/a	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.000249	0.000249	0.0560	0.0000166	0.00372	**0.000249**	0.0000166	0.00372	0.000249	0.00865
HSR2	Industrial activity off Stapylton Street	0.00152	0.00152	0.0570	0.000101	0.00379	**0.00152**	0.000101	0.00379	0.00152	0.0197
HSR3	Industrial activity off Eston Road	0.000895	0.000895	0.0553	0.0000595	0.00367	**0.000895**	0.0000595	0.00367	0.000895	0.0231
HSR4	Residential properties off Cheetham Street	0.00135	0.00135	0.0546	0.0000900	0.00363	**0.00135**	0.0000900	0.00363	0.00135	0.0182
HSR5	Residential properties off Elgin Avenue	0.00126	0.00126	0.0434	0.0000836	0.00289	**0.00126**	0.0000836	0.00289	0.00126	0.0233
HSR6	Residential properties off Passfield Crescent	0.000816	0.000816	0.0440	0.0000542	0.00292	**0.000816**	0.0000542	0.00292	0.000816	0.0114
HSR7	Golden Boy Green Community Centre	0.000730	0.000730	0.0486	0.0000485	0.00323	**0.000730**	0.0000485	0.00323	0.000730	0.0124
HSR8	Residential properties off Lawson Close	0.000841	0.000841	0.0504	0.0000559	0.00335	**0.000841**	0.0000559	0.00335	0.000841	0.0126
HSR9	Industrial activity NNW of Site	0.000897	0.000897	0.0499	0.0000596	0.00332	**0.000897**	0.0000596	0.00332	0.000897	0.0191
HSR10	Grangetown Primary School	0.00113	0.00113	0.0541	0.0000749	0.00359	**0.00113**	0.0000749	0.00359	0.00113	0.0196
HSR11	Large car park off Tees Dock Road	0.00212	0.00212	0.0469	0.000141	0.00312	**0.00212**	0.000141	0.00312	0.00212	0.0123
HSR12	Saint Peter's Catholic College	0.000738	0.000738	0.0448	0.0000490	0.00298	**0.000738**	0.0000490	0.00298	0.000738	0.0114
HSR13	Tesco Extra store entrance	0.000704	0.000704	0.0470	0.0000468	0.00312	**0.000704**	0.0000468	0.00312	0.000704	0.0148
HSR14	Industrial activity off Tees Dock Road	0.00103	0.00103	0.0414	0.0000687	0.00275	**0.00103**	0.0000687	0.00275	0.00103	0.0126
HSR15	Industrial activity ENE of Site	0.00140	0.00140	0.0352	0.0000930	0.00234	**0.00140**	0.0000930	0.00234	0.00140	0.00956
HSR16	Allotments South Garden	0.000523	0.000523	0.0351	0.0000347	0.00233	**0.000523**	0.0000347	0.00233	0.000523	0.00942

Notes to Table 21

(a) Modelled in accordance with the Step 2 screening guidance (i.e., at the revised emission rate calculated with Cr(VI) comprising 0.03% of the Group 3 metals).

(b) It is worth noting that the maximum predicted PC for As occurs in a car park off Tees Dock Road (i.e., HSR11) and is therefore not necessarily a receptor representative of public exposure. Furthermore, As comprises 5% of the Group 3 metals (which, in line with the Step 2 screening guidance, would give a revised maximum GLC of 0.000102 µg/m³ (i.e., a PC and PEC of 3.38% and 30% of the AQS, respectively)).

(c) Background concentrations taken from the urban industrial site at Scunthorpe Low Santon, 2019 data (refer to Section 3.4., for further details on this monitoring station).

4.3. Results – Remaining Pollutants

4.3.1. This section focuses on all pollutants excluding the Group 1, 2 and 3 Metals which are discussed in Section 4.2.

4.3.2. Based on Stage 1 screening (i.e., long-term PCs greater than 1% of their AQS are potentially significant and short-term PCs greater than 10% of their AQS are potentially significant), all pollutants with short-term averaging periods screened out all locations. Potentially significant impacts were observed at two locations for long term impacts of NO_2 and VOC (as benzene) and 11 locations for PAH (as B[a]P). Consequently, PECs were considered for these pollutants.

4.3.3. Following the calculation of the PECs, impacts of NO_2 and VOC at the two potentially sensitive human receptor locations were classed as 'negligible'. For PAH (as B[a]P), the human receptor location with the highest potentially significant PC could be categorised a 'slight'. Consequently, no further assessments are required.

4.3.4. The results of this assessment may be found in Table 22, with any potentially significant impacts highlighted in bold.

Table 22: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for All Remaining Pollutants

	Pollutant	NO_2 (annual mean)	NO_2 (99.79th %ile)	SO_2 (99.18th %ile)	SO_2 (99.73rd %ile)	SO_2 (99.90th %ile)	PM_{10} (annual)	PM_{10} (90.41st %ile)	$PM_{2.5}$ (annual)	CO (8-hour)	VOC (annual)
	AQS (µg/m³)	40	200	125	350	266	40	50	20	10,000	5
	Maximum PC (µg/m³)	**0.494**	4.86	1.77	4.03	4.77	0.0353	0.103	0.0353	6.18	**0.0706**
	Max PC as % of AQS	**1.24%**	2.43%	1.42%	1.15%	1.79%	0.088%	0.21%	0.18%	0.062%	**1.41%**
	Background Concentration (µg/m³)	24.8 [(a)]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.358 [(a)]
	Max PEC as % of AQS	63%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9%
	IAQM Impact Descriptor	Negligible	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negligible
HSR1	Industrial activity off John Boyle Road	0.0579	2.51	0.514	2.01	3.06	0.00414	0.0179	0.00414	3.71	0.00828
HSR2	Industrial activity off Stapylton Street	0.354	4.86	1.77	4.03	4.77	0.0253	0.103	0.0253	6.18	**0.0506**
HSR3	Industrial activity off Eston Road	0.208	4.49	1.62	3.70	4.49	0.0149	0.0492	0.0149	5.44	0.0298
HSR4	Residential properties off Cheetham Street	0.315	3.87	1.59	3.29	3.78	0.0225	0.0860	0.0225	5.07	0.0450
HSR5	Residential properties off Elgin Avenue	0.293	3.59	1.64	3.05	3.51	0.0209	0.0751	0.0209	4.87	0.0418
HSR6	Residential properties off Passfield Crescent	0.190	3.43	0.856	2.92	3.45	0.0136	0.0559	0.0136	5.17	0.0271
HSR7	Golden Boy Green Community Centre	0.170	2.98	0.750	2.51	2.98	0.0121	0.0506	0.0121	4.53	0.0243
HSR8	Residential properties off Lawson Close	0.196	2.89	0.937	2.43	2.99	0.0140	0.0617	0.0140	3.50	0.0279
HSR9	Industrial activity NNW of Site	0.209	2.81	1.41	2.38	2.95	0.0149	0.0471	0.0149	4.36	0.0298
HSR10	Grangetown Primary School	0.262	2.78	1.25	2.37	2.90	0.0187	0.0710	0.0187	3.58	0.0375
HSR11	Large car park off Tees Dock Road	**0.494**	2.58	1.11	2.20	3.93	0.0353	0.102	0.0353	3.22	**0.0706**
HSR12	Saint Peter's Catholic College	0.172	2.41	0.809	2.02	2.50	0.0123	0.0518	0.0123	2.78	0.0245
HSR13	Tesco Extra store entrance	0.164	2.52	1.25	2.15	2.65	0.0117	0.0407	0.0117	3.40	0.0234
HSR14	Industrial activity off Tees Dock Road	0.240	2.26	0.822	1.94	2.52	0.0172	0.0643	0.0172	2.73	0.0344
HSR15	Industrial activity ENE of Site	0.325	1.94	0.815	1.63	2.61	0.0232	0.0693	0.0232	2.24	0.0465
HSR16	Allotments South Garden	0.122	1.84	0.581	1.55	1.98	0.00869	0.0361	0.00869	2.93	0.0174

Table 22: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for All Remaining Pollutants (cont.)

	Pollutant	NH_3 (annual)	NH_3 (1-hour)	HCl (1 hour)	HF (annual)	HF (1-hour)	PAH (as B[a]P) (annual)	PCB (annual)	PCB (1-hour)	Dioxins & Furans (annual)
	AQS (µg/m³)	180	2,500	750	16	160	0.00025	0.2	6	n/a
	Maximum PC (µg/m³)	0.0706	1.89	1.14	0.00706	0.189	**0.00000706**	0.000000000564	0.0000000151	0.000000000283
	Max PC as % of AQS	0.039%	0.076%	0.15%	0.044%	0.12%	**2.82%**	0.00000028%	0.00000025%	n/a
	Background Concentration (µg/m³)	n/a	n/a	n/a	n/a	n/a	0.000206 [(a)]	n/a	n/a	n/a
	Max PEC as % of AQS	n/a	n/a	n/a	n/a	n/a	85%	n/a	n/a	n/a
	IAQM Impact Descriptor	n/a	n/a	n/a	n/a	n/a	Slight	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.00828	1.86	1.12	0.000828	0.186	0.000000828	0.0000000000661	0.0000000149	0.0000000000331
HSR2	Industrial activity off Stapylton Street	0.0506	1.89	1.14	0.00506	0.189	**0.00000506**	0.000000000404	0.0000000151	0.000000000203
HSR3	Industrial activity off Eston Road	0.0298	1.84	1.10	0.00298	0.184	**0.00000298**	0.000000000238	0.0000000147	0.000000000119
HSR4	Residential properties off Cheetham Street	0.0450	1.81	1.09	0.00450	0.181	**0.00000450**	0.000000000359	0.0000000145	0.000000000180
HSR5	Residential properties off Elgin Avenue	0.0418	1.44	0.866	0.00418	0.144	**0.00000418**	0.000000000334	0.0000000115	0.000000000167
HSR6	Residential properties off Passfield Crescent	0.0271	1.46	0.876	0.00271	0.146	**0.00000271**	0.000000000216	0.0000000117	0.000000000109
HSR7	Golden Boy Green Community Centre	0.0243	1.61	0.968	0.00243	0.161	0.00000243	0.000000000194	0.0000000129	0.0000000000972
HSR8	Residential properties off Lawson Close	0.0279	1.67	1.00	0.00279	0.167	**0.00000279**	0.000000000223	0.0000000134	0.000000000112
HSR9	Industrial activity NNW of Site	0.0298	1.66	1.00	0.00298	0.166	**0.00000298**	0.000000000238	0.0000000133	0.000000000119
HSR10	Grangetown Primary School	0.0375	1.80	1.08	0.00375	0.180	**0.00000375**	0.000000000299	0.0000000143	0.000000000150
HSR11	Large car park off Tees Dock Road	0.0706	1.56	0.934	0.00706	0.156	**0.00000706**	0.000000000564	0.0000000124	0.000000000283
HSR12	Saint Peter's Catholic College	0.0245	1.49	0.893	0.00245	0.149	0.00000245	0.000000000196	0.0000000119	0.0000000000982
HSR13	Tesco Extra store entrance	0.0234	1.56	0.936	0.00234	0.156	0.00000234	0.000000000187	0.0000000125	0.0000000000936
HSR14	Industrial activity off Tees Dock Road	0.0344	1.38	0.825	0.00344	0.138	**0.00000344**	0.000000000274	0.0000000110	0.000000000138
HSR15	Industrial activity ENE of Site	0.0465	1.17	0.702	0.00465	0.117	**0.00000465**	0.000000000371	0.00000000935	0.000000000186
HSR16	Allotments South Garden	0.0174	1.17	0.700	0.00174	0.117	0.00000174	0.000000000139	0.00000000932	0.0000000000696

Notes to Table 22

(a) Refer to Section 3.6., for further details on the background sources utilised.

5. ASSESSMENT OF AIR QUALITY IMPACTS - IMPACT ON HABITAT SITES – CRITICAL LEVELS

5.1. Model Setup

5.1.1. This assessment considered the effect of emissions from the Installation on critical levels for the habitat sites identified in Table 2. Modelling was undertaken with the following settings:

- buildings effects were included;
- complex terrain was included (Terrain File One (which was used for all receptors bar NYM1) and Terrain File Two (which was used for NYM1 only) – see Section 2.17.);
- emission rates for pollutants were as outlined in Table 10a of Section 2.11.;
- stack heights of 90m were used;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data); and
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used.

5.2. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Oxides of Nitrogen

5.2.1. A summary of maximum predicted GLCs of oxides of nitrogen at the identified sensitive habitat sites is presented in Table 23. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 23: Comparison of Maximum Predicted Oxides of Nitrogen Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites – SPAs, SACs, Ramsars and SSSIs

	Pollutant	NO_X (annual mean)	NO_X (24-hour mean)
	Critical Level	30	75
	Maximum PC (µg/m^3)	**0.393**	3.85
	Max PC as % of Critical Level	**1.31%**	5.14%
NYM1	North York Moors - SAC / SPA	0.0316	0.392
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	0.188	3.85
TCC2		**0.393 (1.31%)**	3.35
TCC3		0.247	2.98
TCC4		0.109	2.28
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.178	3.82
TCC6		0.188	2.78

Table 23: Comparison of Maximum Predicted Oxides of Nitrogen Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites – SPAs, SACs, Ramsars and SSSIs (cont.)

	Pollutant	NO_X (annual mean)	NO_X (24-hour mean)
	Critical Level	30	75
	Maximum PC (µg/m³)	**0.393**	3.85
	Max PC as % of Critical Level	**1.31%**	5.14%
TCC7	Teesmouth and Cleveland Coast - SPA / Ramsar	0.101	2.01
TCC8		0.173	2.05
TCC9		**0.312 (1.04%)**	1.75
TCC10		0.100	1.37
TCC11		0.0878	1.11
TCC12		0.0602	1.05
TCC13		0.205	1.22
TCC14	Teesmouth and Cleveland Coast - SSSI	0.0849	1.11

5.2.2. It can be seen from the data in Table 23 that the daily mean oxides of nitrogen PCs are all less 10% of the respective critical level and therefore, are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

5.2.3. For the annual mean oxides of nitrogen PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2 and TCC9. Consequently, PECs will need to be calculated for these receptors.

5.2.4. Making use of the relevant background NO_X concentrations, as outlined in Table 6 of Section 2.8., the PECs for TCC2 and TCC9 are 36.17 µg/m^3 and 28.24 µg/m^3, respectively. The PECs as a percentage of the annual critical level would therefore be 121% (TCC2) and 94% (TCC9).

5.2.5. In accordance with Section 2.22., whilst it can be assumed for TCC9 that there will be no adverse effect (i.e., the PEC is less than 100% of the critical level), the PEC for TCC2 is potentially significant.

5.2.6. The data shows that the ambient background level at TCC2 already exceeds the long-term critical level in the absence of the development (i.e., a concentration that is 119% of the critical level).

5.2.7. This issue was considered further in BSG Ecology's ("BSG") shadow Habitat Regulations Assessment ("sHRA") and their assessment of air quality impacts on Teesmouth and Cleveland Coast SSSSI. The reports are included as Appendix 2 of this report for ease of reference.

5.2.8. In summary, the sHRA concludes:

The habitats at the various modelling points are either intertidal mudflat or are permanently inundated with sea water. Mudflat is not considered to be sensitive to elevated NO_X levels of the magnitude predicted for the proposed development due to the effects of inundation, dilution, tidal mixing and dispersal.

It is also understood that parts of the estuary are subject to dredging in order to maintain a navigable channel. The removal of sediment will by default result in the removal of nutrients contained within those sediments.

Examination of the evidence base for the Teesmouth and Cleveland Coast SPA / Ramsar extension indicates that, whilst some tern species may feed within the estuary (and potentially in the vicinity of the areas where small-scale exceedance of NO_X are predicted), most of the qualifying species are associated with more distant areas. Terns are mainly piscivorous and it is concluded that the predicted air quality changes are not likely to affect prey availability and hence the conservation status of these species.

5.3. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Sulphur Dioxide

5.3.1. A summary of maximum predicted GLCs of sulphur dioxide at the identified sensitive habitat sites are presented in Table 24. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). In Table 24, any significant impacts are highlighted in bold.

Table 24: Comparison of Maximum Predicted Sulphur Dioxide Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	SO_2 (annual mean)
	Critical Level (µg/m³)	20 [(a)]
	Maximum PC (µg/m³)	0.120
	Max PC as % of Critical Level	0.60%
NYM1	North York Moors - SAC / SPA	0.0101
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	0.0574
TCC2		0.120
TCC3		0.0755
TCC4		0.0333
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0545
TCC6		0.0573
TCC7		0.0307
TCC8		0.0536
TCC9		0.0962
TCC10		0.0262
TCC11		0.0226
TCC12		0.0153
TCC13		0.0518
TCC14	Teesmouth and Cleveland Coast - SSSI	0.0216

Notes to Table 24

(a) From a review of the citations for each particular ecological designation, of the range of features noted, lichens and bryophytes are not included. It has therefore been considered that lichens and bryophytes are not important components of the ecological habitat sites modelled, with the critical level of 20 µg/m³ therefore used.

5.3.2. It can be seen from the data in Table 24 that the annual mean sulphur dioxide PCs are all less than 1% of the critical level and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

5.4. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Ammonia

5.4.1. A summary of maximum predicted GLCs of ammonia at the identified sensitive habitat sites are presented in Table in Table 25. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 25: Comparison of Maximum Predicted Ammonia Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	NH_3 (annual mean) - Other Vegetation
	Critical Level (µg/m^3)	3 [a]
	Maximum PC (µg/m^3)	**0.0398**
	Max PC as % of Critical Level	**1.33%**
NYM1	North York Moors – SAC / SPA	0.00337
TCC1	Teesmouth and Cleveland Coast – SPA / SSSI	0.0191
TCC2		**0.0398 (1.33%)**
TCC3		0.0251
TCC4		0.0111
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0181
TCC6		0.0190
TCC7		0.0102
TCC8		0.0178
TCC9		**0.0320 (1.07%)**
TCC10		0.00812
TCC11		0.00701
TCC12		0.00471
TCC13		0.0159
TCC14	Teesmouth and Cleveland Coast - SSSI	0.00666

Notes to Table 25

(a) From a review of the citations for each particular ecological designation, of the range of features noted, lichens and bryophytes are not included. It has therefore been considered that lichens and bryophytes are not important components of the ecological habitat sites modelled, with the critical level of 3 µg/m^3 therefore used.

5.4.2. It can be seen from the data in Table 25 that the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the ecological sites assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2 and TCC9. Consequently, PECs will need to be calculated for these receptors.

5.4.3. The relevant background NH_3 concentrations, See Table 6 of Section 2.8.), for TCC2 and TCC9 are 1.64 µg/m^3 and 1.45 µg/m^3, respectively. The PECs as a percentage of the annual critical level would therefore be 55% (TCC2) and 48% (TCC9). In accordance with Section 2.22., it can therefore be assumed that there will be no adverse effect on the ecological sites assessed (i.e., the PECs are less than 100% of the critical level).

5.5. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Hydrogen Fluoride

5.5.1. A summary of maximum predicted GLCs of hydrogen fluoride at the identified sensitive habitat sites are presented in Table 26. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 26: Comparison of Maximum Predicted Hydrogen Fluoride Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	**HF (weekly mean)**	**HF (daily mean)**
	Critical Level (µg/m³)	0.5	5
	Maximum PC (µg/m³)	**0.0187**	0.0389
	Max PC as % of Critical Level	**3.74%**	0.78%
NYM1	North York Moors - SAC / SPA	0.00238	0.00442
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	**0.0146 (2.92%)**	0.0389
TCC2	Teesmouth and Cleveland Coast - SPA / SSSI	**0.0187 (3.74%)**	0.0337
TCC3	Teesmouth and Cleveland Coast - SPA / SSSI	**0.0120 (2.40%)**	0.0300
TCC4	Teesmouth and Cleveland Coast - SPA / SSSI	**0.0118 (2.37%)**	0.0229
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0149 (2.98%)**	0.0386
TCC6	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0145 (2.90%)**	0.0280
TCC7	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0104 (2.07%)**	0.0203
TCC8	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.00864 (1.73%)**	0.0209
TCC9	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.00808 (1.62%)**	0.0177
TCC10	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.00651 (1.30%)**	0.0140
TCC11	Teesmouth and Cleveland Coast - SPA / Ramsar	0.00452	0.0115
TCC12	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.00514 (1.03%)**	0.0106
TCC13	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.00533 (1.07%)**	0.0126
TCC14	Teesmouth and Cleveland Coast - SSSI	0.00436	0.0119

5.5.2. It can be seen from the data in Table 26 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

5.5.3. For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC1-TCC10 (inclusive) and TCC12 and TCC13 - and are therefore potentially significant. NYM1, TCC11 and TCC14 are less than 1% of the critical level therefore no further assessment is required.

5.5.4. For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m^3 with an elevated background of 0.003 µg/m^3 where there are local anthropogenic emission sources [(31)]. In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m^3) will be used for the purposes of calculating the PECs.

5.5.5. The maximum weekly HF PC occurs at TCC2 and therefore the worst-case PEC would be 0.0217 µg/m^3 (or 4.34% of the weekly critical level). In accordance with Section 2.22., it can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level). Consequently, the same can be concluded for all other locations considered.

(31) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

6. ASSESSMENT OF AIR QUALITY IMPACTS - IMPACT ON HABITAT SITES - DEPOSITION

6.1. Model Setup

6.1.1. This assessment considered the effect of emissions from the Installation on critical loads for the habitat sites identified in Table 2. Modelling was undertaken with the following settings:

- buildings effects were included;
- complex terrain was included (Terrain File One (which was used for all receptors bar NYM1) and Terrain File Two (which was used for NYM1 only) – see Section 2.17);
- emission rates for pollutants were as outlined in Table 10a of Section 2.11.;
- the proposed stack heights of 90m were considered;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data);
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used; and
- the deposition velocities for grassland (see Table 8 of Section 2.9.) were utilised for all ecological sites assessed.

6.2. Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads – European Sites and SSSIs

6.2.1. A summary of maximum predicted nutrient nitrogen deposition rates at the identified European Sites and SSSIs are presented in Table 27. It should be noted that the initial approach was to assess the habitat with the lowest lower and upper critical load. However, further to feedback from Natural England ("NE") via their Discretionary Advice Service ("DAS") on the 13th of January 2022 (a copy of which may be found as Appendix V), it has been advised that a critical load range of 10-15 kgN/ha/yr (reflective of *Coastal stable dune grasslands (calcareous type)*) is more appropriate for TCC1 – TCC14 due to the absence of *Coastal stable dune grasslands (acid type)* at any of the modelled ecological receptors. Habitat Interests considered are as specified in Table 5 in Section 2.7.

6.2.2. It should be noted that, as APIS does not provide data for Ramsar sites, as the Ramsar site (i.e., TCC5 – TCC13) is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, the habitat interest and feature selected for the SPA has also been selected for the Ramsar site considered.

6.2.3. In Table 27, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

Table 27: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	5	10	0.0153	0.31%	0.15%	n/a	n/a	n/a	n/a
	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	5	10	0.0153	0.31%	0.15%	n/a	n/a	n/a	n/a
TCC1	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.106	**1.06%**	0.71%	8.96	9.07	91%	60%
TCC2				0.202	**2.02%**	**1.35%**		9.16	92%	61%
TCC3				0.138	**1.38%**	0.92%		9.10	91%	61%
TCC4				0.0631	0.63%	0.42%	n/a	n/a	n/a	n/a

Table 27: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC5	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.0995	0.99%	0.66%	n/a	n/a	n/a	n/a
TCC6				0.107	**1.07%**	0.71%	8.96	9.07	91%	60%
TCC7				0.0578	0.58%	0.39%	n/a	n/a	n/a	n/a
TCC8				0.0945	0.95%	0.63%	n/a	n/a	n/a	n/a
TCC9				0.168	**1.68%**	**1.12%**	8.4	8.57	86%	57%
TCC10				0.0522	0.52%	0.35%	n/a	n/a	n/a	n/a
TCC11				0.0453	0.45%	0.30%	n/a	n/a	n/a	n/a
TCC12				0.0306	0.31%	0.20%	n/a	n/a	n/a	n/a
TCC13				0.103	**1.03%**	0.69%	9.1	9.20	92%	61%

Table 27: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC14	Coastal stable dune grasslands (calcareous type)	10	15	0.0432	0.43%	0.29%	n/a	n/a	n/a	n/a

Notes to Table 27

(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

6.2.4. It can be seen from the data in Table 27 that, following the calculation of PECs, there are no predicted exceedances for nitrogen deposition at any of the modelled points. Consequently, no further assessment is required.

6.2.5. **Further to discussions with NE, via their DAS, additional modelling and assessment has been undertaken for nutrient nitrogen deposition. Please see Section 10 of this report.**

6.3. Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads – European Sites and SSSIs

6.3.1. A summary of maximum predicted acid deposition rates at the identified European Sites and SSSIs are presented in Table 28. Habitat Interests considered are as specified in Table 5 of Section 2.7., with the deposition velocities for grassland (as outlined in Table 8 of Section 2.9.) utilised for all ecological sites assessed.

6.3.2. In Table 28, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

Table 28: Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CLMaxN (keq/ha/yr)	CLMaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	0.00109	1.36	0.00119	0.18	0.321	0.504	0.183	1.36	0.181	0.45%	n/a	n/a
	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	0.00109	1.36	0.00119	0.18	0.178	0.471	0.150	1.36	0.181	0.48%	n/a	n/a
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	0.00754	1.03	0.00833	0.20	0.856	4.856	4.00	1.04	0.208	0.33%	n/a	n/a
TCC2		0.0157	1.03	0.0173	0.20	0.856	4.856	4.00	1.05	0.217	0.68%	n/a	n/a
TCC3		0.00984	1.03	0.0109	0.20	0.856	4.856	4.00	1.04	0.211	0.43%	n/a	n/a
TCC4		0.00449	1.03	0.00495	0.20	0.856	4.856	4.00	1.03	0.205	0.19%	n/a	n/a

Table 28: Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal											
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	0.00708	1.03	0.00783	0.20	0.856	4.856	4.00	1.04	0.208	0.31%	n/a	n/a
TCC6		0.00759	1.03	0.00838	0.20	0.856	4.856	4.00	1.04	0.208	0.33%	n/a	n/a
TCC7		0.00411	1.03	0.00453	0.20	0.856	4.856	4.00	1.03	0.205	0.18%	n/a	n/a
TCC8		0.00673	1.03	0.00742	0.20	0.856	4.856	4.00	1.04	0.207	0.29%	n/a	n/a
TCC9		0.0120	1.01	0.0132	0.23	0.856	4.856	4.00	1.02	0.243	0.52%	n/a	n/a
TCC10		0.00372	1.03	0.00411	0.20	0.856	4.856	4.00	1.03	0.204	0.16%	n/a	n/a
TCC11		0.00322	1.07	0.00354	0.28	0.856	4.856	4.00	1.07	0.284	0.14%	n/a	n/a
TCC12		0.00218	1.07	0.00239	0.28	0.856	4.856	4.00	1.07	0.282	0.09%	n/a	n/a
TCC13		0.00734	0.75	0.00808	0.25	0.856	4.856	4.00	0.757	0.258	0.20%	n/a	n/a

Notes to Table 28

PC N = Process contribution from Nitrogen and Ammonia (dry deposition only)
PC S = Process contribution from Sulphur (dry deposition) and Hydrogen Chloride (wet and dry deposition)
PEC = Predicted environmental concentration
BG = Background concentration
CL = Critical Load

6.3.3. It can be seen from the data in Table 28 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points. Consequently, no further assessment is required.

7. ASSESSMENT OF AIR QUALITY IMPACTS - PLUME VISIBILITY

7.1. Forecast Visible Plumes

7.1.1. This section of the report describes the potential visible plume impacts from the Installation's A1 and A2 stack. A plume will become visible when water vapour in the plume condenses to form small particles in the form of water droplets. A plume is defined as "visible" if the liquid water content of the plume at the centreline exceeds 0.000015 kg/kg and is defined to have grounded if the vertical spread of the plume is larger than the plume centreline height.

7.1.2. In addition to the input parameters for the model used thus far, the initial mixing ration of the plume in kg/kg (i.e., the mass of water vapour per unit mass of dry release at the source) is also required. This value was provided by HZI and is 0.131 kg/kg.

7.1.3. Plume visibility for the main stack was assessed for the 5 years of observed met data and the one year of NWP met data. All met files include the relative humidity and temperature required for plume visibility calculation.

7.1.4. The modelled lengths of visible vapour plumes are provided in Table 29 for all hours – daytime and night time. No visible groundings were observed for any of the met years.

Table 29: Predicted Visible Plumes

	2016	2017	2018	2019	2020	NWP 2020
Number of Met Lines Used	8480	8681	8637	8660	8686	8615
Number of Visible Plumes	2807	2868	3004	2884	3046	1318
Percentage of Visible Plumes	33%	33%	35%	33%	35%	15%
Average length of visible plumes (m)	73.83	78.77	80.82	73.64	70.11	36.40
Max Length of visible plume (m)	405.46	447.61	499.83	412.44	370.35	297.71

7.1.5. The results of the plume visibility assessment concluded that visible plumes will only occur for a maximum of 35% of the hours in a year. The maximum length of a visible plume from the Installation is 499.83m. However, for the worst-case met year, average visible plumes would be 80.82m in length. It should be noted that this assessment includes night-time hours.

7.1.6. It is also important to consider how often the plumes of varying length will be present for. Table 30 provides the 10-100th Percentile plume lengths for each met year considered. All figures are in meters.

Table 30: 10-100th Percentile Plume Lengths

Percentile	2016	2017	2018	2019	2020	NWP 2020
10th Percentile Plume Length	0	0	0	0	0	0
20th Percentile Plume Length	0	0	0	0	0	0
30th Percentile Plume Length	0	0	0	0	0	0
40th Percentile Plume Length	0	0	0	0	0	0
50th Percentile Plume Length	0	0	0	0	0	0
60th Percentile Plume Length	0	0	0	0	0	0
70th Percentile Plume Length	9	9	16	10	14	0
80th Percentile Plume Length	39	47	54	42	43	0
85th Percentile Plume Length	59	67	73	61	62	0
90th Percentile Plume Length	89	90	98	87	87	19
95th Percentile Plume Length	141	139	144	137	135	42
98th Percentile Plume Length	202	216	215	202	195	68
99th Percentile Plume Length	251	266	267	241	238	92
100th Percentile Plume Length	405	448	500	412	370	298

7.1.7. The results in Table 30 show that for 60% of all hours, no visible plume is forecast to occur. When visible, the plume length is predicted to be short, with a maximum plume length of around 16m for the 70th Percentile of hours as shown in Table 30.

7.1.8. The plume is forecast to extend to a length of up to 144m for the 95th Percentile and, when taking the predominant south-westerly wind direction into consideration (see Section 2.12.) the visible plume would remain within the Installation's boundary for the majority of the time. The eastern and north-eastern Installation boundaries are circa 175m – 185m from the stack locations, respectively.

7.1.9. It should be noted that, as the approximate closest point of the Installation's boundary is circa 90m to the north of the A1 and A2 emission points, the maximum visible plume, regardless of plume direction, would remain within the Installation's boundary 85% of the time.

7.1.10. The nearest potentially sensitive human receptor considered in the assessment would be HSR1 – Industrial activity off John Boyle Road, at a distance of 422m from the Installation's stacks. Consequently, as demonstrated by the 99th Percentile in Table 30, the plume would only visibility extend to the closest potentially sensitive human receptor for up to 1% of the time.

7.1.11. In the absence of EA specific guidance on plume visibility, SEPA's H1 guidance[32], has been used to assess the impact of plume visibility. The screening criteria used is provided in Table 31.

Table 31: Screening Criteria for Plume Visibility

Impact	Quantitative Description
Zero	• No visible impacts resulting from operation of process
Insignificant	• Regular small impact from operation of process • Plume length exceeds boundary less than 5% of daylight hours per year • No sensitive local receptors
Low	• Regular small impact from operation of process • Plume length exceeds boundary less than 5% of daylight hours per year • Sensitive local receptors
Medium	• Regular large impact from operation of process • Plume length exceeds boundary for more than 5% of daylight hours per year • Sensitive local receptors
High	• Continuous large impact from operation of process • Plume length exceeds boundary more than 25% of daylight hours per year • Local sensitive receptors

7.1.12. As the SEPA criteria references daylight hours, the model was re-run excluding hours from 10pm to 4am.

7.1.13. Following the assessment of daylight hours only, the results were similar to those displayed in Tables 29 and 30. For 60% of daylight hours, no visible plume is forecast to occur. When visible, the plume length is predicted to be short, with a maximum plume length of around 16m for the 70th Percentile of hours.

7.1.14. For daylight hours, the plume is forecast to extend to a length of up to 152m for the 95th Percentile and, when taking the predominant south-westerly wind direction into consideration (see Section 2.12.) the visible plume would remain within the Installation's boundary for the majority of the time (the eastern and north-eastern Installation boundaries are circa 175m – 185m from the stack locations, respectively).

7.1.15. The maximum visible plume, regardless of plume direction, would remain within the Installation's boundary 85% of the time, with a visible plume length of 77m for the 85th Percentile of hours.

7.1.16. At the nearest potentially sensitive human receptor considered in the assessment (i.e., HSR1) the 99th Percentile visible plume length for daylight hours would only extend to this receptor for up to 1% of the time.

7.1.17. Consequently, based on the SEPA criteria, the impact of the visible plume for daylight hours would be classed as 'medium' for the following reasons:

- the plume is visible 34% of the time;

[32] IPPC Environmental Assessment and Appraisal of BAT, V6, July 2003

- the plume length exceeds the nearest point of the site boundary distance for more than 5% of hours per year (i.e., for the 90th Percentile, with a value of 103m); and
- there are sensitive local receptors considered.

7.1.18. It should be noted that the area to the north of the Installation's boundary (i.e., the point of the boundary approximately closest to the A1 and A2 emission points) is occupied by industrial land use. Visible plumes would not extend to the vast majority of the human receptor locations assessed and only very seldom would plumes be visible at HSR1.

7.1.19. Consequently, it is likely that the impact of visible plumes could be considered insignificant.

8. ASSESSMENT OF AIR QUALITY IMPACTS - ABNORMAL EMISSIONS

8.1. Scenarios Considered

8.1.1. In order to assess the impact of the plant under abnormal operating conditions, two scenarios have been considered:

- with emissions at the half-hourly emission limits prescribed in Annex VI of the IED,
- and to take account of short-term abnormal conditions permitted under Article 46(6) of the IED.

8.2. Emissions at Half-hourly Emission Limit Values

8.2.1. The dispersion modelling results presented below are based on the Installation operating for all hours in the year with the pollutant concentrations at the daily ELVs prescribed by Annex VI of the IED. This is an extreme assumption, especially for long term predictions since the Installation could never operate with release rates as high as this in practice. Annex VI of the IED also prescribes short-term ELVs for some pollutants based on half hourly average concentrations. However, the frequency with which these limits can be applied are very limited (i.e., for the majority of pollutants with half hourly limits the daily limit value must be complied with for 97% of the time).

8.2.2. Half-hourly limit values apply to total dust (30mg/Nm^3), volatile organic compounds (as benzene) (20mg/Nm^3), hydrogen chloride (60mg/Nm^3), hydrogen fluoride (4mg/Nm^3), sulphur dioxide (200mg/Nm^3) and oxides of nitrogen (as nitrogen dioxide) (400mg/Nm^3). The emission rates for the Installation operating at these half-hourly limits are as displayed in Table 10b of Section 2.11.

8.2.3. Short-term peak concentrations may arise if the Installation emits some pollutants that are at concentrations within the half hourly limit values prescribed in Annex VI of the IED but greater than the daily limit values used for the dispersion modelling. The probability of such occasions occurring at the same time as the meteorological conditions that produce the highest one-hour mean GLCs is remote. However, in the event that this does occur, then the maximum one-hour mean GLCs for these pollutants would be as provided in Table 32, with any potentially significant PCs shown in bold.

Table 32: Maximum Predicted One-hour Concentrations (PCs) for Emissions at the Half- hourly IED Emission Limit Values

Pollutant	Maximum Predicted Hourly Mean GLC (PC) (μg/m^3) (b)	Short-term AQS (μg/m^3)	PC as a %age of Short-term AQS
Particulate Matter (as PM_{10})	7.69	No hourly standard	n/a
VOCs (as Benzene)	5.11	No hourly standard	n/a
Hydrogen Chloride	15.32	750	2.04%
Hydrogen Fluoride	1.02	160	0.64%
Sulphur Dioxide	**51.11**	350	**14.60%**
Nitrogen Dioxide (a)	**35.82**	200	**17.91%**

Notes to Table 32
(a) Assuming 35% of NO_x is oxidised to NO_2 (see Section 2.24. of this document).
(b) Maximum predicted hourly concentration for all hours of the meteorological data set.

8.2.4. With the exception of SO_2 and NO_2, predicted PCs under these worst-case conditions are all less than 10% of their respective AQSs and, in accordance with the short-term significance criterion detailed in Section 2.21. of this document, would be assessed as being not significant.

8.2.5. For SO_2 and NO_2, the maximum predicted short term concentrations are approximately 15% and 18%, respectively. This represents the very worst-case conditions (i.e., these are the highest PCs predicted assuming the Installation emits at the half-hourly average for the entire year and therefore, combines the maximum emission with the worst-case hour of meteorological data). Furthermore, these are the maximum concentrations predicted at any location within the model area. Accordingly, it is considered that, in practice, releases of short-term SO_2 and NO_2 will not be significant. However, even at these concentrations, using the IAQM methodology (as outlined in Section 2.21.), the severity of the impact would be described as 'small' (i.e., the predicted PCs for SO_2 and NO_2 are both between 11-20% of their respective AQSs).

8.2.6. Predicted concentrations at the sensitive human receptors will be substantially lower than this, and, accordingly, will not be significant.

8.3. Emissions Under Abnormal Operating Conditions

8.3.1. Article 46(6) of the IED allows abnormal operation, where the ELVs can be exceeded for certain periods, without being in contravention of the Environmental Permit for the plant. This part of the assessment quantifies the impacts on air quality as a result of changes in emissions during abnormal events.

8.3.2. In the event of any process disruption or mechanical failure, the operator would assess the situation to determine if these abnormal conditions can be remedied without resulting in elevated emissions; this would avoid shutting down the process unnecessarily. Where this is not the case, the operator would reduce/cease fuel loading and commence a controlled shutdown of the combustion plant.

8.3.3. The dispersion modelling assessment for abnormal emissions has been adapted to consider short-term impacts during periods of abnormal operation, assuming abatement plant failure. Article 46(6) of the IED specifies that abatement plant or monitoring failure may not occur for longer than four hours whilst the plant is operating. Therefore, if it is likely that the problem cannot be rectified within four hours then a controlled shut down would be implemented as soon as possible. In addition, the total allowable period in a year for abnormal releases must not exceed sixty hours.

8.3.4. Accordingly, the maximum time period for which a failure can occur is four hours. For carbon monoxide and total organic carbon - VOCs (pollutant indicators of poor combustion conditions) are not allowed to exceed their respective ELVs. Therefore, a four-hour exceedance of the ELVs only applies to total dust (maximum concentration of 150mg/Nm^3, expressed as a half-hourly average), hydrogen chloride, hydrogen fluoride, sulphur dioxide and oxides of nitrogen.

8.3.5. For assessing short-term air quality impacts resulting from abnormal operation, it has been assumed that the plant operates for four hours continuously at the maximum emission concentration (i.e., half-hourly limit or abnormal emission limit). Abnormal emission limits apply to carbon monoxide (100mg/Nm^3) and to total dust (150mg/Nm^3).

8.3.6. For assessing long-term impacts - annual mean GLCs - it has been assumed that the plant operates at sixty hours per year at the maximum permissible emission 3% of the time at the half hour limit where these apply and the remainder at the daily emission limit. On this basis an annual average emission limit has been derived to determine annual average concentrations (refer to Table 10c of Section 2.11., for details).

8.3.7. Emission concentrations for the assessment of abnormal emissions on short-term and long-term predicted concentrations are presented in Table 33. Predicted maximum GLCs are compared to the relevant AQSs in Table 34.

Table 33: Short-term and Long-term Emission Concentrations for Abnormal Releases

Pollutant	Half Hour Limit (mg/Nm^3)	Normal Emission Concentration (mg/Nm^3)	Maximum Emission Concentration (mg/Nm^3)	Assumed Short-term Abnormal Emission Concentration (mg/Nm^3)	Assumed Long-term Abnormal Emission Concentration (mg/Nm^3)
Particulate Matter, as PM_{10}	30	5	150	29.2 [(a)]	5.99 [(b)]
Hydrogen Chloride	60	6	-	60	No Long-term AQS
Hydrogen Fluoride	4	1	-	4	1.02 [(c)]

Table 33: Short-term and Long-term Emission Concentrations for Abnormal Releases (cont.)

Pollutant	Half Hour Limit (mg/Nm³)	Normal Emission Concentration (mg/Nm³)	Maximum Emission Concentration (mg/Nm³)	Assumed Short-term Abnormal Emission Concentration (mg/Nm³)	Assumed Long-term Abnormal Emission Concentration (mg/Nm³)
Sulphur Dioxide	200	30	-	200	No Long-term AQS
Nitrogen Dioxide	400	100	-	400	102.05 (c)
Carbon Monoxide	100	50	150 (d)	100	No Long-term AQS

Notes to Table 33

(a) 4 hours at 150mg/Nm³ and 20 hours at the normal emissions concentration (5mg/Nm³) for comparison with daily mean AQS.

(b) 60 hours at 150mg/Nm³ and the remainder of hours at the normal emission concentration of 5mg/Nm³.

(c) 60 hours at half hour limit and the remainder at the normal emissions concentration.

(d) Ten-minute average.

Table 34: Comparison of Maximum Predicted Pollutant Ground Level Concentrations (PCs) with Air Quality Standards for Abnormal Emissions

Pollutant	Averaging Period	Maximum Predicted GLC (PC) (µg/m³)	AQS (µg/m³)	PC as a %age of AQS
Particulate Matter, as PM_{10}	annual	0.0516	40	0.13%
	24-hour	0.211	50	0.42%
Hydrogen Chloride	1-hour	0.516	750	0.07%
Hydrogen Fluoride	annual	0.00879	16	0.05%
	1-hour	1.02	160	0.64%
Sulphur Dioxide	24-hour	**17.1**	125	**13.71%**
	1-hour	29.0	350	8.28%
	15-minute	**33.6**	266	**12.63%**
Nitrogen Dioxide	annual	**0.615**	40	**1.54%**
	1-hour	**20.9**	200	**10.44%**
Carbon Monoxide	8-hour	14.3	10,000	0.14%

8.3.8. It is evident from the data in Table 34, that PCs of PM_{10}, HCl, HF, 1-hour SO_2 and CO can be considered to be not significant as long term GLCs are less than 1% of the long-term AQS and short term GLCs are less than 10% of the short-term AQS.

8.3.9. For annual NO_2, the maximum predicted annual mean GLC is in excess of 1% of the long-term AQS. For 24-hour and 15-minute SO_2 and 1-hour NO_2 and the short-term PCs are in excess of 10% of the short-term AQSs. Stage 2 screening has, therefore, also been undertaken for these pollutants.

8.3.10. The PEC for annual NO_2 (when using DT R27 (2019 data) as the background air quality source – refer to Table 17 in Section 3.4., for details) would be 25.42μg/m^3 (or 64% of the AQS). Under the IAQM methodology the impact of the maximum predicted annual NO_2 PC, under abnormal operating conditions, would therefore be described as 'negligible'.

8.3.11. The potentially significant short-term concentrations (i.e., for 24-hour and 15-minute SO_2 and 1-hour NO_2), are all within 11% - 20% of their AQSs and therefore the severity of the impact would be described as 'small' in accordance with the IAQM methodology.

8.3.12. For SO_2 and NO_2, the potentially significant impacts are all only just above the significance criterion and represent the very worst-case conditions. Furthermore, these are the maximum concentrations predicted at any location within the model area. Accordingly, it is considered that, in practice, releases of SO_2 and NO_2 will not be significant.

9. IN-COMBINATION ASSESSMENT

9.1. Cumulative Impacts

9.1.1. In addition to the effect of the proposed Installation, there are several other developments in the surrounding area which may have an effect on both human and ecological health when considered in combination. Existing emissions within the area are considered to already be accounted for in background air quality data.

9.1.2. The developments that ECL are aware of (at time of writing), but have been excluded from the assessment are as follows:

- Potential new Energy from Waste ("EfW") site opening in 2026 at the former SSI steelworks site – situated approximately 1.6 km east-northeast from the proposed FCC Installation – this information was obtained from pre-release statements only, no further data is available, consequently this development will not be considered;
- Dockside Road (1) and Dockside Road (2) – Teeside Renewable Energy Centre, operated by PD Ports, is expected to be operational within the next few years. Situated approximately 1.7 km to the west of the proposed Installation, again this information was obtained from pre-release statements only, no further data is available, consequently this development will not be considered.
- Wilton 11 EfW, operated by Suez / Sembcorp. Situated approximately 2.1 km east from the proposed Installation. Despite being operational since around 2018, no data is publicly available in relation to the input data required to model the site within either the HHRA or the ADM. An information request has been sent to the EA however, at time of writing no suitable data is available;
- Haverton Hill household waste recycling centre and North East Energy Recovery Centre, both operated by Suez. Both sites are located approximately 6.5 km to the west from the proposed Installation. It is considered, given their considerable distance from the proposed Installation it will not be necessary to include them in the cumulative assessment; and
- Tees Eco Energy – currently proposed (planning and permitting granted). Situated approximately 6.7 km to the west from the proposed Installation. It is considered, given the considerable distance of Tees Eco Energy from the proposed Installation, it will not be necessary to be included in the cumulative assessment.

9.1.3. The development to be included in the assessment is the Redcar Energy Centre ("REC"). The REC will be situated at land formerly occupied by Redcar Bulk Terminal (approximately 4.8km to the north of the Installation) and is due to be commissioned circa 2024 to 2025. Consequently, the emissions arising from the two stacks associated with its two process lines will be incorporated into the cumulative impact assessment undertaken as part of this study. This will be carried out making use of the emissions data disclosed in the air quality chapter submitted as part of the planning application documentation for REC[33].

[33] Planning Application Reference Number: R/2020/0411/FFM. Available online via: https://planning.redcar-cleveland.gov.uk/Planning/Display?applicationNumber=R%2F2020%2F0411%2FFFM

9.2. Model Setup

9.2.1. This assessment considered the effect of any cumulative emissions arising from the proposed Installation and REC at the maximum point of impact and at potentially sensitive human receptor and ecological locations. Modelling was undertaken with the following settings:

- buildings effects were included. For the REC, the buildings included within the model were those detailed in Table 11.8 of the RPS report: *Chapter 11 Air Quality* – which was submitted as part of the planning application for the REC;
- the modelled grid was as specified in Section 2.19.4;
- complex terrain was included (refer to Terrain File Three of Section 2.17., for further details);
- emission rates for pollutants were as outlined in Table 10a of Section 2.11. for the Installation and as calculated from the stack and emission characteristics detailed in the RPS report for the REC (i.e., Tables 11.9 and 11.10 of the *Chapter 11 Air Quality* report submitted as part of the planning application for the REC);
- stack heights of 90m were considered for the Installation, with stack heights of 80m for REC's two emission points;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data); and
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used.

9.3. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Air Quality Standards

9.3.1. The predicted PCs for each of the pollutants considered in the assessment at the maximum point of impact have been extracted and are presented in Table 35. The data is based on the worst case met data year. It should be noted that the location of the maximum impact may not be in an area where there is a relevant public exposure.

9.3.2. Maximum concentrations are considered potentially significant if the long-term prediction is greater than 1% of the long-term AQS. For short-term predictions, a potentially significant concentration would be greater than 10% of the short-term AQS. In Table 35, any PCs that are above these significance criteria are indicated in bold type.

Table 35: Comparison of Predicted Maximum GLCs with AQSs - Cumulative

Pollutant	Worst Case Met Year	Maximum PC ($\mu g/m^3$)	AQS ($\mu g/m^3$)	PC as a % of AQS
NO_2 (annual mean)	NWP 2020	**2.57**	40	**6.41%**
NO_2 (1 hour, 99.79th percentile)	NWP 2020	10.5	200	5.25%
SO_2 (24 hour, 99.18th percentile)	NWP 2020	5.26	125	4.20%
SO_2 (1 hour, (99.73rd percentile)	NWP 2020	7.46	350	2.13%
SO_2 (15min, 99.90th Percentile)	NWP 2020	8.17	266	3.07%
PM_{10} (annual mean)	NWP 2020	0.154	40	0.39%
PM_{10} (24 hour, 90.41st Percentile)	NWP 2020	0.471	50	0.94%
$PM_{2.5}$ (annual mean)	NWP 2020	0.154	20	0.77%
CO (8 hour, 100th percentile)	2019	12.1	10,000	0.12%
VOC (annual mean)	NWP 2020	**0.308**	5	**6.16%**
NH_3 (annual mean)	NWP 2020	0.308	180	0.17%
NH_3 (1-hour)	2017	3.65	2,500	0.15%
HCl (1-hour)	2017	2.19	750	0.29%
HF (annual mean)	NWP 2020	0.0306	16	0.19%
HF (1-hour)	2017	0.363	160	0.23%
Sb (annual mean)	NWP 2020	0.00944	5	0.19%
Sb (1-hour)	2017	0.112	150	0.07%
As (annual mean)	NWP 2020	**0.00944**	0.003	**314.78%**
Cd (annual mean)	NWP 2020	**0.000559**	0.005	**11.19%**
Cr (annual mean)	NWP 2020	0.00944	5	0.19%
Cr (1-hour)	2017	0.112	150	0.07%
Cr(VI) (annual mean)	NWP 2020	**0.00944**	0.0002	**4721.75%**
Co (annual mean)	NWP 2020	**0.00944**	0.2	**4.72%**
Co (1-hour)	2017	0.112	6	1.86%
Cu (annual mean)	NWP 2020	0.00944	10	0.09%
Cu (1-hour)	2017	0.112	200	0.06%
Pb (annual mean)	NWP 2020	**0.00944**	0.25	**3.78%**

Table 35: Comparison of Predicted Maximum GLCs with AQSs – Cumulative (cont.)

Pollutant	Worst Case Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS
Mn (annual mean)	NWP 2020	0.00944	1	0.94%
Mn (1-hour)	2017	0.112	1,500	0.01%
Hg (annual mean)	NWP 2020	0.000559	0.25	0.22%
Hg (1-hour)	2017	0.00668	7.5	0.09%
Ni (annual mean)	NWP 2020	**0.00944**	0.02	**47.22%**
Tl (annual mean)	NWP 2020	0.000559	1	0.06%
Tl (1-hour)	2017	0.00668	30	0.02%
V (annual mean)	NWP 2020	0.00944	5	0.19%
V (24-hour)	NWP 2020	0.0620	1	6.20%
PAH (as B[a]P) (annual mean)	NWP 2020	**0.0000890**	0.00025	**35.61%**
PCBs (annual mean)	NWP 2020	0.00000000188	0.2	0.0000009%
PCBs (1-hour)	2018	0.0000000232	6	0.0000004%
Dioxins and Furans	NWP 2020	0.00000000123	No Standard Applies	

9.3.3. It can be seen from the data in Table 35, that the cumulative impact varies depending on the pollutant considered. The potentially significant impacts are for long-term (annual):

- NO_2,
- VOC (as benzene),
- As,
- Cd,
- Cr(VI),
- Co,
- Pb,
- Ni, and
- PAH (as B[a]P)

9.3.4. It is important to note that the metals, at this step of the assessment, have each been modelled at their respective ELVs (see Table 10a of Section 2.11., of this report for the Installation and Table 11.10. of the RPS report for REC[34]).

9.3.5. However, it would not be reasonable to assume that each Group 3 metal emits at the maximum ELV for the group. In this regard, the EA has provided guidance on the steps required for assessing the impact of metals emissions (see Section 2.23., of this report). If any of the Group 3 metals exceed 1% of a long-term standard, then the PEC should be compared against the AQS. If the PEC is greater than 100% of the AQS then case specific screening is required. Consequently, background concentrations for As, Cr(VI), Co, Pb and Ni are required. Cd will also be considered with the Group 3 metals.

[34] Refer to Chapter 11, Air Quality of Planning Application Reference Number: R/2020/0411/FFM. Available online via: https://planning.redcar-cleveland.gov.uk/Planning/Display?applicationNumber=R%2F2020%2F0411%2FFFM

9.4. Step 1 and 2 Screening of Group 2 and 3 Metals

9.4.1. Using the background concentrations detailed in Table 14 of Section 3.4., and a background concentration of 0.000647 µg/m^3 for Cd (as also acquired from Scunthorpe Low Santon urban industrial monitoring site (2019 data)), PECs for the potentially significant Group 2 and 3 metals are provided in Table 36. Any PECs greater than 100% of the AQS are highlighted in bold.

Table 36: PECs of Group 3 Metals – Step 1 Screening - Cumulative

Pollutant	Worst Case Met Year	Maximum PC (µg/m^3)	AQS (µg/m^3)	PC as a % of AQS	Background Concentration (µg/m^3)	Maximum PEC (µg/m^3)	PEC as a % of AQS
As (annual mean)	NWP 2020	**0.00944**	0.003	**314.78%**	0.000788	**0.0102**	**341%**
Cd (annual mean)	NWP 2020	**0.000559**	0.005	**11.19%**	0.000647	0.00121	24%
Cr(VI) (annual mean)	NWP 2020	**0.00944**	0.0002	**4721.75%**	0.000749	**0.0102**	**5096%**
Co (annual mean)	NWP 2020	**0.00944**	0.2	**4.72%**	0.000177	0.00962	5%
Pb (annual mean)	NWP 2020	**0.00944**	0.25	**3.78%**	0.0154	0.0248	10%
Ni (annual mean)	NWP 2020	**0.00944**	0.02	**47.22%**	0.00124	0.0107	53%

9.4.2. The data in Table 36 indicates that, although for the majority of pollutants the PECs can be screened out, further screening is required for long-term As and Cr(VI).

9.4.3. Step 2 screening indicates that where the PC exceeds 1% of the long standard, the maximum emissions data in Appendix A of the EA's Group 3 metals assessment guidance can be used to revise the predictions, and the PEC then compared against the AQS. The guidance states that As comprises 5% of the Group 3 metals, and Cr(VI) 0.03%. Consequently, the emission rates for each have been recalculated based on these percentages. The results of the assessment may be found in Table 37.

Table 37: PECs of Group 3 Metals – Step 2 Screening - Cumulative

Pollutant	Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS
As (annual mean)	NWP 2020	**0.000462**	0.003	**15%**	0.000788	0.00125	42%
Cr(VI) (annual mean)	NWP 2020	**0.00000277**	0.0002	**1.4%**	0.000749	**0.000751**	**376%**

9.4.4. The data in Table 37 indicates that, following further screening, the PECs for As can now be screened out.

9.4.5. The PCs for Cr(VI) (as shown in Table 37), whilst significantly lower than the results presented in Table 36 for the Step 1 screening, are still potentially significant, at 1.4% of the AQS.

9.4.6. The maximum predicted annual GLC for Cr(VI), for the cumulative emissions, occurs in an area approximately 500m north of REC (456185 (X), 526429 (Y)) and is therefore, in the context of this modelling study, more likely to be associated with the predicted PCs for REC's two emission points. This was further explored by running the model in groups to be able to differentiate between the predicted PCs associated with the Installation and the predicted PCs associated with REC. For the worst-case met year (i.e., NWP 2020) the annual GLC for Cr(VI) for REC was 0.00000263 µg/m^3 (or 1.31% of the AQS) at 456185 (X), 526429 (Y).

9.4.7. Furthermore, the predicted location of the maximum GLC is not necessarily representative of permanent human exposure as the location is that of grassland and sand dune and lies just outside the boundary of the Teesmouth and Cleveland Coast habitat site. In addition, the worst-case met year is the site-specific NWP data for the Installation and therefore may not be reflective of this very coastal location.

9.4.8. As discussed in Section 2.12., the wind rose for the NWP data, compared to the observed data from Loftus recording station, appears to demonstrate a more significant and focused south-westerly wind. Any differences in the prevailing wind direction, as well as other meteorological effects accounted for, will have a significant impact on the predicted PCs.

9.4.9. Consequently, for Cr(VI), the Step 2 screening results for the five years of met data from Loftus recording station have also been provided for comparison with the NWP 2020 data. These results are presented as Table 38.

Table 38: PECs of As – Step 2 Screening – All Met Years - Cumulative

Pollutant	Met Year	Maximum PC (µg/m³)	AQS (µg/m³)	PC as a % of AQS	Background Concentration (µg/m³)	Maximum PEC (µg/m³)	PEC as a % of AQS
Cr(VI) (annual mean)	2016	0.00000151	0.0002	0.76%	0.000749	**0.000750**	**375%**
	2017	0.00000159		0.80%		**0.000750**	**375%**
	2018	0.00000156		0.78%		**0.000750**	**375%**
	2019	0.00000190		0.95%		**0.000750**	**375%**
	2020	**0.00000210**		**1.05%**		**0.000751**	**375%**
	NWP 2020	**0.00000277**		**1.39%**		**0.000751**	**376%**

9.4.10. It can be seen from the data in Table 38, that for met years 2016 – 2019 (inclusive), the predicted Cr(VI) PCs, following Step 2 screening, would be considered not significant (i.e., the PCs are less than 1% of the AQS).

9.4.11. It should be noted that, whilst the impact of the PCs associated with met years 2020 and NWP 2020 are potentially significant – they only just exceed the AQS when both the Installation and REC (i.e., four emission points in total) have been modelled on a worst-case scenario basis of emitting at the calculated ELV, 24-hours a day, 365 of the year.

9.4.12. In accordance with the IAQM guidance, the severity of impact for the Step 2 screening Cr(IV) PCs for met years 2020 and NWP 2020 would be regarded as 'moderate'. In reality however, the overall emissions arising from the cumulative scenario considered are likely to be much lower during normal operation. Furthermore, the potentially significant PCs only account for a very small percentage of the PEC when being added to a background concentration which is already highly elevated (i.e., 374% of the Cr(IV) AQS).

9.4.13. Consequently, taking the above assessment into consideration, no further assessments are considered necessary for the metals.

9.5. Step 2 Screening of Remaining Pollutants

9.5.1. The long-term impacts of NO_2, VOC and PAH, as displayed in Table 35, also require further assessment. The next stage of the Step 2 impact significance screening process is to compare the long-term pollutant PECs with the criteria outlined in Section 2.21. of this report.

9.5.2. Using the relevant background data discussed in section 3.6., the PEC assessment for annual NO_2, VOC and PAH is shown in Table 39, with any potentially significant PCs indicated in bold.

Table 39: Long-term impacts of NO_2, VOC and PAH – Step 2 Screening - Cumulative

Pollutant	Worst Case Met Year	Maximum PC ($\mu g/m^3$)	AQS ($\mu g/m^3$)	PC as a % of AQS	Background Concentration ($\mu g/m^3$)	Maximum PEC ($\mu g/m^3$)	PEC as a % of AQS	Impact Descriptor
NO_2 (annual mean)	NWP 2020	**2.57**	40	**6%**	24.8	27.37	68%	Slight
VOC (annual mean)	NWP 2020	**0.308**	5	**6%**	0.355	0.663	13%	Slight
PAH (as B[a]P) (annual mean)	NWP 2020	**0.0000890**	0.00025	**36%**	0.000206	0.000295	118%	Substantial

9.5.3. The data in Table 39 indicates that for annual NO_2 and VOC the impact on the environment can be classed as 'slight', in accordance with the IAQM guidance. When using the EA online guidance for screening assessments for emissions to air, further detailed modelling is not required if PECs are less than 70% of the long-term AQS. Although not directly applicable to the detailed modelling stage, the PECs of annual NO_2 and VOC would be considered not significant based on the screening criteria.

9.5.4. For PAH (as B[a]P) the impact on the environment can be classed as 'substantial', in accordance with the IAQM guidance. It is worth noting that, as the maximum predicted annual GLC for PAH (as B[a]P) occurs in an area approximately 500m north of REC (456185 (X), 526429 (Y)) it is suspected, in the context of this modelling study, that the maximum GLC is more likely to be associated with the emissions arising from the REC. This was further explored by running the model in groups to be able to differentiate between the predicted PCs associated with the Installation and the predicted PCs associated with REC. For the worst-case met year (i.e., NWP 2020) the annual GLC for PAH (as B[a]P) for REC was 0.0000874 $\mu g/m^3$ (or 35% of the AQS) at 456185 (X), 526429 (Y).

9.5.5. Furthermore, the predicted location of the maximum GLC is not necessarily representative of permanent human exposure as the location is that of grassland and sand dune and lies just outside the boundary of the Teesmouth and Cleveland Coast habitat site. In addition, the worst-case met year is the site-specific NWP data for the Installation and therefore may not be reflective of this very coastal location.

9.5.6. As discussed in Section 2.12., the wind rose for the NWP data, compared to the observed data from Loftus recording station, appears to demonstrate a more significant and focused south-westerly wind. Any differences in the prevailing wind direction, as well as other meteorological effects accounted for, will have a significant impact on the predicted PCs.

9.5.7. In reality, the overall emissions arising from the cumulative scenario considered are likely to be much lower during normal operation. Furthermore, the potentially significant annual PAH PCs, arising from four stacks modelled on a worst-case scenario basis (i.e., emitting at the maximum ELV 24-hours a day, 365 days of the year), are being added to a background concentration which is already elevated (i.e., 83% of the AQS).

9.5.8. Consequently, taking the above assessment into consideration, no further assessments are considered necessary for annual NO_2, VOC or PAH.

9.6. Assessment of Air Quality Impacts – Potentially Sensitive Human Receptor Locations – Cumulative Impacts

9.6.1. This assessment considered the effect of cumulative emissions from the Installation and REC on the potentially sensitive human receptors identified in Table 1.

9.7. Results – Group 1, 2 and 3 Metals

9.7.1. Due to the number of potentially sensitive human receptors, and the varying screening methodology, the results have been split into two sections. This section focuses on Group 1, 2 and 3 metals only, the remaining pollutants are discussed in Section 9.8.

9.7.2. Based on Stage 1 screening (i.e., long-term PCs greater than 1% of their AQS are potentially significant and short-term PCs greater than 10% of their AQS are potentially significant), all metals with short-term averaging periods screened out. The metals with potentially significant impacts were As, Cd, Cr(VI), Co, Pb and Ni (all annual mean). Consequently, PECs were considered for these metals.

9.7.3. Following calculation of the PECs, all metals with the exception of As and Cr(VI) screened out (i.e., the PECs were all less than 100% of their respective AQSs). Step 2 screening indicates that where the PC exceeds 1% of the long standard, the maximum emissions data in Appendix A of the EA's Group 3 metals assessment guidance can be used to revise the predictions, and the PEC then compared against the AQS. The guidance states that As comprises 5% of the Group 3 metals, and Cr(VI) 0.03%. Consequently, the emission rates for each have been recalculated based on these percentages.

9.7.4. Following Step 2 screening for As and Cr(VI), all Group 1, 2 and 3 metals screen out as being not significant at all potentially sensitive human receptors when assessing the cumulative impacts.

9.7.5. The results of the screening assessments for Group 1, 2 and 3 metals may be found in Table 40, with any potentially significant impacts highlighted in bold.

Table 40: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for Group 1, 2 and 3 Metals – Cumulative Impacts

	Pollutant	**Sb (annual)**	**Sb (1-hour)**	**As (annual) [(a)]**	**Cd (annual)**	**Cr (annual)**	**Cr (1-hour)**	**Cr VI (annual) [(a)]**	**Co (annual)**	**Co (1-hour)**	**Cu (annual)**	**Cu (1-hour)**
	AQS (µg/m³)	5	150	0.003	0.005	5	150	0.0002	0.2	6	10	200
	Maximum PC (µg/m³)	0.00253	0.0769	**0.000126**	**0.000166**	0.00253	0.0769	0.000000756	**0.00253**	0.0769	0.00253	0.0769
	Max PC as % of AQS	0.05%	0.05%	**4.19%**	**3.31%**	0.05%	0.05%	0.38%	**1.27%**	1.28%	0.03%	0.04%
	Background Concentration (µg/m³)	n/a	n/a	0.000788 [(b)]	0.000647 [(b)]	n/a	n/a	n/a	0.000177 [(b)]	n/a	n/a	n/a
	Max PEC as % of AQS	n/a	n/a	30%	16%	n/a	n/a	n/a	1.35%	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.000521	0.0561	0.0000257	0.0000326	0.000521	0.0561	0.000000154	0.000521	0.0561	0.000521	0.0561
HSR2	Industrial activity off Stapylton Street	0.00172	0.0659	**0.0000854**	**0.000113**	0.00172	0.0659	0.000000512	0.00172	0.0659	0.00172	0.0659
HSR3	Industrial activity off Eston Road	0.00116	0.0769	**0.0000575**	**0.0000752**	0.00116	0.0769	0.000000345	0.00116	0.0769	0.00116	0.0769
HSR4	Residential properties off Cheetham Street	0.00155	0.0584	**0.0000769**	**0.000101**	0.00155	0.0584	0.000000462	0.00155	0.0584	0.00155	0.0584
HSR5	Residential properties off Elgin Avenue	0.00143	0.0503	**0.0000713**	**0.0000941**	0.00143	0.0503	0.000000428	0.00143	0.0503	0.00143	0.0503
HSR6	Residential properties off Passfield Crescent	0.00108	0.0592	**0.0000534**	**0.0000698**	0.00108	0.0592	0.000000321	0.00108	0.0592	0.00108	0.0592
HSR7	Golden Boy Green Community Centre	0.000980	0.0508	**0.0000486**	**0.0000634**	0.000980	0.0508	0.000000292	0.000980	0.0508	0.000980	0.0508
HSR8	Residential properties off Lawson Close	0.00108	0.0672	**0.0000538**	**0.0000703**	0.00108	0.0672	0.000000323	0.00108	0.0672	0.00108	0.0672
HSR9	Industrial activity NNW of Site	0.00109	0.0539	**0.0000542**	**0.0000710**	0.00109	0.0539	0.000000325	0.00109	0.0539	0.00109	0.0539
HSR10	Grangetown Primary School	0.00130	0.0589	**0.0000647**	**0.0000853**	0.00130	0.0589	0.000000389	0.00130	0.0589	0.00130	0.0589
HSR11	Large car park off Tees Dock Road	0.00253	0.0478	**0.000126**	**0.000166**	0.00253	0.0478	0.000000756	**0.00253**	0.0478	0.00253	0.0478
HSR12	Saint Peter's Catholic College	0.000965	0.0640	**0.0000479**	**0.0000625**	0.000965	0.0640	0.000000288	0.000965	0.0640	0.000965	0.0640
HSR13	Tesco Extra store entrance	0.000904	0.0616	**0.0000449**	**0.0000585**	0.000904	0.0616	0.000000269	0.000904	0.0616	0.000904	0.0616
HSR14	Industrial activity off Tees Dock Road	0.00135	0.0418	**0.0000669**	**0.0000864**	0.00135	0.0418	0.000000402	0.00135	0.0418	0.00135	0.0418
HSR15	Industrial activity ENE of Site	0.00152	0.0368	**0.0000758**	**0.000100**	0.00152	0.0368	0.000000455	0.00152	0.0368	0.00152	0.0368
HSR16	Allotments South Garden	0.000738	0.0376	**0.0000366**	0.0000475	0.000738	0.0376	0.000000220	0.000738	0.0376	0.000738	0.0376

Table 40: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for Group 1, 2 and 3 Metals – Cumulative Impacts (cont.)

	Pollutant	Pb (annual)	Mn (annual)	Mn (1-hour)	Hg (annual)	Hg (1-hour)	Ni (annual)	Tl (annual)	Tl (1-hour)	V (annual)	V (24-hour)
	AQS (µg/m³)	0.25	1	1,500	0.25	7.5	0.02	1	30	5	1
	Maximum PC (µg/m³)	**0.00253**	0.00253	0.0769	0.000166	0.00503	**0.00253**	0.000166	0.00503	0.00253	0.0249
	Max PC as % of AQS	**1.01%**	0.25%	0.01%	0.07%	0.07%	**13%**	0.017%	0.02%	0.05%	2.49%
	Background Concentration (µg/m³)	0.0154 (b)	n/a	n/a	n/a	n/a	0.00124 (b)	n/a	n/a	n/a	n/a
	Max PEC as % of AQS	7.15%	n/a	n/a	n/a	n/a	19%	n/a	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.000521	0.000521	0.0561	0.0000326	0.00373	**0.000521**	0.0000326	0.00373	0.000521	0.00936
HSR2	Industrial activity off Stapylton Street	0.00172	0.00172	0.0659	0.000113	0.00438	**0.00172**	0.000113	0.00438	0.00172	0.0203
HSR3	Industrial activity off Eston Road	0.00116	0.00116	0.0769	0.0000752	0.00503	**0.00116**	0.0000752	0.00503	0.00116	0.0249
HSR4	Residential properties off Cheetham Street	0.00155	0.00155	0.0584	0.000101	0.00388	**0.00155**	0.000101	0.00388	0.00155	0.0188
HSR5	Residential properties off Elgin Avenue	0.00143	0.00143	0.0503	0.0000941	0.00333	**0.00143**	0.0000941	0.00333	0.00143	0.0232
HSR6	Residential properties off Passfield Crescent	0.00108	0.00108	0.0592	0.0000698	0.00382	**0.00108**	0.0000698	0.00382	0.00108	0.0126
HSR7	Golden Boy Green Community Centre	0.000980	0.000980	0.0508	0.0000634	0.00338	**0.000980**	0.0000634	0.00338	0.000980	0.0128
HSR8	Residential properties off Lawson Close	0.00108	0.00108	0.0672	0.0000703	0.00435	**0.00108**	0.0000703	0.00435	0.00108	0.0156
HSR9	Industrial activity NNW of Site	0.00109	0.00109	0.0539	0.0000710	0.00358	**0.00109**	0.0000710	0.00358	0.00109	0.0191
HSR10	Grangetown Primary School	0.00130	0.00130	0.0589	0.0000853	0.00392	**0.00130**	0.0000853	0.00392	0.00130	0.0199
HSR11	Large car park off Tees Dock Road	**0.00253**	0.00253	0.0478	0.000166	0.00318	**0.00253**	0.000166	0.00318	0.00253	0.0124
HSR12	Saint Peter's Catholic College	0.000965	0.000965	0.0640	0.0000625	0.00414	**0.000965**	0.0000625	0.00414	0.000965	0.0141
HSR13	Tesco Extra store entrance	0.000904	0.000904	0.0616	0.0000585	0.00400	**0.000904**	0.0000585	0.00400	0.000904	0.0166
HSR14	Industrial activity off Tees Dock Road	0.00135	0.00135	0.0418	0.0000864	0.00278	**0.00135**	0.0000864	0.00278	0.00135	0.0124
HSR15	Industrial activity ENE of Site	0.00152	0.00152	0.0368	0.000100	0.00244	**0.00152**	0.000100	0.00244	0.00152	0.00953
HSR16	Allotments South Garden	0.000738	0.000738	0.0376	0.0000475	0.00249	**0.000738**	0.0000475	0.00249	0.000738	0.00951

Notes to Table 40

(a) Modelled in accordance with the Step 2 screening guidance (refer to Section 9.7.3., for details).

(b) Background concentrations taken from the urban industrial site at Scunthorpe Low Santon, 2019 data (refer to Section 3.4., for further details on this monitoring station).

9.8. Results – Remaining Pollutants

9.8.1. This section focuses on all pollutants excluding the Group 1, 2 and 3 Metals which are discussed in Section 9.7.

9.8.2. Based on Stage 1 screening (i.e., long-term PCs greater than 1% of their AQS are potentially significant and short-term PCs greater than 10% of their AQS are potentially significant), all pollutants with short-term averaging periods screened out all locations. Potentially significant impacts were observed at two locations for long term impacts of NO_2, four locations for VOC (as benzene) and all sixteen locations for PAH (as B[a]P). Consequently, PECs were considered for these pollutants.

9.8.3. Following the calculation of the PECs, impacts of NO_2 and VOC at the potentially sensitive human receptor locations were classed as 'negligible'. For PAH (as B[a]P), the human receptor location with the highest potentially significant PC could be categorised a 'slight'. Consequently, no further assessments are required.

9.8.4. The results of this assessment may be found in Table 41, with any potentially significant impacts highlighted in bold.

Table 41: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for All Remaining Pollutants – Cumulative Impacts

	Pollutant	NO_2 (annual mean)	NO_2 (99.79th %ile)	SO_2 (99.18th %ile)	SO_2 (99.73rd %ile)	SO_2 (99.90th %ile)	PM_{10} (annual)	PM_{10} (90.41st %ile)	$PM_{2.5}$ (annual)	CO (8-hour)	VOC (annual)
	AQS (μg/m³)	40	200	125	350	266	40	50	20	10,000	5
	Maximum PC (μg/m³)	**0.604**	4.86	1.86	4.05	4.94	0.0419	0.103	0.0419	6.06	**0.0839**
	Max PC as % of AQS	**1.51%**	2.43%	1.49%	1.16%	1.86%	0.10%	0.21%	0.21%	0.06%	**1.68%**
	Background Concentration (μg/m³)	24.8 [(a)]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.358 [(a)]
	Max PEC as % of AQS	64%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9%
	IAQM Impact Descriptor	Negligible	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negligible
HSR1	Industrial activity off John Boyle Road	0.132	2.59	0.537	2.05	3.10	0.00858	0.0354	0.00858	3.82	0.0172
HSR2	Industrial activity off Stapylton Street	**0.406**	4.85	1.81	3.95	4.82	0.0285	0.103	0.0285	6.06	**0.0569**
HSR3	Industrial activity off Eston Road	0.279	4.86	1.86	4.05	4.94	0.0192	0.0658	0.0192	5.82	0.0384
HSR4	Residential properties off Cheetham Street	0.367	3.91	1.62	3.33	3.81	0.0256	0.0871	0.0256	5.09	**0.0513**
HSR5	Residential properties off Elgin Avenue	0.340	3.62	1.67	3.07	3.56	0.0238	0.0821	0.0238	4.86	0.0475
HSR6	Residential properties off Passfield Crescent	0.260	3.77	0.997	3.10	3.58	0.0178	0.0821	0.0178	5.27	0.0356
HSR7	Golden Boy Green Community Centre	0.237	3.07	0.841	2.53	3.03	0.0162	0.0685	0.0162	4.74	0.0324
HSR8	Residential properties off Lawson Close	0.261	3.44	1.16	2.81	3.55	0.0179	0.0730	0.0179	4.02	0.0359
HSR9	Industrial activity NNW of Site	0.262	2.83	1.41	2.40	3.08	0.0181	0.0502	0.0181	4.51	0.0361
HSR10	Grangetown Primary School	0.310	2.80	1.27	2.38	2.92	0.0216	0.0769	0.0216	3.62	0.0432
HSR11	Large car park off Tees Dock Road	**0.604**	2.93	1.13	2.21	3.70	0.0419	0.103	0.0419	3.26	**0.0839**
HSR12	Saint Peter's Catholic College	0.233	3.11	1.02	2.51	3.88	0.0160	0.0661	0.0160	3.54	0.0319
HSR13	Tesco Extra store entrance	0.218	2.91	1.36	2.42	3.00	0.0150	0.0585	0.0150	3.77	0.0299
HSR14	Industrial activity off Tees Dock Road	0.333	2.44	0.837	1.91	2.72	0.0223	0.0700	0.0223	2.71	0.0446
HSR15	Industrial activity ENE of Site	0.360	1.98	0.813	1.64	2.68	0.0253	0.0683	0.0253	2.25	**0.0506**
HSR16	Allotments South Garden	0.180	2.18	0.696	1.75	2.52	0.0122	0.0521	0.0122	3.07	0.0244

Table 41: Predicted Maximum GLCs at Potentially Sensitive Human Receptors for All Remaining Pollutants – Cumulative Impacts (cont.)

Pollutant		NH_3 (annual)	NH_3 (1-hour)	HCl (1 hour)	HF (annual)	HF (1-hour)	PAH (as B[a]P) (annual)	PCB (annual)	PCB (1-hour)	Dioxins & Furans (annual)
AQS (µg/m³)		180	2,500	750	16	160	0.00025	0.2	6	n/a
Maximum PC (µg/m³)		0.0839	2.55	1.53	0.00838	0.255	**0.0000107**	0.000000000647	0.0000000196	0.000000000336
Max PC as % of AQS		0.05%	0.10%	0.20%	0.05%	0.16%	**4.29%**	0.00000032%	0.00000033%	n/a
Background Concentration (µg/m³)		n/a	n/a	n/a	n/a	n/a	0.000206 [(a)]	n/a	n/a	n/a
Max PEC as % of AQS		n/a	n/a	n/a	n/a	n/a	87%	n/a	n/a	n/a
IAQM Impact Descriptor		n/a	n/a	n/a	n/a	n/a	Slight	n/a	n/a	n/a
HSR1	Industrial activity off John Boyle Road	0.0172	1.86	1.12	0.00171	0.186	**0.00000344**	0.000000000120	0.0000000149	0.0000000000687
HSR2	Industrial activity off Stapylton Street	0.0569	2.19	1.31	0.00569	0.219	**0.00000684**	0.000000000443	0.0000000175	0.000000000228
HSR3	Industrial activity off Eston Road	0.0384	2.55	1.53	0.00383	0.255	**0.00000538**	0.000000000291	0.0000000196	0.000000000154
HSR4	Residential properties off Cheetham Street	0.0513	1.94	1.16	0.00512	0.194	**0.00000628**	0.000000000398	0.0000000155	0.000000000205
HSR5	Residential properties off Elgin Avenue	0.0475	1.67	1.00	0.00475	0.154	**0.00000579**	0.000000000369	0.0000000132	0.000000000190
HSR6	Residential properties off Passfield Crescent	0.0356	1.96	1.17	0.00356	0.170	**0.00000507**	0.000000000270	0.0000000146	0.000000000143
HSR7	Golden Boy Green Community Centre	0.0324	1.69	1.01	0.00324	0.169	**0.00000474**	0.000000000244	0.0000000135	0.000000000130
HSR8	Residential properties off Lawson Close	0.0359	2.22	1.33	0.00358	0.155	**0.00000501**	0.000000000272	0.0000000168	0.000000000144
HSR9	Industrial activity NNW of Site	0.0361	1.79	1.07	0.00361	0.179	**0.00000492**	0.000000000276	0.0000000143	0.000000000145
HSR10	Grangetown Primary School	0.0432	1.96	1.17	0.00431	0.196	**0.00000537**	0.000000000334	0.0000000156	0.000000000173
HSR11	Large car park off Tees Dock Road	0.0839	1.59	0.952	0.00838	0.159	**0.0000107**	0.000000000647	0.0000000127	0.000000000336
HSR12	Saint Peter's Catholic College	0.0319	2.12	1.27	0.00319	0.165	**0.00000455**	0.000000000242	0.0000000159	0.000000000128
HSR13	Tesco Extra store entrance	0.0299	2.04	1.22	0.00299	0.204	**0.00000429**	0.000000000226	0.0000000155	0.000000000120
HSR14	Industrial activity off Tees Dock Road	0.0446	1.39	0.833	0.00445	0.139	**0.00000735**	0.000000000331	0.0000000111	0.000000000179
HSR15	Industrial activity ENE of Site	0.0506	1.22	0.732	0.00505	0.122	**0.00000597**	0.000000000395	0.00000000975	0.000000000202
HSR16	Allotments South Garden	0.0244	1.25	0.749	0.00243	0.121	**0.00000376**	0.000000000182	0.00000000989	0.0000000000977

Notes to Table 41

(a) Refer to Section 3.6., for further details on the background sources utilised.

9.9. Assessment of Air Quality Impacts – Impact on Habitat Sites – Critical Levels

9.9.1. This assessment considered the effect of cumulative emissions from the Installation and REC on critical levels for the habitat sites identified in Table 2.

9.10. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Oxides of Nitrogen

9.10.1. A summary of maximum predicted GLCs of oxides of nitrogen at the identified sensitive habitat sites is presented in Table 42. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 42: Comparison of Maximum Predicted Oxides of Nitrogen Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	NO_X (annual mean)	NO_X (24-hour mean)
	Critical Level (µg/m³)	30	75
	Maximum PC (µg/m³)	**0.827**	5.99
	Max PC as % of Critical Level	**2.76%**	7.98%
NYM1	North York Moors - SAC / SPA	0.0549	0.572
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	0.252	3.88
TCC2		**0.573**	3.37
TCC3		**0.383**	2.99
TCC4		0.157	2.27
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.235	3.83
TCC6		0.236	2.79
TCC7		0.147	2.01
TCC8		**0.357**	3.33
TCC9		**0.598**	5.99
TCC10		0.133	1.39
TCC11		0.230	4.26
TCC12		0.127	1.99
TCC13		**0.827**	5.14
TCC14	Teesmouth and Cleveland Coast – SSSI	**0.300**	3.63

9.10.2. It can be seen from the data in Table 42 that the daily mean oxides of nitrogen PCs are all less than 10% of the respective critical level and therefore, are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

9.10.3. For the annual mean oxides of nitrogen PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2, TCC3, TCC8, TCC9, TCC13 and TCC14. Consequently, PECs will need to be calculated for these receptors.

9.10.4. Using the background NO_X concentrations, provided in Table 6 of Section 2.8., the PEC assessment for TCC2, TCC3, TCC8, TCC9, TCC13 and TCC14 is shown in Table 43.

Table 43: Comparison of Maximum Predicted Oxides of Nitrogen PECs with Critical Levels at Sensitive Habitat Sites

ADMS Ref. (a)	Annual NO_X PC (µg/m³)	CL (µg/m³)	Annual NO_X PC as %age of CL	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL
TCC2	**0.573**	30	**1.91%**	35.78	36.35	**121%**
TCC3	**0.383**		**1.28%**	35.78	36.16	**121%**
TCC8	**0.357**		**1.19%**	49.10	49.46	**165%**
TCC9	**0.598**		**1.99%**	27.93	28.53	95%
TCC13	**0.827**		**2.76%**	21.52	22.35	74%
TCC14	**0.300**		**1.00%**	24.14	24.44	81%

Notes to Table 43
(a) Refer to Section 2.4., for further details regarding the receptor name and designation.
CL = Critical Level.

9.10.5. It can be seen from the results in Table 43, and in accordance with Section 2.22., that whilst it can be assumed for TCC9, TCC13 and TCC14 that there will be no adverse effect (i.e., the PECs are less than 100% of the critical level), the PECs for TCC2, TCC3 and TCC8 are potentially significant.

9.10.6. The data shows that the ambient background levels at TCC2, TCC3 and TCC8 already exceed the long-term critical level in the absence of the development (i.e., a concentration that is 119% of the critical level at TCC2 and TCC3 and a concentration that is 164% of the critical at TCC8).

9.10.7. As discussed in Section 5.2., BSG have provided the following assessment, (see BSG's reports in Appendix 2):

The habitats at the various modelling points are either intertidal mudflat or are permanently inundated with sea water. Mudflat is not considered to be sensitive to elevated NO_X levels of the magnitude predicted for the proposed development due to the effects of inundation, dilution, tidal mixing and dispersal.

It is also understood that parts of the estuary are subject to dredging in order to maintain a navigable channel. The removal of sediment will by default result in the removal of nutrients contained within those sediments.

Examination of the evidence base for the Teesmouth and Cleveland Coast SPA / Ramsar extension indicates that, whilst some tern species may feed within the estuary (and potentially in the vicinity of the areas where small-scale exceedance of NO_X are predicted), most of the qualifying species are associated with more distant areas. Terns are mainly piscivorous and it is concluded that the predicted air quality changes are not likely to affect prey availability and hence the conservation status of these species.

9.11. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Sulphur Dioxide

9.11.1. A summary of maximum predicted GLCs of sulphur dioxide at the identified sensitive habitat sites are presented in Table 44. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 44: Comparison of Maximum Predicted Sulphur Dioxide Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	**SO_2 (annual mean)**
	Critical Level (µg/m³)	20 [(a)]
	Maximum PC (µg/m³)	**0.215**
	Max PC as % of Critical Level	**1.08%**
NYM1	North York Moors - SAC / SPA	0.0164
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	0.0739
TCC2		0.166
TCC3		0.109
TCC4		0.0460
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0691
TCC6		0.0699
TCC7		0.0430
TCC8		0.0991
TCC9		0.169
TCC10		0.0399
TCC11		0.0634
TCC12		0.0362
TCC13		**0.215**
TCC14	Teesmouth and Cleveland Coast – SSSI	0.0728

Notes to Table 44

(a) From a review of the citations for each particular ecological designation, of the range of features noted, lichens and bryophytes are not included. It has therefore been considered that lichens and bryophytes are not important components of the ecological habitat sites modelled, with the critical level of 20 µg/m³ therefore used.

9.11.2. It can be seen from the data in Table 44 that, with the exception of TCC13, the annual mean sulphur dioxide PCs are all less than 1% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

9.11.3. For the annual mean sulphur dioxide PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC13. It should be noted that the latest background SO_2 concentration at TCC13, as reported by APIS (refer to Table 6 of Section 2.8., for details), is 0 µg/m^3. However, it is suspected this value is erroneous and in the interest of being conservative the SO_2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m^3 will be used for calculating the SO_2 PECs for TCC13.

9.11.4. Consequently, with a PEC of 2.60 µg/m^3 (or 13% of the critical level) at TCC13, it can be assumed there will be no adverse effect (i.e., the PEC is less than 100% of the critical level).

9.12. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Ammonia

9.12.1. A summary of maximum predicted GLCs of ammonia at the identified sensitive habitat sites are presented in Table in Table 45. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 45: Comparison of Maximum Predicted Ammonia Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	**NH_3 (annual mean) - Other Vegetation**
	Critical Level (µg/m^3)	3 [(a)]
	Maximum PC (µg/m^3)	**0.0717**
	Max PC as % of Critical Level	**2.39%**
NYM1	North York Moors – SAC / SPA	0.00545
TCC1	Teesmouth and Cleveland Coast – SPA / SSSI	0.0246
TCC2		**0.0552**
TCC3		**0.0361**
TCC4		0.0153
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0230
TCC6		0.0232
TCC7		0.0143
TCC8		**0.0330**
TCC9		**0.0561**
TCC10		0.0133
TCC11		0.0211
TCC12		0.0121

Table 45: Comparison of Maximum Predicted Ammonia Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites (cont.)

	Pollutant	NH_3 (annual mean) - Other Vegetation
	Critical Level (µg/m³)	3 [(a)]
	Maximum PC (µg/m³)	**0.0717**
	Max PC as % of Critical Level	**2.39%**
TCC13	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0717**
TCC14	Teesmouth and Cleveland Coast – SSSI	0.0223

Notes to Table 45

(a) From a review of the citations for each particular ecological designation, of the range of features noted, lichens and bryophytes are not included. It has therefore been considered that lichens and bryophytes are not important components of the ecological habitat sites modelled, with the critical level of 3 µg/m³ therefore used.

9.12.2. It can be seen from the data in Table 45 that the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the ecological sites assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2, TCC3, TCC8, TCC9 and TCC13. Consequently, PECs will need to be calculated for these receptors.

9.12.3. Using the relevant background NH_3 concentrations, provided in Table 6 of Section 2.8., the PEC assessment for TCC2, TCC3, TCC8, TCC9 and TCC13 is shown in Table 46.

Table 46: Comparison of Maximum Predicted NH_3 PECs with Critical Levels at Sensitive Habitat Sites

ADMS Ref. [(a)]	Annual NH_3 PC (µg/m³)	CL (µg/m³)	Annual NH_3 PC as %age of CL	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL
TCC2	**0.0552**	3	**1.84%**	1.60	1.66	55%
TCC3	**0.0361**		**1.20%**	1.60	1.64	55%
TCC8	**0.0330**		**1.10%**	1.60	1.63	54%
TCC9	**0.0561**		**1.87%**	1.42	1.48	49%
TCC13	**0.0717**		**2.39%**	0.89	0.962	32%

Notes to Table 46

(b) Refer to Section 2.4., for further details regarding the receptor name and designation.

CL = Critical Level.

9.12.4. As displayed by the results in Table 46, and in accordance with Section 2.22., it can be assumed that there will be no adverse effect on the ecological sites assessed (i.e., the PECs are all less than 100% of the critical level).

9.13. Comparison of Maximum Predicted Pollutant Ground Level Concentrations with Critical Levels for the Protection of Vegetation and Ecosystems - Hydrogen Fluoride

9.13.1. A summary of maximum predicted GLCs of hydrogen fluoride at the identified sensitive habitat sites are presented in Table 47. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs (see Section 2.22. of this document). Any significant impacts are highlighted in bold.

Table 47: Comparison of Maximum Predicted Hydrogen Fluoride Ground Level Concentrations (PCs) with Critical Levels at Sensitive Habitat Sites

	Pollutant	HF (weekly mean)	HF (daily mean)
	Critical Level (µg/m³)	0.5	5
	Maximum PC (µg/m³)	**0.0190**	0.0500
	Max PC as % of Critical Level	**3.81%**	1.00%
NYM1	North York Moors - SAC / SPA	0.00383	0.00579
TCC1	Teesmouth and Cleveland Coast - SPA / SSSI	**0.0146**	0.0390
TCC2		**0.0186**	0.0339
TCC3		**0.0121**	0.0301
TCC4		**0.0120**	0.0229
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0150**	0.0387
TCC6		**0.0148**	0.0281
TCC7		**0.0107**	0.0203
TCC8		**0.0133**	0.0277
TCC9		**0.0177**	0.0500
TCC10		**0.00656**	0.0141
TCC11		**0.0135**	0.0355
TCC12		**0.00769**	0.0166
TCC13		**0.0177**	0.0428
TCC14	Teesmouth and Cleveland Coast – SSSI	**0.0190**	0.0302

9.13.2. It can be seen from the data in Table 47 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

9.13.3. For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC1- TCC14, inclusive, and are therefore potentially significant. For NYM1 the long-term significance criteria has not been exceeded (being less than 1% of the critical level).

9.13.4. For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m^3 with an elevated background of 0.003 µg/m^3 where there are local anthropogenic emission sources [35]. In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m^3) will be used for the purposes of calculating the PECs.

9.13.5. The maximum weekly HF PC occurs at TCC14 and therefore the worst-case PEC would be 0.0220 µg/m^3 (or 4.41% of the weekly critical level). In accordance with Section 2.22., it can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

9.14. Assessment of Air Quality Impacts – Impacts on Habitat Sites – Deposition

9.14.1. Sections 9.15. and 9.16. considered the effect of cumulative emissions from the Installation and REC on critical loads for the habitat sites identified in Table 2. The deposition velocities for grassland (as outlined in Table 8 of Section 2.9.) were utilised for all ecological sites assessed.

9.15. Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads – European Sites and SSSIs

9.15.1. A summary of maximum predicted nutrient nitrogen deposition rates at the identified European Sites and SSSIs are presented in Table 48. Refer to Section 6.2.1., for an explanation as to the Critical Load ranges selected in the assessment. Habitat Interests considered are as specified in Table 5 of Section 2.7.

9.15.2. It should be noted that, as APIS does not provide data for Ramsar sites, as the Ramsar site (i.e., TCC5 – TCC13) is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, the habitat interest and feature selected for the SPA has also been selected for the Ramsar site considered.

9.15.3. In Table 48, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

(35) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

Table 48: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	5	10	0.0248	0.50%	0.25%	n/a	n/a	n/a	n/a
NYM1	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	5	10	0.0248	0.50%	0.25%	n/a	n/a	n/a	n/a
TCC1	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.135	**1.35%**	0.90%	8.96	9.09	91%	n/a
TCC2	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.280	**2.80%**	**1.86%**	8.96	9.24	92%	62%
TCC3	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.197	**1.97%**	**1.31%**	8.96	9.16	92%	61%
TCC4	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.0835	0.83%	0.56%	n/a	n/a	n/a	n/a

Table 48: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [a] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC5	Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	10	15	0.125	**1.25%**	0.83%	8.96	9.09	91%	61%
TCC6				0.128	**1.28%**	0.85%		9.09	91%	61%
TCC7				0.0776	0.78%	0.52%	n/a	n/a	n/a	n/a
TCC8				0.180	**1.80%**	**1.20%**	8.96	9.14	91%	61%
TCC9				0.308	**3.08%**	**2.05%**	8.4	8.71	87%	58%
TCC10				0.0668	0.67%	0.45%	n/a	n/a	n/a	n/a
TCC11				0.117	**1.17%**	0.78%	10.78	10.90	**109%**	73%
TCC12				0.0618	0.62%	0.41%	n/a	n/a	n/a	n/a
TCC13				0.418	**4.18%**	**2.79%**	9.1	9.52	95%	63%

Table 48: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC14	Coastal stable dune grasslands (calcareous type)	10	15	0.151	**1.51%**	**1.01%**	10.78	10.93	**109%**	73%

Notes to Table 48
(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

9.15.4. It can be seen from the data in Table 48 that, following the calculations of the PECs, there are predicted exceedances for nitrogen deposition at modelling points TCC11 and TCC14, with the remaining sites screening out as insignificant.

9.15.5. It is worth noting that the background levels are already elevated and exceed the lower critical load for both TCC11 and TCC14 in the absence of the predicted process contributions from the Installation and REC. This point is further raised by NE in their DAS (see Appendix V for a copy of the full DAS):

Given that the predicted exceedance is small and should be taken in the context with the elevated background concentrations, Natural England does not require further information at this stage.

9.15.6. **Further to discussions with NE, via their DAS, additional modelling and assessment has been undertaken for nutrient nitrogen deposition. Please see Section 10 of this report.**

9.16. Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads – European Sites and SSSIs

9.16.1. A summary of maximum predicted acid deposition rates at the identified European Sites and SSSIs are presented in Table 49. Habitat Interests considered are as specified in Table 5 of Section 2.7., with the deposition velocities for grassland (as outlined in Table 8 of Section 2.9.) utilised for all ecological sites assessed.

9.16.2. In Table 49, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

Table 49: Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	0.00176	1.36	0.00190	0.18	0.321	0.504	0.183	1.36	0.182	0.73%	n/a	n/a
	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	0.00176	1.36	0.00190	0.18	0.178	0.47	0.150	1.36	0.182	0.78%	n/a	n/a
TCC1	Teesmouth and Cleveland Coast – SPA Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	0.00961	1.03	0.0105	0.20	0.856	4.856	4.00	1.04	0.211	0.41%	n/a	n/a
TCC2		0.0217	1.03	0.0237	0.20	0.856	4.856	4.00	1.05	0.224	0.93%	n/a	n/a
TCC3		0.0140	1.03	0.0152	0.20	0.856	4.856	4.00	1.04	0.215	0.60%	n/a	n/a
TCC4		0.00594	1.03	0.00648	0.20	0.856	4.856	4.00	1.04	0.206	0.26%	n/a	n/a

Table 49: Comparison of Maximum Predicted Acid Deposition Rates with Critical Loads at Sensitive Habitat Sites – European Sites and SSSIs (cont.)

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC1 – TCC4 & TCC14	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal											
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type)	0.00891	1.03	0.00977	0.20	0.856	4.856	4.00	1.04	0.210	0.38%	n/a	n/a
TCC6		0.00912	1.03	0.0100	0.20	0.856	4.856	4.00	1.04	0.210	0.39%	n/a	n/a
TCC7		0.00553	1.03	0.00602	0.20	0.856	4.856	4.00	1.04	0.206	0.24%	n/a	n/a
TCC8		0.0128	1.03	0.0139	0.20	0.856	4.856	4.00	1.04	0.214	0.55%	n/a	n/a
TCC9		0.0219	1.01	0.0238	0.23	0.856	4.856	4.00	1.03	0.254	0.94%	n/a	n/a
TCC10		0.00476	1.03	0.00520	0.20	0.856	4.856	4.00	1.03	0.205	0.21%	n/a	n/a
TCC11		0.00829	1.07	0.00894	0.28	0.856	4.856	4.00	1.08	0.289	0.35%	n/a	n/a
TCC12		0.00440	1.07	0.00475	0.28	0.856	4.856	4.00	1.07	0.285	0.19%	n/a	n/a
TCC13		0.0298	0.75	0.0318	0.25	0.856	4.856	4.00	0.780	0.282	0.79%	n/a	n/a

Notes to Table 49

PC N = Process contribution from Nitrogen and Ammonia (dry deposition only)

PC S = Process contribution from Sulphur (dry deposition) and Hydrogen Chloride (wet and dry deposition)

PEC = Predicted environmental concentration

BG = Background concentration

CL = Critical Load

9.16.1. It can be seen from the data in Table 28 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points. Consequently, no further assessment is required.

10. NATURAL ENGLAND – DISCRETIONARY ADVICE SERVICE

10.1. Meeting Summary

10.1.1. As discussed in Sections 6 and 9 of this report, there have been predicted exceedances of long-term NO_X and nutrient nitrogen deposition on the Teesmouth and Cleveland Coast habitat site. Consequently, a meeting was held with NE's DAS, on the 24th of November 2021 (refer to Appendix III for the meeting minutes) to discuss this in further detail.

10.1.2. During the meeting ECL discussed the nutrient nitrogen deposition results (see Sections 6.2. and 9.15.) and drew reference to the fact that the NH_3 contributions, making up the majority of the combined PCs, were likely being dramatically overestimated. Further to Table 27 of Section 6.2., Table 50 displays the breakdown of the predicted PCs on nutrient nitrogen deposition, for the ecological sites with potentially significant impacts.

Table 50: Nutrient Nitrogen Deposition Breakdown for Sites with Potentially Significant Impacts – Installation Only (BAT-AELs)

ADMS Ref.	NO_2 PC (kgN/Ha/Yr)	NH_3 PC (kgN/Ha/Yr)	Total PC (kgN/Ha/Yr)	% Contribution from NO_2	% Contribution from NH_3
TCC1	0.0189	0.0870	0.106	18%	82%
TCC2	0.0395	0.162	0.202	20%	80%
TCC3	0.0248	0.113	0.138	18%	82%
TCC5	0.0179	0.0815	0.0995	18%	82%
TCC6	0.0189	0.0877	0.107	18%	82%
TCC8	0.0174	0.0771	0.0945	18%	82%
TCC9	0.0314	0.137	0.168	19%	81%
TCC13	0.0206	0.0825	0.103	20%	80%

10.1.3. It can be seen from the data in Table 50 that, when using emission rates for NO_X and NH_3 calculated from the BAT-AELs (as displayed in Table 10a of Section 2.11.), the predicted NH_3 concentration on nutrient nitrogen deposition is significantly higher than that from NO_2.

10.1.4. ECL therefore suggested undertaking additional modelling for emissions of NO_X and NH_3, using emission rates calculated from monitored data (as opposed to the BAT-AELs), as based on previous experience, actual NH_3 emissions are significantly lower than the BAT-AEL.

10.1.5. It was considered that this approach would be more reflective of the ERF's normal operating regime and therefore a more realistic predicted nutrient nitrogen deposition rate. NE agreed this would be helpful in their assessment of impact for the modelled ecological sites with predicted exceedances. Consequently, further assessment was undertaken.

10.2. Revised Emissions Data

10.2.1. Further to discussion with the technology provider, HZI, emissions data was provided based on monitoring undertaken for a similar FCC/HZI plant in Edinburgh, the Millerhill Resource and Energy Recovery Centre (a copy of which may be found as Appendix IV).

10.2.2. It should be noted that the current ELV for NO_X for Millerhill is 200mg/Nm^3, however tests have been undertaken with the 1-hour NO_X concentration being reduced to 130 mg/Nm^3 (dry, 11% O_2). At this concentration, the 1-hour NH_3 concentration was 1.5 mg/Nm^3 (dry, 11% O_2). Based on this testing, and in the interest of providing a conservative assessment, HZI would expect that, with the plant operating at the lower NO_X ELV of 100mg/Nm^3, NH_3 concentrations would be in the order of 3.5mg/Nm^3.

10.2.3. Consequently, the emission rate for NH_3 has been calculated as 0.148 g/s for both the A1 and A2 emission points (See Section 2.11 for all stack emissions characteristics).

10.3. Additional Scenarios – Nutrient Nitrogen Deposition

10.3.1. Additional modelled runs were performed to expand on the results displayed in both Section 6.2. (i.e., the Installation only scenario) and Section 9.15. (i.e., the in-combination assessment of the Installation's and REC's emissions).

10.3.2. The only specified points considered for this assessment were the specified points for the Teesmouth and Cleveland Coast habitat site (i.e., TCC1 – TCC14, inclusive) for emissions of annual NO_X and NH_3 (i.e., to calculate the revised predicted nutrient nitrogen deposition rates).

10.3.3. A revised output grid (see Section 10.4.) was also modelled to provide additional isopleths to assist with the ecological assessment of impact.

10.4. Model Setup

10.4.1. The additional modelling was undertaken with the following settings:

- buildings effects were included. Refer to Section 2.16., for the Installation. For the REC, the buildings included within the model were those detailed in Table 11.8 of the RPS report: *Chapter 11 Air Quality* – which was submitted as part of the planning application for the REC;
- the revised modelled grid sizing was 7km by 7km (in order to capture the predicted pollutant GLCs arising from both the Installation in isolation and the in-combination scenario (i.e., with REC included)). The grid coordinates were X = 450325 to 457325 and Y = 519912 to 526912, with 701 nodes along each axis (i.e., a grid spacing of 10m);
- complex terrain was included. Further to Section 2.17., a fourth terrain file was created. To capture the output grid as detailed above, and the specified points for Teesmouth and Cleveland Coast habitat site within this area (i.e., TCC1 – TCC14), terrain data was used for an area of 8km by 8km (with an ADMS grid resolution of 64 x 64);
- emission rates for NO_X, for the Installation, were as outlined in Table 10a of Section 2.11. For NH_3, the emissions rates for the Installation were as outlined in Section 10.2.3. For the REC the emission characteristics were as detailed in the RPS report (i.e., Tables

11.9 and 11.10 of the *Chapter 11 Air Quality* report submitted as part of the planning application for the REC);

- stack heights of 90m were considered for the Installation, with stack heights of 80m for REC's two emission points;
- a surface roughness of 0.5m was used for the dispersion site and 0.3m for the met measurement site (a value of 0.5m was used for the dispersion site and met measurement site when using the 2020 NWP met data); and
- 5 years of hourly sequential meteorological data from Loftus recording station for the period 2016 – 2020 (inclusive) and 2020 NWP data was used.

10.5. Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads – TCC1 – TCC14 (Installation Only - Revised NH_3 Data)

10.5.1. A summary of maximum predicted nutrient nitrogen deposition rates, based on the revised NH_3 concentrations, at modelled points TCC1 – TCC14 (inclusive), are presented in Table 51. Refer to Section 6.2.1., for an explanation as to the Critical Load ranges selected in the assessment. Habitat Interests considered are as specified in Table 5 in Section 2.7. This section considers the FCC Installation in isolation.

10.5.2. It should be noted, as APIS does not provide data for Ramsar sites, as the Ramsar site (i.e., TCC5 – TCC14) is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, the habitat interest and feature selected for the SPA has also been selected for the Ramsar site considered.

10.5.3. In Table 51, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

Table 51: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC14 (Installation Only)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)
TCC1	Teesmouth and Cleveland Coast – SPA & SSSI (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0524	0.524%	0.349%	n/a	n/a
TCC2				0.0964	0.964%	0.643%	n/a	n/a
TCC3				0.0637	0.637%	0.425%	n/a	n/a
TCC4				0.0285	0.285%	0.190%	n/a	n/a
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0482	0.482%	0.321%	n/a	n/a
TCC6				0.0469	0.469%	0.313%	n/a	n/a
TCC7				0.0260	0.260%	0.173%	n/a	n/a
TCC8				0.0437	0.437%	0.291%	n/a	n/a
TCC9				0.0786	0.786%	0.524%	n/a	n/a

Table 51: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC14 (Installation Only) (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)
TCC10	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0239	0.239%	0.159%	n/a	n/a
TCC11				0.0216	0.216%	0.144%	n/a	n/a
TCC12				0.0164	0.164%	0.109%	n/a	n/a
TCC13				0.0492	0.492%	0.328%	n/a	n/a
TCC14	Teesmouth and Cleveland Coast (SSSI Coastal stable dune grasslands (calcareous type))	10	15	0.0204	0.204%	0.136%	n/a	n/a

<u>Notes to Table 51</u>

(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

10.5.1. It can be seen from the data in Table 51 that the maximum nutrient nitrogen deposition rates due to the Installation's PCs, with the revised NH_3 emission rates, are now less than 1% of the critical load at all the modelled points.

10.5.2. To assist with the ecological assessment of impact, additional isopleths have been created based on the revised output grid (as detailed in Section 10.4.). Figure 33 provides the nutrient nitrogen deposition rates in the area surrounding the modelled points for Teesmouth and Cleveland Coast habitat site.

10.5.3. In addition, Figure 34 has been included to allow for comparison to be made between the NH_3 emissions at the revised concentration and the NH_3 emissions at the BAT-AELs (i.e., as per Section 6.2.). Please note that, for consistency with Figure 33, the grid extent and terrain file for the emissions at the BAT-AELs modelled runs are as specified in Section 10.4.1 (with the emission rates as per Table 10a of Section 2.11.).

10.5.4. In Figures 33 and 34, the specified ecological receptors are represented by the pink annotated pins and the Installation as the red annotated circle.

Figure 33: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (Revised NH_3 Emission Rate) – Met Year 2020

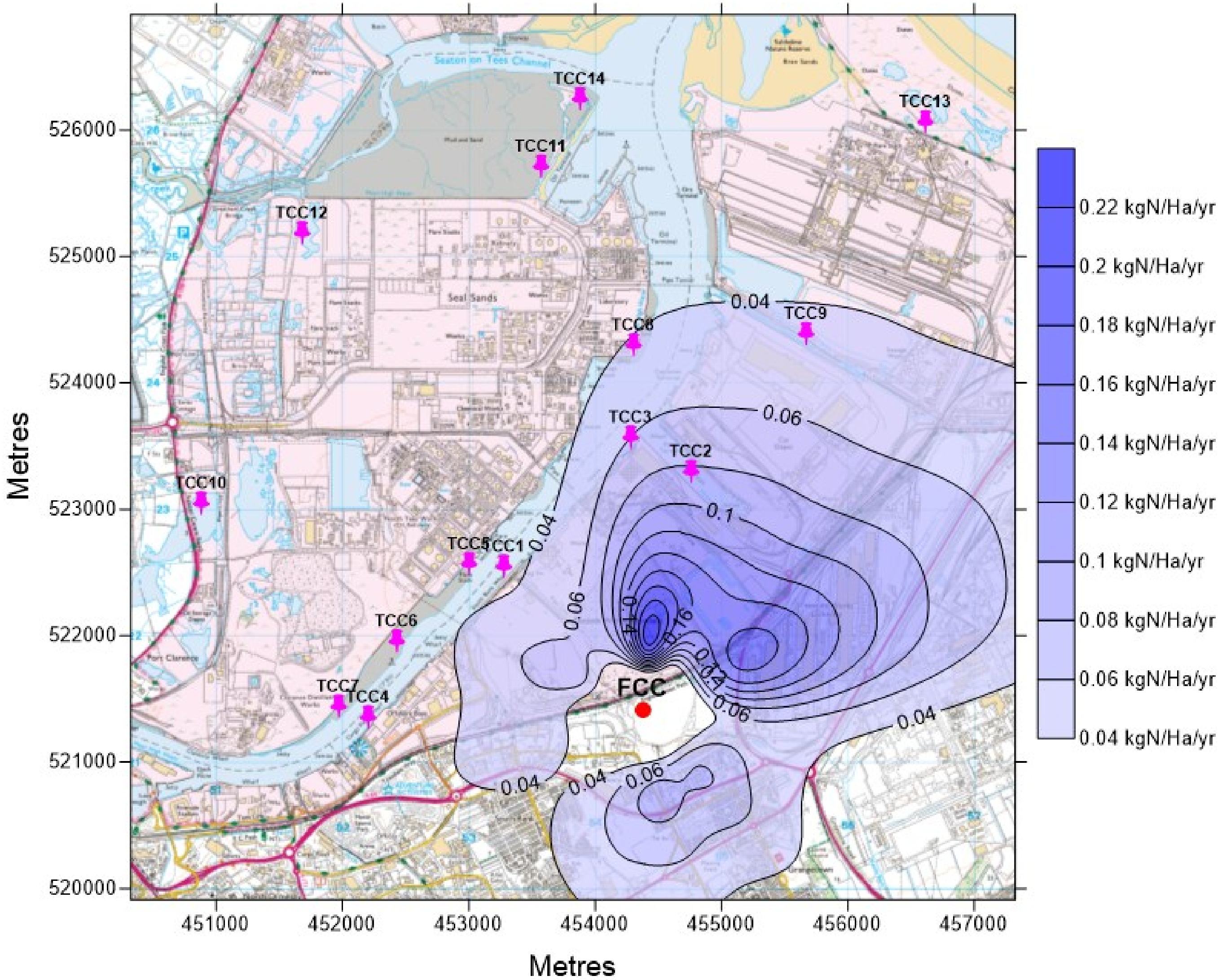
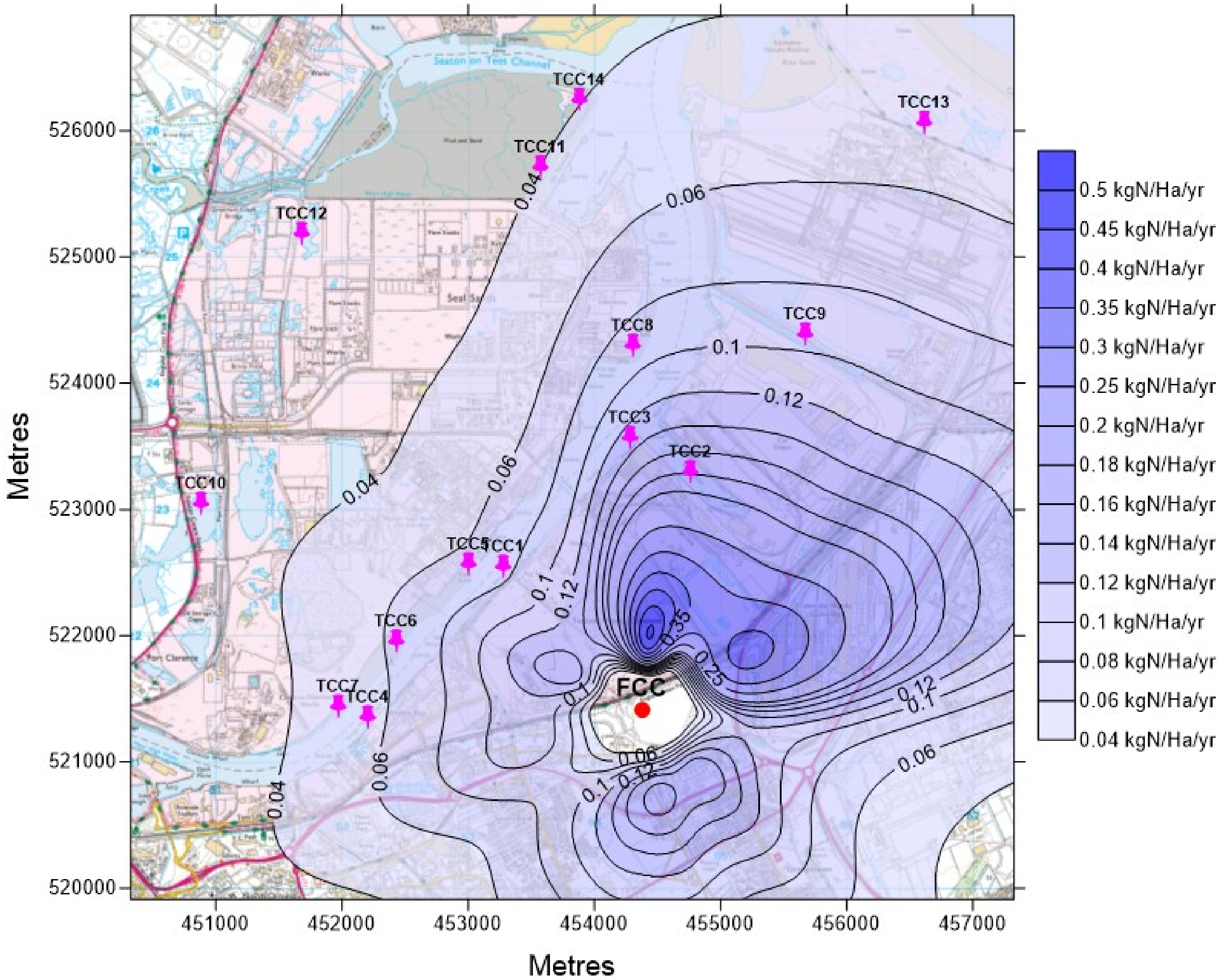


Figure 34: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (NO_X & NH_3 at BAT-AELs) – Met Year 2020



10.6. Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads – TCC1 – TCC14 (Installation (Revised NH_3 Data) + REC)

10.6.1. A summary of maximum predicted nutrient nitrogen deposition rates, based on the revised NH_3 concentrations for the Installation, at modelled points TCC1 – TCC14 (inclusive), are presented in Table 52. This section considers the FCC Installation together with the REC operating at the ELVs as detailed in Tables 11.9 and 11.10 of the *Chapter 11 Air Quality* report submitted as part of the planning application for the REC. Refer to Section 6.2.1., for an explanation as to the Critical Load ranges selected in the assessment. Habitat Interests considered are as specified in Table 5 in Section 2.7. As previously mentioned, the habitat interest and feature selected for the SPA has also been selected for the Ramsar site considered.

10.6.2. In Table 52, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

Table 52: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC14 (Installation + REC)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC1	Teesmouth and Cleveland Coast – SPA & SSSI (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0810	0.81%	0.540%	n/a	n/a	n/a	n/a
TCC2				0.176	**1.76%**	**1.18%**	8.96	9.14	91%	61%
TCC3				0.138	**1.38%**	0.92%		9.10	91%	n/a
TCC4				0.0522	0.522%	0.348%	n/a	n/a	n/a	n/a
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0741	0.741%	0.494%	n/a	n/a	n/a	n/a
TCC6				0.0679	0.679%	0.453%	n/a	n/a	n/a	n/a
TCC7				0.0478	0.478%	0.319%	n/a	n/a	n/a	n/a
TCC8				0.137	**1.37%**	0.91%	8.96	9.10	91%	n/a
TCC9				0.223	**2.23%**	**1.48%**	8.4	8.62	86%	57%

Table 52: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC14 (Installation + REC) (cont.)

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC10	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern - Supralittoral sediment - Coastal stable dune grasslands (calcareous type))	10	15	0.0397	0.397%	0.264%	n/a	n/a	n/a	n/a
TCC11				0.0919	0.92%	0.613%	n/a	n/a	n/a	n/a
TCC12				0.0475	0.475%	0.316%	n/a	n/a	n/a	n/a
TCC13				0.382	**3.82%**	**2.54%**	9.1	9.48	95%	63%
TCC14	Teesmouth and Cleveland Coast (SSSI Coastal stable dune grasslands (calcareous type))	10	15	0.125	**1.25%**	0.83%	10.78	10.91	**109%**	n/a

Notes to Table 52

(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

10.6.3. It can be seen from the data in Table 52 that, following the calculation of PECs, there is only one predicted exceedance for nitrogen deposition at modelling point TCC14, with the remaining sites screening out as insignificant.

10.6.4. It is worth noting that the background levels are already elevated and exceed the lower critical load for TCC14 in the absence of the predicted process contributions from the Installation and REC (i.e., the background concentration alone is 108% of the lower critical load). This point is further raised by NE in their DAS (see Appendix V for a copy of the full DAS):

Given that the predicted exceedance is small and should be taken in the context with the elevated background concentrations, Natural England does not require further information at this stage.

10.6.5. It is interesting to note that the Installation operating in isolation does not lead to a breach of the relevant nutrient nitrogen critical loads for any of the modelled points assessed - with the cumulative impact of both installations operating simultaneously resulting in the vast majority of the exceedances displayed. Consequently, REC's emissions were modelled in isolation to ascertain the predicted nutrient nitrogen deposition rates.

10.6.6. Table 53 demonstrates the predicted nutrient nitrogen deposition rates associated with the three distinct scenarios modelled (i.e., the Installation in isolation, REC in isolation and the cumulative scenario of the Installation's and REC's emissions).

Table 53: Predicted Nutrient Nitrogen Deposition Rates at Sensitive Habitat Sites (TCC1 – TCC14) For Three Distinct Scenarios

ADMS Ref.	Site Details	Nutrient Nitrogen Deposition Rate [a] [b] (kgN/ha/yr)		
		Installation Only	REC Only	Installation + REC
TCC1	Teesmouth and Cleveland Coast – SPA & SSSI (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	0.0524	0.0501	0.0810
TCC2		0.0964	0.0799	0.176
TCC3		0.0637	0.0838	0.138
TCC4		0.0285	0.0333	0.0522
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.0482	0.0465	0.0741
TCC6		0.0469	0.0375	0.0679
TCC7		0.0260	0.0321	0.0478
TCC8		0.0437	0.0986	0.137

Table 53: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC14 - Three Scenarios (cont.)

ADMS Ref.	Site Details	Nutrient Nitrogen Deposition Rate [a] [b] (kgN/ha/yr)		
		Installation Only	REC Only	Installation + REC
TCC9	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.0786	0.144	0.223
TCC10		0.0239	0.0310	0.0397
TCC11		0.0216	0.0714	0.0919
TCC12		0.0164	0.0356	0.0475
TCC13		0.0492	0.356	0.382
TCC14	Teesmouth and Cleveland Coast – SSSI (Sandwich Tern / Little Tern / Common Tern – Supralittoral sediment (acidic type))	0.0204	0.105	0.125

Notes to Table 53

(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

(b) The NO_X and NH_3 emission rates for both the Installation and REC are as discussed in Section 10.4.1.

10.6.7. It can be seen from the results in Table 53 that, overall, the predicted nutrient nitrogen deposition rates for the REC are greater than those for the Installation. For example, for TCC8, the nutrient nitrogen deposition rate is 0.0437 kgN/ha/yr for the Installation and 0.0986 kgN/ha/yr REC only (or 0.44% and 0.99% of the lower critical load).

10.6.8. It is anticipated that the greater predicted deposition rate associated with the REC scenario is largely due to REC's closer proximity to a number of the specified ecological points (TCC9, TCC11, TCC13 and TCC14, in particular). In addition, the emission rates for REC are based on the BAT-AELs (as detailed in Tables 11.9 and 11.10 of the *Chapter 11 Air Quality* report submitted as part of the planning application for REC). When accounting for normal day to day operation, it is anticipated that the actual emission rates for REC, particularly in regard to NH_3, are likely to be lower, as is the case with the FCC Installation.

10.6.9. Consequently, if measured concentrations of NO_X and NH_3 for the REC were also known – a more representative cumulative scenario could be considered. It is likely that the predicted cumulative nutrient nitrogen deposition rates, would be lower and potentially could be considered not significant.

10.6.10. To assist with ecological assessment of impact, Figure 35 provides the isopleth for nutrient nitrogen deposition rates.

10.6.11. In addition, Figure 36 has been included to allow for comparisons to be made between the cumulative emissions with the Installation's actual NH_3 concentration, compared to the BAT-AELs (i.e., as per Section 9.15.). Please note that, for consistency with Figure 35, the grid extent and terrain file for the emissions at the BAT-AELs modelled runs are as specified in Section 10.4.1 (with the emission rates as per Table 10a of Section 2.11. for the Installation and as detailed in Tables 11.9 and 11.10 of the *Chapter 11 Air Quality* report submitted as part of the planning application for REC).

10.6.12. In Figures 35 and 36, the specified ecological receptors are represented by the pink annotated pins and the Installation and REC as the red annotated circles.

Figure 35: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation (with revised NH_3) + REC – NWP 2020

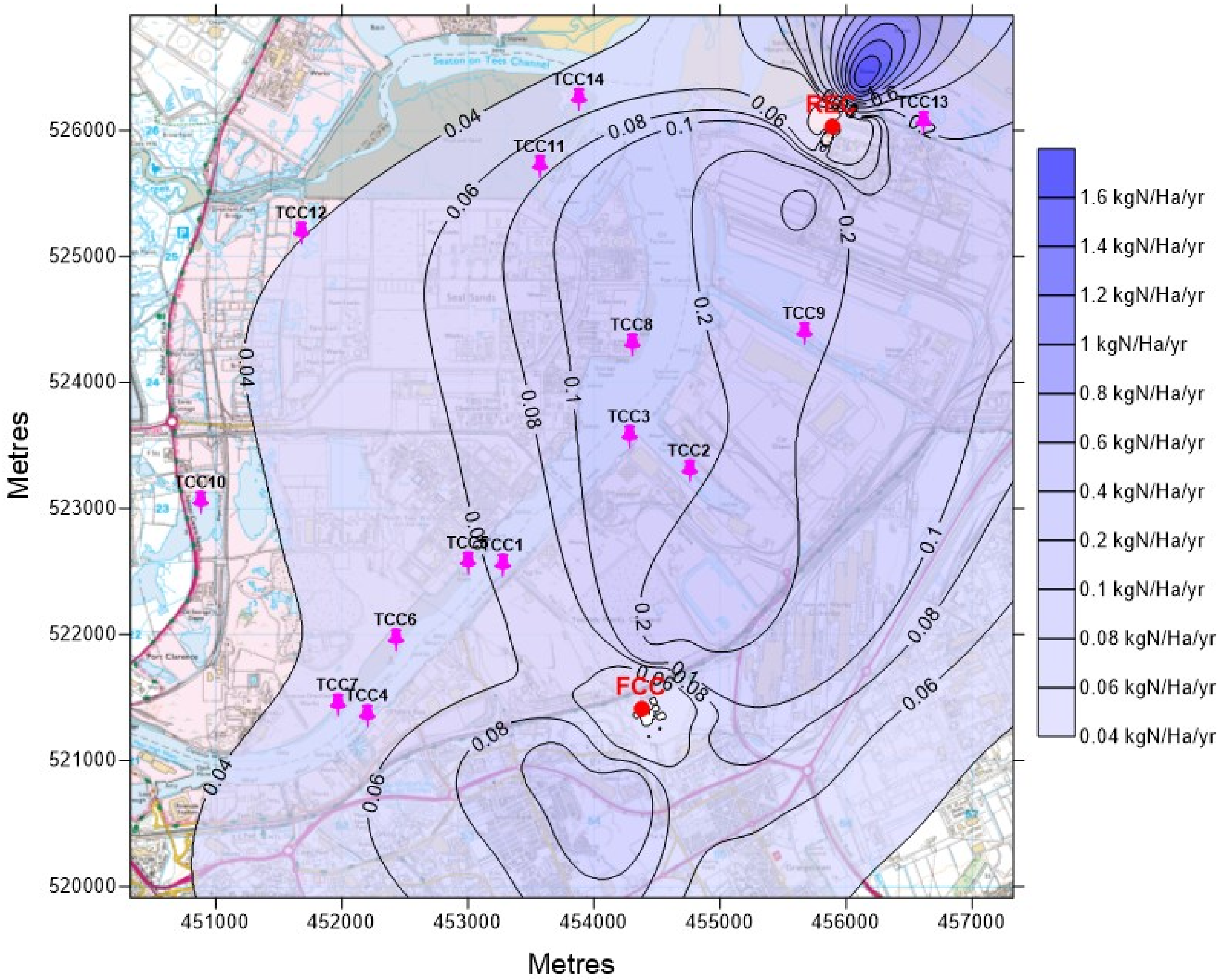
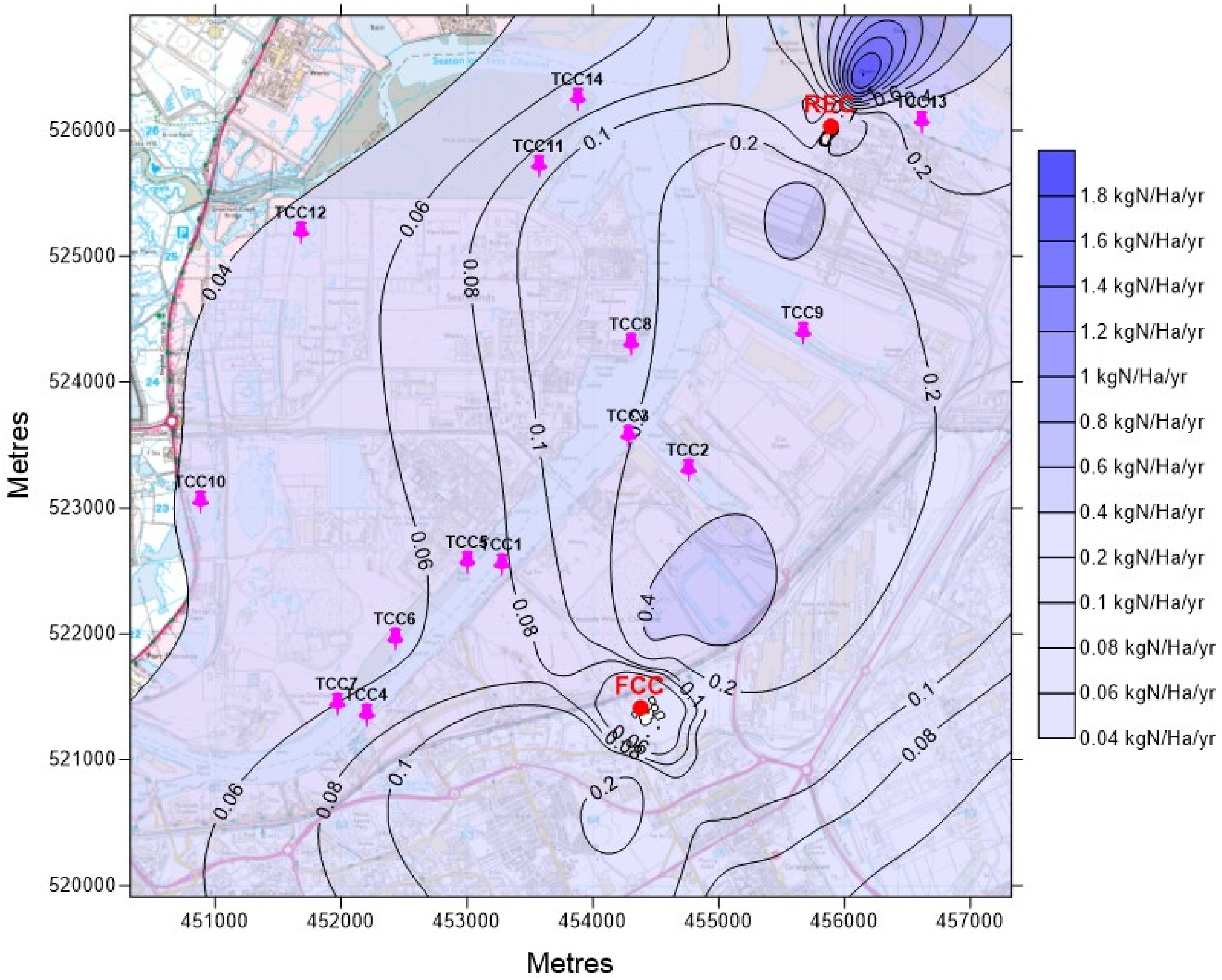


Figure 36: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation + REC (BAT-AELs) – NWP 2020



11. CONCLUSIONS

11.1.1. An assessment has been carried out to determine the local air quality impacts associated with the emissions from the proposed ERF at Tees Valley.

11.1.2. Detailed air quality modelling using the ADMS dispersion model has been undertaken to predict the impacts associated with stack emissions from the Installation. As a worst-case, emissions from the Installation's A1 and A2 stacks have been assumed to be released at the maximum ELVs twenty-four hours a day, 365 days of the year. This represents a conservative assessment of the impact since the actual emissions from the site are likely to be significantly lower during normal operation.

11.1.3. A detailed screening assessment has been carried out to determine the optimum discharge stack heights for the Installation's A1 and A2 emission points. Stack heights of 90m were considered appropriate.

11.1.4. Predicted maximum GLCs ("PCs") are within the long-term and short-term air quality objectives and are assessed as not significant for most pollutants assessed. For pollutants with potentially significant impacts, further screening has demonstrated that it is unlikely that any AQSs will be exceeded as a result of emissions from the proposed Installation at the maximum point of GLC or at any of the potentially significant human receptors.

11.1.5. For the sensitive habitat sites assessed, it has been demonstrated that the impact from the proposed Installation is unlikely to have a detrimental effect on these sites. For the critical levels of oxides of nitrogen, further screening demonstrated an exceedance of the significance criteria at one ecological point. However, further ecological assessment concluded that the predicted PCs are very small compared to elevated background levels. Emissions arising from the Installation are therefore considered unlikely to have an adverse effect on the conservation status of any qualifying species and hence the integrity of the Teesmouth and Cleveland Coast SPA / SSSI / Ramsar habitat site.

11.1.6. Following a meeting with NE, the additional assessments undertaken for nutrient nitrogen deposition (with the Installation's NH_3 emission rates revised to be more akin to normal operation) demonstrated that the Installation operating in isolation would not lead to an exceedance of the significance criteria for any of the modelled points for Teesmouth and Cleveland Coast habitat site.

11.1.7. An assessment of plume visibility was also undertaken which included daytime and night time hours. When daylight hours only were considered, visible plumes would only occur for 40% of the time and for 85% of the time would remain within the site boundary.

11.1.8. An assessment was also made of the impact of the proposed plant when operating under the abnormal conditions permitted under Article 46(6) of the IED. The results of the assessment indicated that it would be unlikely that any AQSs would be exceeded under such abnormal operating conditions.

11.1.9. For the in-combination assessment, predicted maximum GLCs are within the long-term and short-term air quality objectives and are assessed as not significant for most pollutants assessed. For the pollutants with potentially significant impacts, further screening has demonstrated that it is unlikely the predicted GLCs will be detrimental to human health. For the sensitive habitat sites assessed, it has been demonstrated that the impact from the cumulative scenario is unlikely to have a detrimental effect on these sites. For the critical levels of oxides of nitrogen and for nutrient nitrogen deposition, further screening demonstrated an exceedance of the significance criteria. Additional assessments demonstrated that, whilst there were still predicted exceedances of the significance criteria at a select few modelled points for Teesmouth and Cleveland Coast habitat site, these were fewer in number, the overall significance less and are still likely to be an over-estimation of impact.

11.1.10. In summary, therefore, it can be concluded that the proposed ERF at Tees Valley will not have a detrimental impact on local air quality, human health or sensitive habitat sites.

APPENDIX I

RCBC: 2020 AIR QUALITY ASR

2020 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

June 2020

Local Authority Officer	Tracy Hilton and Lyndsey Gill
Department	Adults and Communities, Public Health, Health Protection Healthcare Quality Service, Environmental Protection Team
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Report Reference number	RCASR2020
Date	25th June 2020

This report is submitted with the approval of the joint Director of Public Health for Redcar and Cleveland and Middlesbrough Councils, Mr Mark Adams.

Executive Summary: Air Quality in Our Area

Air Quality in Redcar and Cleveland

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

The formal assessment of air quality within Redcar and Cleveland has been undertaken since 2000, providing us with a long history of data and trends of the pollutants monitored. The submission of formal air quality returns to the UK Government have been completed independently and in conjunction with the Environment Agency and other authorities within the Tees Valley, enabling a region wide view of air quality and endorsing a positive joint working history.

Conclusions from Redcar and Cleveland's annual reports to Government have consistently shown good air quality as measured at monitoring stations and in locations where members of the public are regularly exposed to air pollution. Our results continue to be well below the UK Government objective levels and overall show a downwards trend, particularly for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2). During the 2019 reporting period a slight increase in particulate matter (PM_{10}) levels has been measured, however there has been no observed exceedance of the PM_{10} 24-hour mean objective. Given the continued compliance with the objective levels Redcar and Cleveland have had no requirement to declare an Air Quality Management Area (AQMA), however we will continue to improve air quality for the public by improving our monitoring network and publishing our first South Tees Clean Air Strategy, jointly with Middlesbrough Council with whom we share the Director of Public Health.

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[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

Redcar and Cleveland has an extensive coastline within its boundary which has the potential to be a source of high levels of natural particulates. During times of strong north-easterly weather, this may have health implications for vulnerable members of the public. Further information regarding current air quality and public health notifications can be found using the link below.

https://www.airqualityengland.co.uk/local-authority/?la_id=279

Members of the public are able to access a free app for users of iPhone, iPad and Android software, developed by Ricardo-AEA Ltd, providing air pollution health advice for where it is needed.

Actions to Improve Air Quality

Redcar and Cleveland continues to prioritise improving air quality within the Borough via a number of legislative means, such as permitting of industrial activities, reviewing and conditioning planning applications that have the potential to impact air quality and developing a robust monitoring regime.

Redcar and Cleveland continues to participate in joint working across the Tees Valley to improve air quality across the region. The Tees Valley Strategic Transport Plan, issued January 2020, outlines the priorities until 2030 that will positively contribute to air quality improvements. https://teesvalley-ca.gov.uk/transport/strategic-transport-plans/

The South Tees Clean Air Strategy continues to be developed, identifying actions and priorities for the two involved local authority boroughs (Redcar and Cleveland and Middlesbrough), to ensure a stronger consistent approach for improving the public's air quality. This strategy is due for publication during 2020.

Our joint Director of Public Health (DPH) has chosen air quality as the theme for the 2019 DPH Report, reaffirming our commitment to raise the profile and improve air quality for all. A link to the 2019 report can be found below.

https://www.redcar-cleveland.gov.uk/resident/adult-children-health/health-care-services/Pages/health-care-services.aspx

Conclusions and Priorities

Redcar and Cleveland continues to monitor and demonstrate compliance with the Government's National Objectives for a range of air quality pollutants. https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits

Continued compliance is achieved using a long-standing monitoring regime; a static continuous air quality station, a passive diffusion tube network, effective inspection of industrial processes and consultation on large planning developments.

Redcar and Cleveland have no requirement to declare an AQMA and it is anticipated that this situation will not change in the near future.

An annual review of the diffusion tube network is completed after analysis of existing results and in light of new exposure areas being identified so that a comprehensive assessment of the Borough can be developed.

Although Redcar and Cleveland does not at present actively monitor $PM_{2.5}$, a conversion factor enables PM_{10} values to be used to establish a likely emission. Redcar and Cleveland has guaranteed that $PM_{2.5}$ monitoring will be undertaken from 2020 through the acquisition of a continuous monitor.

The first South Tees Clean Air Strategy, due for publication in 2020, highlights Redcar and Cleveland's commitment to a strong pro-active approach to improving air quality.

Redcar and Cleveland Borough Council declared a 'Climate Emergency' in March 2019 with a pledge to become carbon neutral by 2030, compounding our vision to make substantial improvements for our residents.

The Council is also preparing an Environmental Strategy, led by colleagues in Economic Growth Directorate, due for publication in 2020 outlining measures to reduce our carbon footprint and become more energy and resource efficient.

Local Engagement and How to get Involved

Redcar and Cleveland continues to be part of the "Let's Go Tees Valley" organisation whose ambitions are to improve and change the way the public travels around the region, making small changes to journeys to make a big difference. A Commuter Challenge was launched during September 2019 to change the way in which you travel to work, encouraging car shares or alternative means of transport with the added health benefits. Further information is available from:

https://www.letsgoteesvalley.co.uk/in-your-area/redcar-and-cleveland/

Let's Go Tees Valley were also responsible for developing a 'Free Guided Ride' scheme on a Friday from June 2019 to increase resident's riding confidence, improve health and increase the uptake of cycle routes within the Borough.

The Environmental Protection Team participated in National Clean Air Day 2019 by hosting a publicity campaign within the authority's main publically accessible building, asking residents to make a pledge on our pledge tree and find out what materials can be burnt on a multi-fuel stove.

The Team will be again participating in National Clean Air Day 2020 on 8th October, further information on how you can get involved can be found at:

https://www.cleanairday.org.uk/

The Energy Saving Trust provides advice on fuel saving, driving techniques and deliberations to consider when purchasing a new car. The combination of factors which allows an individual to reduce their air pollution contribution. Additional information can be found at:

https://energysavingtrust.org.uk/transport

Redcar and Cleveland host the 'Festival of Thrift' event in September each year, the 2019 events theme was Clean Air. The Environmental Protection Team were able to acquire a stall promoting the work on improving air quality, a survey on transport modes to the festival, mapping public perceptions of areas of good and bad air quality and engaging with people through craft.

The Environmental Protection Team continue to provide advice to a range of internal department, external agencies and public enquiries regarding air quality in accordance with relevant legislation.

Residents within Redcar and Cleveland are responding positively to local and national publicity regarding air quality, especially with regard to the use of wood burning stoves. The Environmental Protection Team began a publicity campaign during 2019 to raise awareness of the legislation and smoke control areas within the Borough to stove suppliers and installers. This campaign was received positively by those businesses approached and further publicity for residents is planned for 2020.

Additional information and leaflets regarding the work undertaken by the Environmental Protection Team can be found using the link below:

https://www.redcar-cleveland.gov.uk/resident/environmental-protection/Pages/environmental-protection.aspx

“The South Tees Local Delivery Pilot January 2019, in conjunction with Sport England Delivery Pilot - You’ve Got This”. Their vision is for more people to be more active, more often; working with local partners to support individual and organisational change.

Since the formal announcement of the 12 pilot areas in December 2017, work has been progressing at a local level in collaboration with Sport England, to agree and implement the initial development phase of the pilot. They have spent a great deal of time talking to communities to really understand the reasons residents are inactive which sadly includes fear of crime and road safety, all in turn which harm the air quality agenda because people believe they have to drive everywhere to stay safe. Addressing stubborn inequalities in our communities is key to improving quality of life and achieving environmental aspirations for South Tees. Further information is available at: https://sportengland-production-files.s3.eu-west-2.amazonaws.com/s3fs-public/south-tees-sep-18.pdf?c0OwClZmokcDQUdWI2UilmO3jB8uxyxe

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in Redcar and Cleveland Council during 2019. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Redcar and Cleveland Borough Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

Redcar and Cleveland Borough Council currently does not have any AQMAs. The first voluntary South Tees Clean Air Strategy continues to be developed by Redcar and Cleveland and Middlesbrough Councils and publication is planned during 2020. For reference, a map of Redcar and Cleveland's monitoring locations is available in Appendix D. The Council is also preparing an Environment Strategy for publication in 2020 which will address climate emergency.

2.2 Progress and Impact of Measures to address Air Quality in Redcar and Cleveland

Defra's appraisal of last year's ASR concluded that the report was well structured, detailed and provided the information specified in the guidance.

- *The report is well-written and comprehensive. It includes all required information and has been completed to a high standard.*
- *The report continues to confirm that Redcar and Cleveland has no exceedances of air quality objectives, with no AQMA's or the requirement for an action plan.*

Redcar and Cleveland has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality.

Redcar and Cleveland has no formal air quality action plans as the declaration of an AQMA has not been required. The Authority remains committed to monitoring and improving air quality within the Borough.

Redcar and Cleveland, as a member of the Tees Valley Combined Authority, participates in joint working to address air quality across the region. The Strategic Transport Plan was produced in January 2020 outlining the priorities until 2030.

Redcar and Cleveland identified in the 2019 ASR a number of initiatives that would be implemented, progress against each one is outlined below:

- **Publicity campaign to raise awareness and understanding of the correct installation and use of wood and multi-fuel stoves and fireplaces within the Borough.** Stove suppliers were visited by officers within the Team to provide leaflets, maps of SCA's and advice to ensure compliance with the legislation. Further publicity will be undertaken during the next reporting year to increase awareness with the public.
- **Publication of the first South Tees Clean Air Quality Strategy**. In preparing for the Strategy, the two authorities involved (Redcar and Cleveland and Middlesbrough) held a stakeholder event on 1st March 2019, attended by representatives of businesses, local authorities, transport businesses, voluntary sector organisations, Environment Agency and educational establishments. The event focused on sharing information, what is already being done to

improve air quality, what more can be done and how the new Strategy can be a tool to help us achieve further improvements in our air quality.

- **Redcar and Cleveland and Middlesbrough Council supported the Tees Valley Nature Partnership Conference** held on 28th June 2019 by providing a workshop focused on the importance of further reducing levels of air pollution, promotion of the first South Tees Clean Air Strategy, the value of the community approach to achieving ambitions, the artistic interpretation of air pollution and the role of artists in raising the status and awareness of air quality issues across the world.
- **The annual South Tees Health Protection Conference held** on 20th November 2019 attended by a wide range of professionals included table discussions with the same focus, on Air Quality which had been employed at the stakeholder event held earlier in the year.
- **The publication of the first South Tees Clean Air Strategy** has encountered a delay, however, it is envisaged that this will be finalised during 2020.
- **Support and participate in National Clean Air Day 2019**. A public awareness event was held on 20th June 2019 incorporating a pledge tree, model wood burning stove, bold posters and posts on the Authority's Facebook and Twitter pages.
- **Attendance and participation in the Festival of Thrift**, September 2019. The Environmental Protection Team attended the festival and were approached by a large number of the public to discuss clean air. During the event officers introduced the concept of the first voluntary South Tees Clean Air Strategy, asked people to complete a survey on transport modes used to reach the event, to identify areas of 'good' and 'bad' air quality within the Borough and also make a pledge for a pledge tree.
- **Campaign to target industrial areas regarding the legal routes for disposal of commercial waste**. Following receipt of a justified complaint of burning, all businesses on the same industrial estate were provided with advice and education. Campaign is to continue during 2020.

- **Procurement of 10 fully electric small panel vans to replace 10 diesel Ford Connect vans**. The Authority was successful in procuring 10 Nissan e-NV200 zero emission vans for use within the Technical and Highways Teams during June 2019. The electric panel vans have been really successful in implementation, Redcar and Cleveland are hoping to acquire further vehicles during the next reporting period.
- **Procurement and use of 8 x 7.5ton Euro VI vehicles for the Highways Team**. These vehicles have been successfully procured and are in use for the Authority's fleet.
- **Street lighting LED replacement programme**. This initiative was a long term replacement scheme that has been undertaken during the 2019 reporting year and will continue into the next.
- **Request to our electricity supplier that all future supplies are from renewable resources**. Redcar and Cleveland have been successful in this request from our energy supplier.
- **Declaration of a climate emergency**. Redcar and Cleveland Borough Council declared a Climate Emergency on 28th March 2019 to become carbon neutral by 2030. This declaration confirms our commitment to improve air quality and the climate. Climate emergency will be included in the Environment Strategy, due for publication in 2020.
- **Sign up to the UK100 clean energy pledge**. Redcar and Cleveland signed up this pledge to have 100% clean energy by 2050.

Priorities and initiatives for the forthcoming year (2020) are:

- Publication of the first South Tees Clean Air Quality Strategy, a voluntary and joint Air Quality Strategy with neighbouring authority Middlesbrough Council.
- Support and participate in the 2020 National Clean Air Day campaign 8th October 2020, the UK's largest air pollution campaign.
- Campaign to target industrial areas within the Borough regarding the legal routes for disposal of commercial waste.

- Publication of the Redcar and Cleveland Environment Strategy which will identify priorities to achieve the 2030 Climate Emergency Declaration.
- Support and contribute to the implementation of the actions identified in the Joint Director of Public Health's 2019 Annual Report, which focused on air quality.
- Procurement of 8 small panel electric zero emission vans to complement the existing fully electric fleet within the Authority.
- Procurement of 5 x 26ton Euro VI vehicles into the fleet.
- Completion of the LED street lighting replacement scheme for all areas within the Authority.
- Publicity campaign relating to the change in fuel stock availability for domestic heating.
- Feasibility study to assess the potential for large Council buildings to be fitted with solar PV and battery storage systems.
- Replacement of lighting at two primary schools with energy efficient LED lighting.
- Investigate the potential to utilise an E-bike loan scheme within the Borough encouraging the use of alternative modes of transport.

The Covid-19 worldwide pandemic placed the UK into extreme measures for social distancing and lockdown conditions from March 2020. It is anticipated that these actions may have an effect on the ability to complete all priorities and incentives detailed above.

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

2.3.1 Redcar and Cleveland $PM_{2.5}$ Measures

Redcar and Cleveland is taking the following measures to address $PM_{2.5}$:

- Use the Environmental Permitting Regulations to ensure that businesses are implementing best practice for emission control.
- Procure more efficient Euro VI fleet vehicles.
- Use the planning consultation process to identify sources of $PM_{2.5}$, ensure appropriate modelling of emissions is undertaken and work with the construction industry to ensure robust dust suppression techniques are employed.
- Attendance at the industry, regulator and community supported Industrial Briefing Group on the Wilton International Complex, to share information on emission control and technological improvements.
- Co-operative working with the South Tees Development Corporation (STDC) during the redevelopment of the former Redcar Steelworks site to ensure clean technologies are supported and air quality is not harmed during the implementation of the “South Tees Regeneration Master Plan”, a 25 year vision for the area.

2.3.2 $PM_{2.5}$ Tees Valley Overview

$PM_{2.5}$ particulates have been identified as the cause of a more significant health risk than PM_{10} due to the smaller particle size and ability to penetrate further into the respiratory system. UK Public Health Outcomes Framework includes an indicator relating to fine particulate pollution. The 2018 factors across the Tees valley for the indicator “Fraction of mortality attributed to particulate air pollution” are shown below:

	England	North East	Darlington	Hartlepool	Middlesbrough	Redcar & Cleveland	Stockton-on-Tees
Fraction	5.2	3.8	3.9	4.0	4.4	4.0	4.1

The values are estimates of the percentage of mortality to long term exposure to particulate air pollution. In comparison to the 2017 data Redcar and Cleveland has remained at the same fraction, however all other authorities within the Tees Valley, North East and England have increased.

Tees Valley region has three $PM_{2.5}$ monitors as part of the AURN network, Breckon Hill within Middlesbrough, Eaglescliffe and A1035 Nelson Terrace located within Stockton-on-Tees. The annual means measured at these locations range from 8 to 10.3µg/m^3, this data has been obtained from neighbouring authority colleagues and the Defra AURN website, https://uk-air.defra.gov.uk/data/exceedence

2.3.3 Redcar and Cleveland $PM_{2.5}$

Redcar and Cleveland Borough Council is one of the five unitary authorities forming the Tees Valley area. Redcar & Cleveland covers 24,490 hectares and is geographically the largest borough in the Tees Valley. The map below shows the relative location with extensive coastline between South Gare and Cowbar, including 12km of 'Heritage Coast' from Saltburn eastwards. A large proportion of our borough is rural land use and 23 square miles of the southern area is within the North York Moors National Park.

Historically Redcar and Cleveland has been associated with a heavy industrial identity from chemical and steelmaking, unfortunately over the last 20 years this has declined with the closure of some plants. Opportunely, investment in the Borough is now on an increase and industrial developments are beginning to blossom. The new industrial developments come with an added benefit of improved technology and research so that air quality remains a priority and will prevent a decline to historical levels.

In acknowledgement of the Government's Clean Air Strategy 2019 which highlighted PM2.5 as a major pollutant of concern to health, although Redcar and Cleveland had monitored PM_{10} for a number of years and are therefore able to calculate an estimate of $PM_{2.5}$ from this data, we felt this was an opportune time to pro-actively respond to current local air quality matters and adjust to the pollutants of major concern at present. The Council has therefore committed to procure a dedicated $PM_{2.5}$ continuous monitor for use at the static monitoring station from 2020.

The Government's Clean Air Strategy, 2019 also highlighted the pollution potential from domestic heating sources linked to the recent increase in installation of wood burning stoves into properties. Redcar and Cleveland acknowledged this situation and during 2019 began a campaign to increase awareness and understanding of multi-fuel stove use. Initially the focus of this campaign was to stove suppliers and installers, during the next reporting year this campaign will have a greater public emphasis.

Redcar and Cleveland declared 51 smoke control areas (SCA) during the 1970's and 1980's which remain in place today. The Environmental Protection Team has noted a seasonal rise in smoke complaints over the last 2 years in relation to wood burning and multi-fuel stoves use within the Borough. Education and advice is provided as an initial response to ensure the public are aware of the legal requirements and it is hoped that the additional publicity campaign will further enhance this. A map identifying the 51 SCA's has been provided in Appendix D.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Redcar and Cleveland undertook automatic (continuous) monitoring at one site during 2019. Table A.1 in Appendix A shows the details of the site referenced as 'Dormanstown'. National monitoring results are available at https://www.airqualityengland.co.uk/local-authority/?la_id=279

A map showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

Dormanstown continuous suburban monitoring location is within school grounds in an area of relevant public exposure, it remains a key site within the Tees Valley region. The monitoring site is affected by light traffic, it is within 4km of the Borough's main industrial complexes and is within the prevailing wind direction for 75% of the year. The two industrial and chemical complexes are subject to large amounts of re-development, confirming the need to maintain and support the continuous monitoring site's use, operational since January 2012.

The site monitors oxides of nitrogen (NO_x), particulate matter (PM_{10}), ozone (O_3) and sulphur dioxide (SO_2). During the reporting year the NO_x monitor experienced age-related failures, meaning that for a small proportion of time the monitor was turned off, this has been detailed in the 'valid data capture' in the tables below. As a result of this Redcar and Cleveland procured a new NO_x monitor which was installed at the beginning of 2020. The SO_2 monitor also suffered similar failings and a loan analyser was provided by our supplier. A review of the SO_2 levels over the last few years was undertaken. This review showed a consistent decline in levels therefore a decision was made not to replace the SO_2 analyser at the end of the 2019 reporting period. The on loan SO_2 analyser was removed from Dormanstown during January 2020 so that we had a full reporting year for this report. The reduced 'valid data capture' for this pollutant is again identified in the tables below.

3.1.2 Non-Automatic Monitoring Sites

Redcar and Cleveland undertook non-automatic (passive) monitoring of NO_2 at 18 sites during 2019 including three co-location studies at the continuous monitoring site in Dormanstown. Table A.2 in Appendix A shows the details of the sites.

It was detailed during the 2018 report that a review of the co-location diffusion tubes would be undertaken to address the variation in results at the site. This review was completed and the findings confirmed that the co-location tubes are deployed in accordance with TG 16 guidance. During the 2019 reporting period the results from the co-location site showed minor variation for most of the year, however September results showed a greater measurement range. Redcar and Cleveland have contributed to the National Bias Adjustment survey for a number of years. Unfortunately, this year due to the varied results from September 2019 and low continuous monitoring levels our results could not be utilised in the study. As a result of this, discussions have taken place with our continuous monitoring site's data analysts. They were able to review our continuous monitoring data and confirm that it is robust in nature, therefore it is likely that the variation in values is linked to the diffusion tube methodology. The results will continue to be monitored.

A travel blank diffusion tube was also deployed as part of the non-automatic study, used as a quality checking mechanism for the transportation of the diffusion tubes. The travel blank confirmed that the transportation of the diffusion tubes placed a negligible effect on the final reported results, non-bias adjusted results are shown below. There was no value for January due to an error made by the supplier.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
R00	-	0.71	0.47	0.24	0.13	0.57	0.2	0.12	0.18	0.29	0.06	0.24	0.29

The diffusion tubes deployed in the study are 50% trimethylamine (TEA) in acetone and the results have been bias adjusted using the national bias factor. Further information relating to this has been outlined in Appendix C.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

The diffusion tube network has been in operation since 2014 across various areas of the Borough, targeting areas of high traffic flow, industrial activity and public exposure. Each year the diffusion tube network is reviewed to ensure that the most appropriate locations are monitored and to allow monitoring in previously unmonitored areas. Redcar and Cleveland continue to monitor at areas close to schools to ascertain if the ‘school run’ has an observed effect on public exposure in our Borough. Results to date have not shown an increased value at these locations.

Diffusion tube R27 (West Lane) was employed due to the 2010 Defra modelling that identified the A66 main thoroughfare as being non-compliant with the EU limit for nitrogen dioxide. Monitoring has shown actual levels to be below the EU limit. The annual mean for 2019 when subject to bias adjustment and distance correction was 21.2µg/m3, below the 2018 figure of 23.6µg/m^3. Redcar and Cleveland are committed to continued monitoring at this location to ensure compliance with objective levels.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias[4], “annualisation” (where the data capture falls below 75%), and distance correction[5]. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, for two sites (R27 and R41). Additional details on this bias adjustment and distance correction can be found in Appendix C.

[4] https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
[5] Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

During 2019 there have been no exceedances of the annual mean or 1-hour mean objective level at any monitoring site.

Figure A.1 depicts the trend graphs for the Dormanstown monitoring site incorporating historical data from the previous site at Corporation Road, this identifies that since 1998 levels have continued in a downwards trend.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

There have been no exceedances of the annual mean PM_{10} concentration at the monitoring site, a level of 14µg/m^3 recorded during 2019, a slight increase from the previous year of 12µg/m^3. There has been one exceedance of the PM_{10} daily mean objective level during the reporting year.

Figure A.2 identifies trends in PM_{10} emissions since 1998 from the current Dormanstown site and previous Corporation Road location, depicting the slight increase for 2019 values.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

Redcar and Cleveland did not directly measure $PM_{2.5}$ during 2019, however an estimation using PM_{10} data can be completed using the nationally derived correction factor of 0.7. Results in 2019 have increased slightly from the previous year, 9.8µg/m^3 for 2019 compared to 8.4µg/m^3 in 2018 and in 2017. This increase may be attributable to the redevelopment of the industrial and chemical complexes within 4km of the monitoring site and the rise in popularity of domestic wood burning stoves.

$PM_{2.5}$ monitoring is currently completed by two authorities within the Tees Valley, Middlesbrough and Stockton-on-Tees, forming part of the national AURN network as they are located within areas of high urban traffic flow. These sites ranged between 8 to 10.3µg/m^3 during 2019. $PM_{2.5}$ monitoring will be undertaken by Redcar and Cleveland in 2020.

3.2.4 Sulphur Dioxide (SO_2)

Table A.8 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2019 with the air quality objectives for SO_2.

Results for 2019 show no exceedances of the three air quality objectives and the annual mean at the site is again 1µg/m^3, however, due to the age of the SO_2 analyser, there has been a reduction in data capture, 76.77%, due to shutdown of the unit. Given the historical trend data of the pollutant Redcar and Cleveland has decided to cease SO_2 monitoring from 2020 with a shift to $PM_{2.5}$ monitoring instead. Figure A.3 depicts the historical data incorporting data from the former Corporation Road site and existing Dormanstown site from 1998.

3.2.5 Ozone (O_3)

Ozone is a complex secondary pollutant formed in the atmosphere by the chemical reaction between volatile organic compounds (VOC’s), oxides of nitrogen (NO_x) and sunlight. The sources of these pollutants are wide ranging, with ozone levels naturally recording higher levels at coastal areas and being very spatially and seasonally dependant. Due to this, although O_3 is not a regulated pollutant required for LAQM reporting purposes, we have chosen to monitor long-term at the Dormanstown static continuous monitoring station. During 2019 over a period of 12 days, Redcar and Cleveland monitored 92 exceedances of the National Air Quality Objective, 100µg/m^3 not to be exceeded more than 10 times a year when measured as an 8-hour mean.

Appendix A: Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
Redcar Dormanstown	Dormanstown (2012 - Present)	Suburban	458379	523486	NO2, PM10, SO2, O3	N	NO2 - Chemiluminescence, PM10 – BAM from 2013, SO2 - UV fluorescence, O3 – UV Absorption	1	150	2.5
Redcar Corporation Road	Corporation Road (1997 - 2011)	Suburban	459900	524600	NO2, PM10, SO2, O3	N	NO2 - Chemiluminescence, PM10 – TEOM (vcm correction), SO2 - UV fluorescence, O3 – UV Absorption	1	20	2.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
R17	Dormanstown	Suburban	458379	523486	NO_2	NO	-	150	YES	2.5
R18	Dormanstown	Suburban	458379	523486	NO_2	NO	-	150	YES	2.5
R19	Dormanstown	Suburban	458379	523486	NO_2	NO	-	150	YES	2.5
R26	South Bank, Trunk Road	Roadside	453142	520836	NO_2	NO	42	11	NO	2.5
R27	West Lane, Grangetown	Roadside	454712	520678	NO_2	NO	42	1	NO	2
R36	Rectory Lane	Roadside	461211	515667	NO_2	NO	6	4	NO	2
R37	Lingdale Pharmacy	Roadside	467369	516404	NO_2	NO	3	1.8	NO	2.5
R38	Skelton High Street	Roadside	465640	518819	NO_2	NO	0	6.6	NO	2
R39	Arlington Street	Roadside	472403	518211	NO_2	NO	0	2.3	NO	2.5
R40	Keilder Close	Roadside	459909	522873	NO_2	NO	0.8	3.2	NO	2.5
R41	Mersey Road	Roadside	459695	524553	NO_2	NO	17	3.7	NO	2.5
R42	Primrose Court	Roadside	453834	519869	NO_2	NO	0	9.6	NO	2
R43	Normanby Road	Roadside	453964	519621	NO_2	NO	0	11.6	NO	2
R44	Normanby Road	Roadside	454648	518546	NO_2	NO	0	7.9	NO	2
R45	The Crescent	Roadside	453922	515096	NO_2	NO	11.2	3.7	NO	2.5
R46	Haven Site	Suburban	452644	520921	NO_2	NO	0	85.4	NO	2.5
R47	Whitehouse Café	Roadside	454621	518344	NO_2	NO	0	3.9	NO	2.5

R48	Kirkleatham Lane	Roadside	459257	524555	NO_2	NO	0	13.4	NO	2

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m³) (3) (4)				
							2015	2016	2017	2018	2019
Redcar Dormanstown	458379	523486	Suburban	Automatic	100	93.58	12.7	11	12	10	9
R01	461530	516410	Roadside	Diffusion Tube	-	-	15	-	-	-	-
R02	461531	516412	Roadside	Diffusion Tube	-	-	12.2	9.9	-	-	-
R03	472062	518152	Roadside	Diffusion Tube	-	-	12.9	11.2	-	-	-
R04	470786	519142	Suburban	Diffusion Tube	-	-	7.8	-	-	-	-
R05	466502	521298	Roadside	Diffusion Tube	-	-	14.2	11.7	-	-	-
R06	466256	521206	Roadside	Diffusion Tube	-	-	11	8.9	-	-	-
R07	463155	522293	Roadside	Diffusion Tube	-	-	14.5	11.6	-	-	-
R08	462339	521391	Roadside	Diffusion Tube	-	-	12.3	-	-	-	-
R09	460291	522268	Roadside	Diffusion Tube	-	-	29.8	24.1	-	-	-
R10	459289	524187	Roadside	Diffusion Tube	-	-	23	-	-	-	-
R11	459310	524177	Roadside	Diffusion Tube	-	-	17.2	14.2	-	-	-
R12	459355	522825	Roadside	Diffusion Tube	-	-	18.4	-	-	-	-
R13	458890	524510	Roadside	Diffusion Tube	-	-	21.4	15.2	-	-	-

R14	459144	525203	Industrial	Diffusion Tube	-	-	13	10.5	-	-	-
R15	459198	525251	Suburban	Diffusion Tube	-	-	15.4	-	-	-	-
R16	459945	525076	Suburban	Diffusion Tube	-	-	15.9	11.6	-	-	-
R17	458379	523486	Suburban	Diffusion Tube	100	100	12.7	13.5	13.9	17.9	17.4
R18	458379	523486	Suburban	Diffusion Tube	100	100	12.5	12.9	14.2	17.3	16.5
R19	458379	523486	Suburban	Diffusion Tube	100	100	12.2	13.2	14.8	17.5	15.2
R20	457440	519862	Suburban	Diffusion Tube	-	-	10.5	-	-	-	-
R21	455678	518799	Suburban	Diffusion Tube	-	-	14	-	-	-	-
R22	454540	518684	Suburban	Diffusion Tube	-	-	13.2	10.8	-	-	-
R23	453541	520651	Roadside	Diffusion Tube	-	-	17.6	16.2	-	-	-
R24	454986	520309	Suburban	Diffusion Tube	-	-	12.9	10.2	-	-	-
R25	453123	517395	Roadside	Diffusion Tube	-	-	12.7	-	-	-	-
R26	453142	520836	Roadside	Diffusion Tube	100	91.7	21.9	20.5	19.8	24.7	19.5
R27	454712	520678	Roadside	Diffusion Tube	100	100	30	26.4	25.5	29.8	24.8
R28	469251	519643	Roadside	Diffusion Tube	-	-	8	-	-	-	-
R29	453695	516766	Roadside	Diffusion Tube	-	-	-	11.5	-	-	-
R30	465523	518376	Background	Diffusion Tube	-	-	-	6.3	6.2	-	-
R31	471967	518208	Roadside	Diffusion Tube	-	-	-	-	12.9	-	-

R32	463609	522253	Roadside	Diffusion Tube	-	-	-	-	10.2	-	-
R33	460818	524938	Roadside	Diffusion Tube	-	-	-	-	16.6	18.6	-
R34	456476	519137	Roadside	Diffusion Tube	-	-	-	-	12.9	-	-
R35	454237	515505	Suburban	Diffusion Tube	-	-	-	-	12.0	-	-
R36	461211	515667	Roadside	Diffusion Tube	100	100	-	-	-	17.8	15.6
R37	467369	516404	Roadside	Diffusion Tube	100	100	-	-	-	10.9	9.7
R38	465640	518819	Roadside	Diffusion Tube	100	100	-	-	-	15.6	13.5
R39	472403	518211	Roadside	Diffusion Tube	100	91.7	-	-	-	20.0	15.5
R40	459909	522873	Roadside	Diffusion Tube	100	83.3	-	-	-	16.5	11.8
R41	459695	524553	Roadside	Diffusion Tube	100	100	-	-	-	20.2	19.4
R42	453834	519869	Roadside	Diffusion Tube	100	100	-	-	-	16.6	13.9
R43	453964	519621	Roadside	Diffusion Tube	100	100	-	-	-	16.1	15.2
R44	454648	518546	Roadside	Diffusion Tube	100	91.7	-	-	-	15.7	12.9
R45	453922	515096	Roadside	Diffusion Tube	100	100	-	-	-	15.2	13.5
R46	452644	520921	Suburban	Diffusion Tube	100	100	-	-	-	-	16.1
R47	454621	518344	Roadside	Diffusion Tube	100	100	-	-	-	-	20.3
R48	459257	524555	Roadside	Diffusion Tube	100	100	-	-	-	-	17.7

☒ **Diffusion tube data has been bias corrected**

☐ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

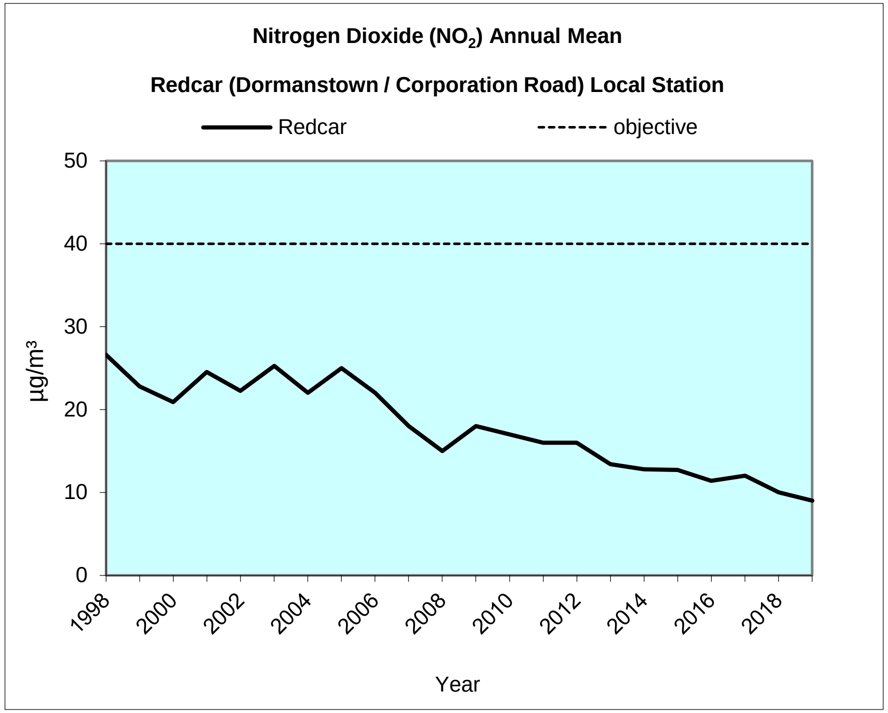
(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

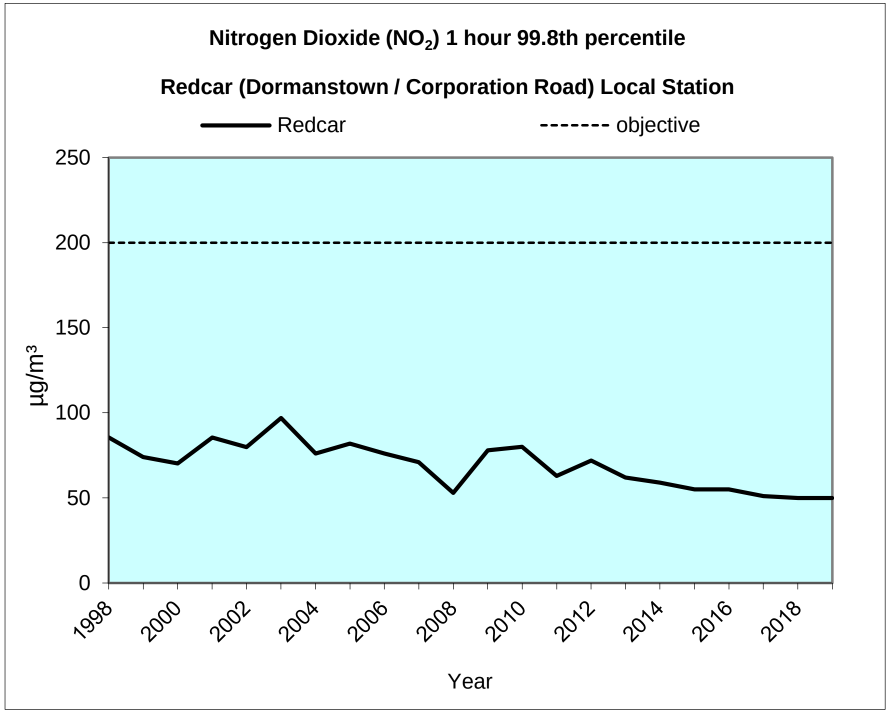
Monitoring was carried out for a full calendar year at all sites, this is represented in Column 'Valid Data Capture for Monitoring Period (%)(1). Column 'Valid Data Capture(2)' represents the data capture during the 12 month period.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations

REDCAR (Dormanstown & Corporation Road) Local Station

(suburban industrial site classification)





Station relocated to Dormanstown from Corporation Road January 2012

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m³ (3)				
							2015	2016	2017	2018	2019
Redcar Dormanstown	458379	523486	Suburban	Automatic	100	93.58	0	0	0	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Monitoring was carried out for a full calendar year at all sites, this is represented in Column 'Valid Data Capture for Monitoring Period (%)(1). Column 'Valid Data Capture(2)' represents the data capture during the 12 month period.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration (µg/m³) (3)				
						2015	2016	2017	2018	2019
Redcar Dormanstown	458379	523486	Suburban	100	97.5	15.7	12.7	12	12	14

☐ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the PM_{10} annual mean objective of 40µg/m³ are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

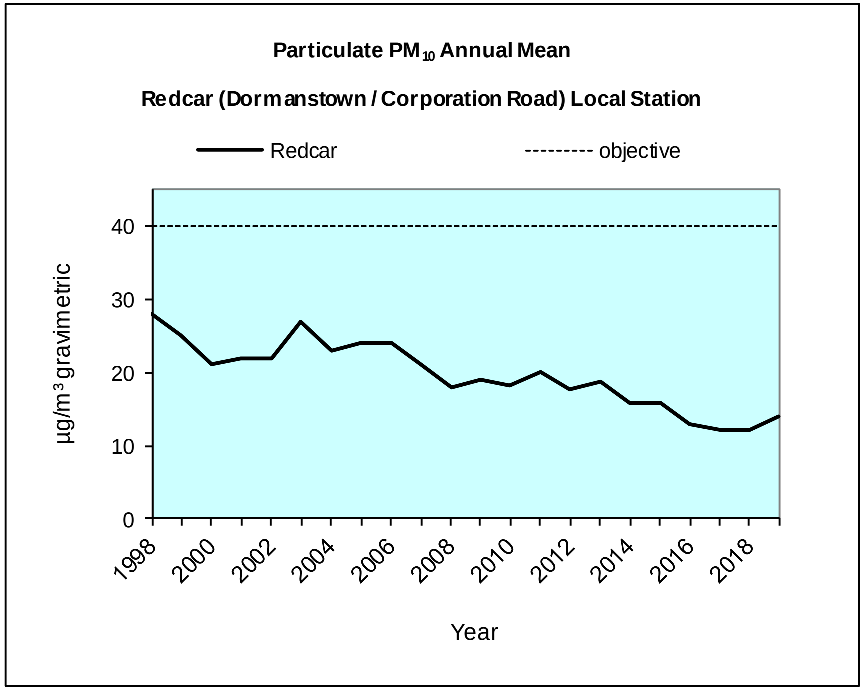
(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

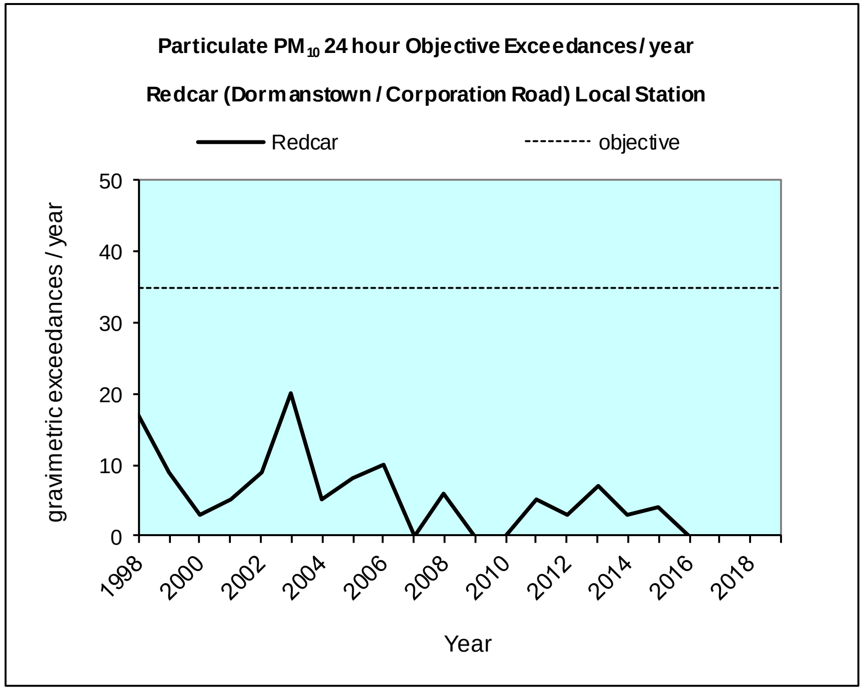
Monitoring was carried out for a full calendar year at all sites, this is represented in Column 'Valid Data Capture for Monitoring Period (%)(1). Column 'Valid Data Capture(2)' represents the data capture during the 12 month period.

Figure A.3 – Trends in Annual Mean PM_{10} Concentrations

REDCAR (Dormanstown & Corporation Road) Local Station

(suburban industrial site classification)





Station relocated to Dormanstow n from Corporation Road January 2012

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m³ (3)				
						2015	2016	2017	2018	2019
Redcar Dormanstown	458379	523486	Suburban	100	97.5	4	0	1	0	0

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m³ not to be exceeded more than 35 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Monitoring was carried out for a full calendar year at all sites, this is represented in Column 'Valid Data Capture for Monitoring Period (%)(1). Column 'Valid Data Capture(2)' represents the data capture during the 12 month period.

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
						2015	2016	2017	2018	2019
Redcar Dormanstown	458379	523486	Suburban	100	97.5	11	8.9	8.4	8.4	9.8
Middlesbrough Breckon Hill	450506	519620	Urban Background	100	96	10.5	10.2	7	8.9	10.3
Middlesbrough Macmillan College	447800	519300	Urban Background	100	91	11.9	11	6.7	7	8.7
Stockton Eaglescliffe	441623	513674	Roadside	100	94	10.7	9.2	8	10	8
Stockton A1305 Nelson Terrace	444331	519170	Roadside	100	95	-	9.5	8	9	8

☐ **Annualisation has been conducted where data capture is <75%**

Notes:

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been “annualised” as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Monitoring was carried out for a full calendar year at all sites, this is represented in Column ‘Valid Data Capture for Monitoring Period (%)(1). Column ‘Valid Data Capture(2)’ represents the data capture during the 12 month period.

The “Middlesbrough Macmillan College” site does not monitor $PM_{2.5}$ therefore these values have been calculated using PM_{10} actual values.

Table A.8 – SO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	Number of Exceedances 2019 (percentile in bracket) (3)		
						15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
Redcar Dormanstown	458379	523486	Suburban	100	76.77	0(4)	0(3)	0(2)
Middlesbrough Breckon Hill	450506	519620	Urban Background	100	94	0	0	0

Notes:

Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

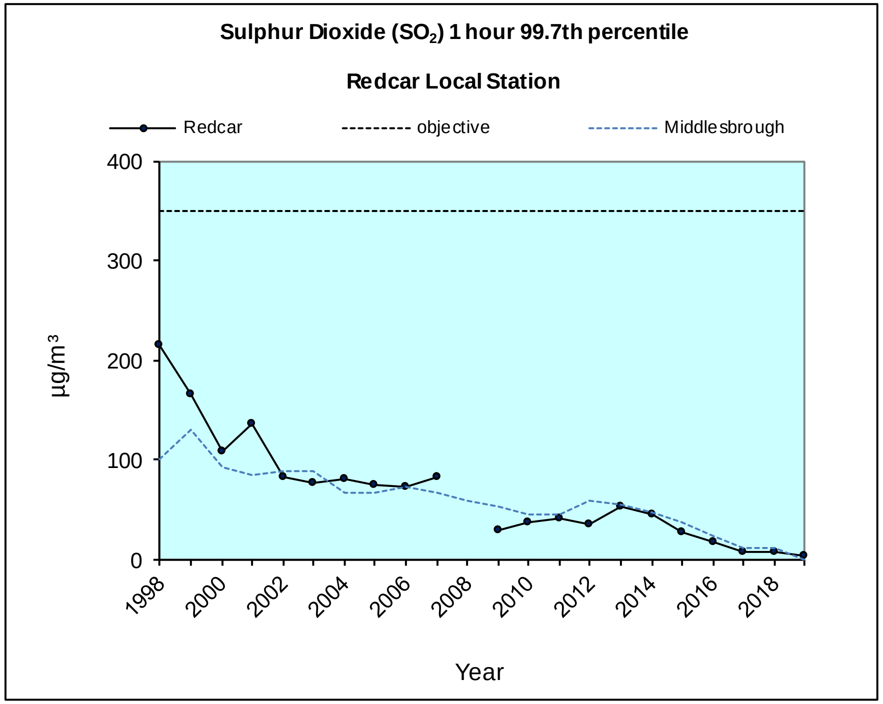
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

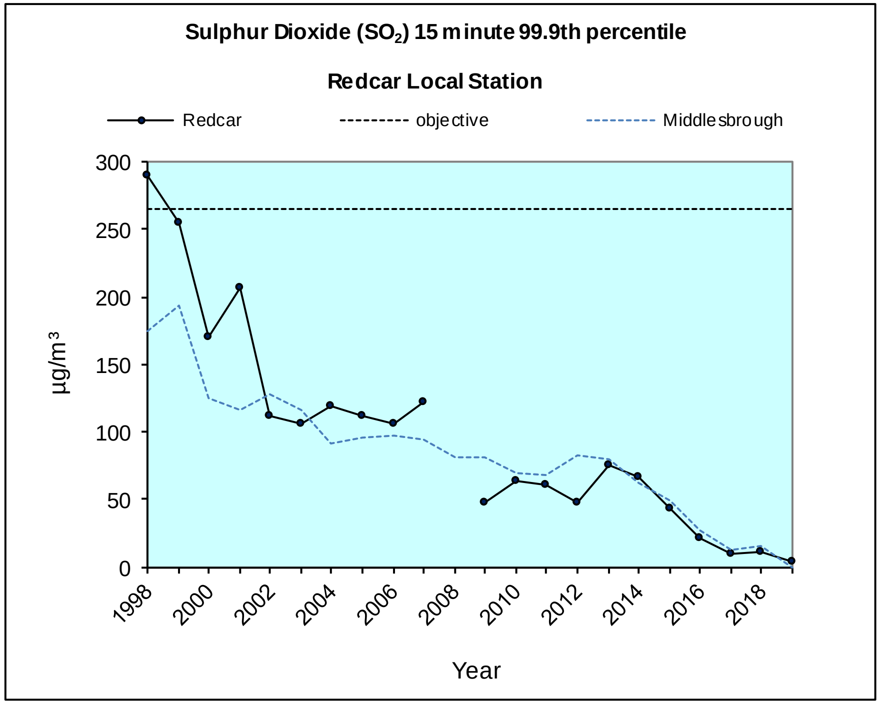
(3) If the period of valid data is less than 85%, the relevant percentiles are provided in brackets.

Figure A.6 – Trends in SO_2 Concentrations

REDCAR (Dormanstown & Corporation Road) Local Station

(suburban industrial site classification)





Station relocated to Dormanstown from Corporation Road January 2012

Middlesbrough Breckon Hill AURN station trend line added for comparison

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Mean Concentrations ($\mu g/m^3$)														
													Annual Mean		
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.87) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
R17	458379	523486	32.7	30.1	22.4	11.1	10.7	11.4	12.9	19.6	20.5	19.5	20.9	27.8	20.0	17.4	-
R18	458379	523486	26.7	35.8	24.5	10.4	7.6	10.8	12.5	16.7	12.6	21.8	16.8	32.1	19.0	16.5	-
R19	458379	523486	34.34	35.44	20.52	9.67	9.36	11.23	13.93	19.09	15.74	17.72	16:59	22.5	17.5	15.2	-
R26	453142	520836	38.45	28.75	22.61	25.96	12.94	22.42	19.08	17.41	24.15	26.28	30.99		22.4	19.5	-
R27	454712	520678	40.44	29.34	24.65	35.57	15.36	31.92	27.4	22.4	28.41	29.38	34.6	22.79	28.5	24.8	21.2
R36	461211	515667	27.65	19.59	15.11	18.48	9.82	13.79	15.36	13.56	16.16	21.14	25.02	19.52	17.9	15.6	-
R37	467369	516404	18.06	16.16	9.7	10.45	6.4	8.25	8.5	8.36	10.55	11.95	14.2	11.08	11.1	9.7	-
R38	465640	518819	22.71	18.17	11.83	17.15	8.36	12.51	13	12.92	15.29	17.26	20.39	17.05	15.6	13.5	-
R39	472403	518211	28.68		23.1	17.71	10.24	16.03	16.78	14.97	19.58	21.76	25.94	19.4	17.8	15.5	-
R40	459909	522873	26.77	22.76	20.53	10.57	9.16	10.29	10.44	13.27		18.08	21.08		13.6	11.8	-
R41	459695	524553	35.71	33.84	26.26	13.6	7.77	14.93	15.83	17.18	21.09	24.24	26.25	30.81	22.3	19.4	19.0
R42	453834	519869	21.01	20.44	13.38	16.49	9.46	14.16	13.17	9.96	15.41	20.2	21.77	16.56	16.0	13.9	-
R43	453964	519621	26.32	20.25	13.41	21.94	13.03	19.79	13.48	9.82	12.43	18.4	24.27	15.87	17.4	15.2	-
R44	454648	518546	27.84	23.86	14.06	13.48	8.12	12.14	12.02	11.23	16.23	16.46	22.84		14.9	12.9	-
R45	453922	515096	24.45	18.5	14.73	12.13	7.45	12.48	11.97	11.72	15.82	18.08	21.02	17.71	15.5	13.5	-
R46	452644	520921	28.73	25.11	16.65	21.22	8.05	14.22	15.5	13.22	16.85	20.18	22.93	19.53	18.5	16.1	-
R47	454621	518344	34.23	27.51	23.45	20.2	10.37	20.09	19.82	17.9	21.38	29.21	31.15	24.97	23.4	20.3	-
R48	459257	524555	31.5	23.04	21.25	19.09	12.65	18.9	18.54	17.55	20.72	22.39	21.05	18.03	20.4	17.7	-

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☐ **Annualisation has been conducted where data capture is <75%**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

AC.1 Diffusion Tube Bias Adjustment Factors

Diffusion tubes are supplied and analysed by Gradko International Ltd, using a 50% TEA in acetone. The nationally derived bias adjustment factor has been used for reporting purposes, a figure of 0.87. The Gradko International Ltd bias figure uses results from the national database of 5 co-location studies. Redcar and Cleveland Borough Council usually contribute to the national database, however due to an anomaly with the diffusion tube measurement range for September 2019 our co-location study cannot be used this time. The local bias adjustment factor (0.52) for 2019 has been calculated using triplicate co-location tubes at the Dormanstown static monitoring site. The local bias adjustment figure has not been used this year as there was one month of poor data capture and another month of poor precision, therefore Redcar and Cleveland has used the more conservative national bias factor.

AC.2 PM Monitoring Adjustment

The Dormanstown monitor is BAM gravimetric equivalence for particulate matter. The Ricardo-AEA monitoring tool has been used to adjust the figures using a value of 0.833 to produce a direct gravimetric equivalence.

AC.3 Short-term to Long-term Data Adjustment

Redcar Dormanstown continuous monitoring site had a data capture range of 76.77% to 97.5% during 2019 meaning that no data adjustment is required as no value was below 75%. During 2019 the SO_2 analyser experienced a large amount of downtime due to age related failings in the equipment. A loan analyser was provided by our contractor as replacement parts for the unit could not be sourced. A review of the SO_2 data was undertaken and as it has shown a decline over several years and no exceedances have been observed from the site, Redcar and Cleveland decided to cease monitoring of SO_2 from 2020 and instead invest in a $PM_{2.5}$ analyser.

During 2019 no diffusion tube had a data capture of less than 75% therefore no site had to be annualised.

AC.4 QA/QC of Automatic Monitoring

The Redcar and Cleveland static continuous local monitoring station (NO_x, PM_{10}, SO_2, O_3) is operated under a comprehensive service contract with the supplier. Operators of the site have received supplier training. All data since 2012 has been collected and rescaled by Ricardo-AEA.

Redcar and Cleveland are committed to achieving accuracy, precision, data capture, traceability and long term consistency to ensure that data is representative of ambient air quality. Redcar and Cleveland has documented quality assurance and control programme, which includes an established schedule of regular site calibrations, validation of data and documentation of all procedures. Details are as follows:

Calibration	Daily ‘automatic’ calibration with frequent (usually fortnightly) manual checks. Calibration gas obtained from approved gas standard suppliers.
Equipment	Comprehensive service agreement with the supplier.
Data Capture	Site operators are experienced and trained personnel. Monitoring data capture is inspected on a daily basis where possible by Ricardo-ARA to ensure that faults are detected and corrected quickly.
Ratification	Data verification is carried out on an ongoing basis, to check for unusual measurements. Data ratification reviews all calibrated data, information from analyser services and repairs and any other information available for the particular site or analyser over the whole

ratification period. In addition, the results from the independent QA/QC audits are incorporated to take account of any problems detected during the QA/QC audits such as:

- Long-term drift in an ozone instrument calibration.
- Faulty NO_x converters.
- Drifts in calibration cylinder concentrations.
- Instrument leaks or flow faults.
- Faulty instrument configuration.

Incorporation of the QA/QC audits ensures that ratified data are traceable to UK national and international gas calibration standards.

Redcar Dormanstown data can be found on Ricardo Energy & Environment using the web address below:

https://www.airqualityengland.co.uk/local-authority/?la_id=279

AC.5 QA/QC of Diffusion Tube Monitoring

Redcar and Cleveland operate the nitrogen dioxide diffusion tube study via an approved laboratory (Gradko International Ltd) with formal accreditation to BS standards and participation in the AIR-PT programme. Particular attention is given to correct installation of the tubes at site and a reliable exposure duration.

Gradko International Ltd have demonstrated 100% performance in three of the four AIR-PT schemes during 2019, results from scheme can be found using the address below,

https://laqm.defra.gov.uk/assets/laqmno2performancedatauptonovember2019v1.pdf

During 2019 the co-location study measured a large range of results for September (12.6 / 15.74 / 20.5) which gave a poor precision value. A review of the co-location tubes position was undertaken during 2019 and in accordance with the guidance in TG16. From this review the tubes are located in accordance with the guidance and there is no obvious reason for the variation in results for this particular month. The results continue to be reviewed on receipt to ensure that this situation does not occur each month.

Table C.1 – Triplicate NO_2 Diffusion Tube Bias Calculation 2019

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	09/01/2019	06/02/2019	32.7	26.7	34.3	31	4.0	13	10.0	8.51	30.65	Good	or Data Capture
2	06/02/2019	06/03/2019	30.1	35.8	35.6	34	3.2	10	8.0	16.45	92.41	Good	Good
3	06/03/2019	03/04/2019	22.4	24.5	20.5	22	2.0	9	5.0	10.14	99.85	Good	Good
4	03/04/2019	01/05/2019	11.1	10.4	9.7	10	0.7	7	1.8	7.37	98.96	Good	Good
5	01/05/2019	05/06/2019	10.7	7.6	9.4	9	1.6	17	3.9	6	99.88	Good	Good
6	05/06/2019	03/07/2019	11.4	10.8	11.2	11	0.3	3	0.7	5	99.85	Good	Good
7	03/07/2019	07/08/2019	12.9	12.5	13.9	13	0.7	6	1.8	6	99.52	Good	Good
8	07/08/2019	04/09/2019	19.6	16.7	19.1	18	1.6	9	3.9	8	100	Good	Good
9	04/09/2019	02/10/2019	20.5	12.6	15.7	16	4.0	25	9.9	9	99.55	Poor Precision	Good
10	02/10/2019	06/11/2019	19.5	21.8	17.7	20	2.0	10	5.0	10	97.02	Good	Good
11	06/11/2019	04/12/2019	20.9	16.8	16.6	18	2.4	13	6.0	12.76	99.85	Good	Good
12	04/12/2019	08/01/2020	27.8	32.1	22.5	27	4.8	18	11.9	12.22	99.76	Good	Good
13													

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey --> Good precision | Good Overall DC

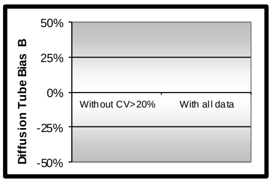
Site Name/ ID: Redcar Dormanstown

Precision 11 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.52 (0.45 - 0.6)
Bias B	94% (68% - 120%)
Diffusion Tubes Mean:	18 µgm⁻³
Mean CV (Precision):	10 caution
Automatic Mean:	9 µgm⁻³
Data Capture for periods used:	99%
Adjusted Tubes Mean:	10 (8 - 11) µgm⁻³

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.52 (0.46 - 0.59)
Bias B	92% (68% - 116%)
Diffusion Tubes Mean:	18 µgm⁻³
Mean CV (Precision):	11 caution
Automatic Mean:	9 µgm⁻³
Data Capture for periods used:	99%
Adjusted Tubes Mean:	9 (8 - 11) µgm⁻³



Jaume Targa, for AEA
Version 04 - February 2011

Calculations were undertaken using the AEA Energy and Environment tool and data supplied by Ricardo Energy and Environment to obtain a local bias factor. As the data quality check showed one ‘Poor Precision’ and one ‘Poor Data Capture’ during the reporting year it was decided that the national bias adjustment figure would be reported for 2019. The national bias adjustment figure also provides a more conservative adjustment of the NO_2 figures, as show in Table C3.

Table C.2 – National NO_2 Diffusion Tube Bias Calculation 2019

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/20

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2020
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in acetone	2019	R	City of London	12	74	71	4.1%	G	**0.96**
Gradko	50% TEA in acetone	2019	UB	City of London	12	37	33	14.3%	G	**0.88**
Gradko	50% TEA in acetone	2019	KS	Marylebone Road Intercomparison	12	83	65	26.3%	G	**0.79**
Gradko	50% TEA in acetone	2019	R	London Borough of Richmond upon Thames	12	46	35	30.4%	G	**0.77**
Gradko	50% TEA in acetone	2019	R	London Borough of Richmond upon Thames	12	29	27	7.1%	G	**0.93**
Gradko	50% TEA in acetone	2019	B	London Borough of Richmond upon Thames	11	21	21	1.0%	G	**0.99**
Gradko	50% TEA in acetone	2019	UB	Falkirk Council	9	18	15	18.1%	G	**0.85**
Gradko	50% TEA in acetone	2019	R	LB New ham	12	35	30	16.2%	G	**0.86**
Gradko	50% TEA in acetone	2019		**Overall Factor[3] (8 studies)**				Use		**0.87**

Table C.3 – Comparison of National and Local Bias Adjustment

Site ID	NO_2 Raw Data	Local Bias Adjustment (0.52)	National Bias Adjustment (0.87)
R17	20.0	10.4	17.4
R18	19.0	9.9	16.5
R19	17.5	9.1	15.2
R26	22.4	11.6	19.5
R27	28.5	14.8	24.8
R36	17.9	9.3	15.6
R37	11.1	5.8	9.7
R38	15.6	8.1	13.6
R39	17.8	9.3	15.5
R40	13.6	7.1	11.8
R41	22.3	11.6	19.4
R42	16.0	8.3	13.9
R43	17.4	9.0	15.1
R44	14.9	7.7	13.0
R45	15.5	8.1	13.5
R46	18.5	9.6	16.1
R47	23.4	12.2	20.4
R48	20.4	10.6	17.7

An example of the calculation used to derive the above results is shown below:

Bias Adjusted Figure = Raw Data x bias adjustment figure

= 20.0 x 0.52

= **10.4**

Table C.4 – Distance Correction Calculation

Distance correction calculations were undertaken for sites R27 and R41 due to their proximity from sensitive receptors. The Bureau Veritas NO_2 fall off calculator methodology was used to make these adjustments, as shown in the image below.

Enter data into the pink cells

Site Name/ID	Distance (m)		NO_2 Annual Mean Concentration (μg/m^3)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
R27 - West Lane	11.0	42.0	17.9	24.8	21.2	Warning: your receptor is more than 20m further from the kerb than your monitor - treat result with caution. Warning: your monitor is more than 10m further from the kerb than your receptor - treat result with caution.
R41 - Mersey Road	4.1	10.2	17.9	19.4	19.0	

AC.6 – Estimating $PM_{2.5}$ Concentrations from PM_{10} Monitoring

Redcar and Cleveland have not monitored $PM_{2.5}$ during the reporting period, therefore PM_{10} measurements are used to estimate $PM_{2.5}$ concentrations. These estimates have been calculated using the National Factor Figure, an example of the calculation is shown below.

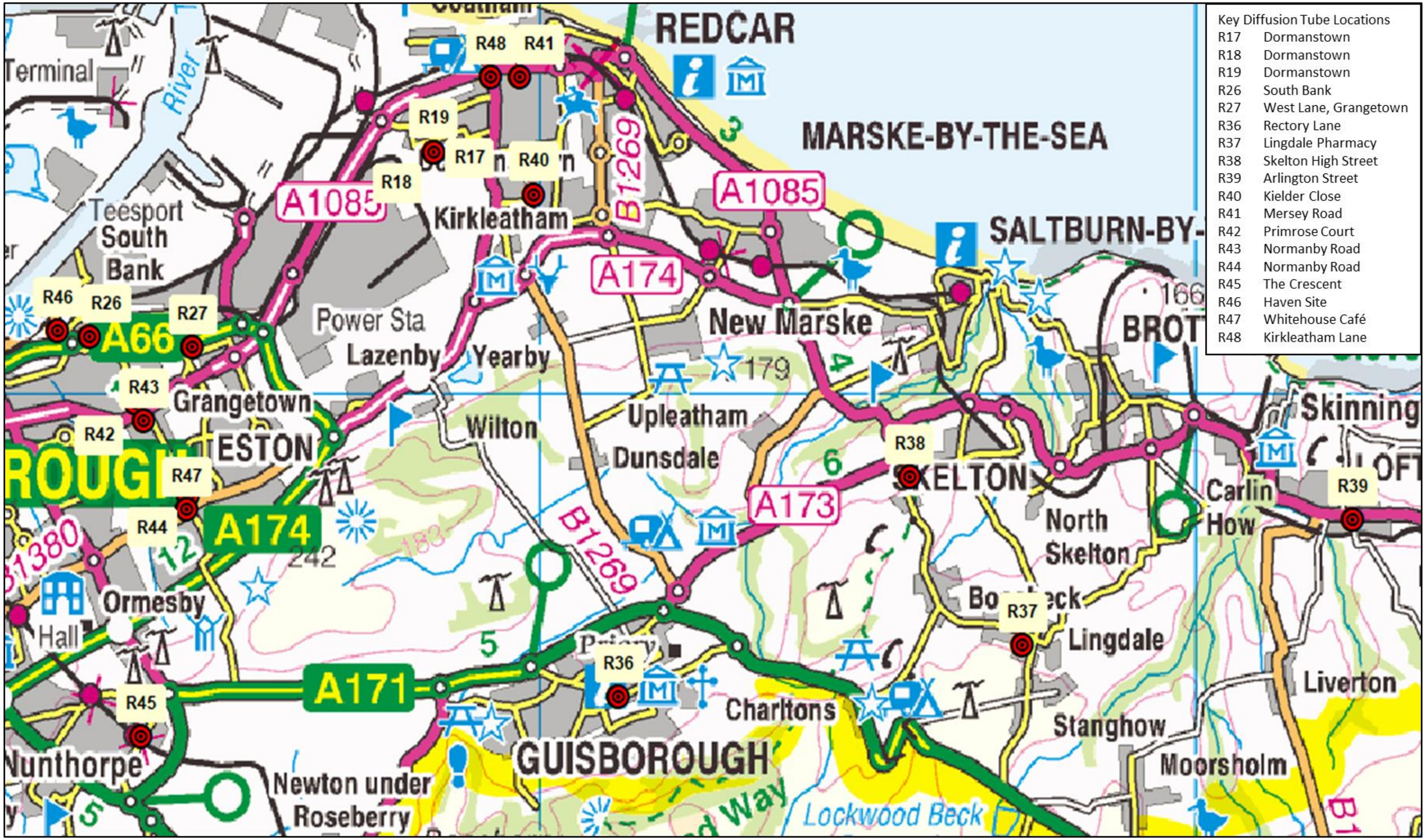
$PM_{2.5}$ Estimation = Annual Mean PM_{10} concentration x National correction factor

= 14 x 0.7

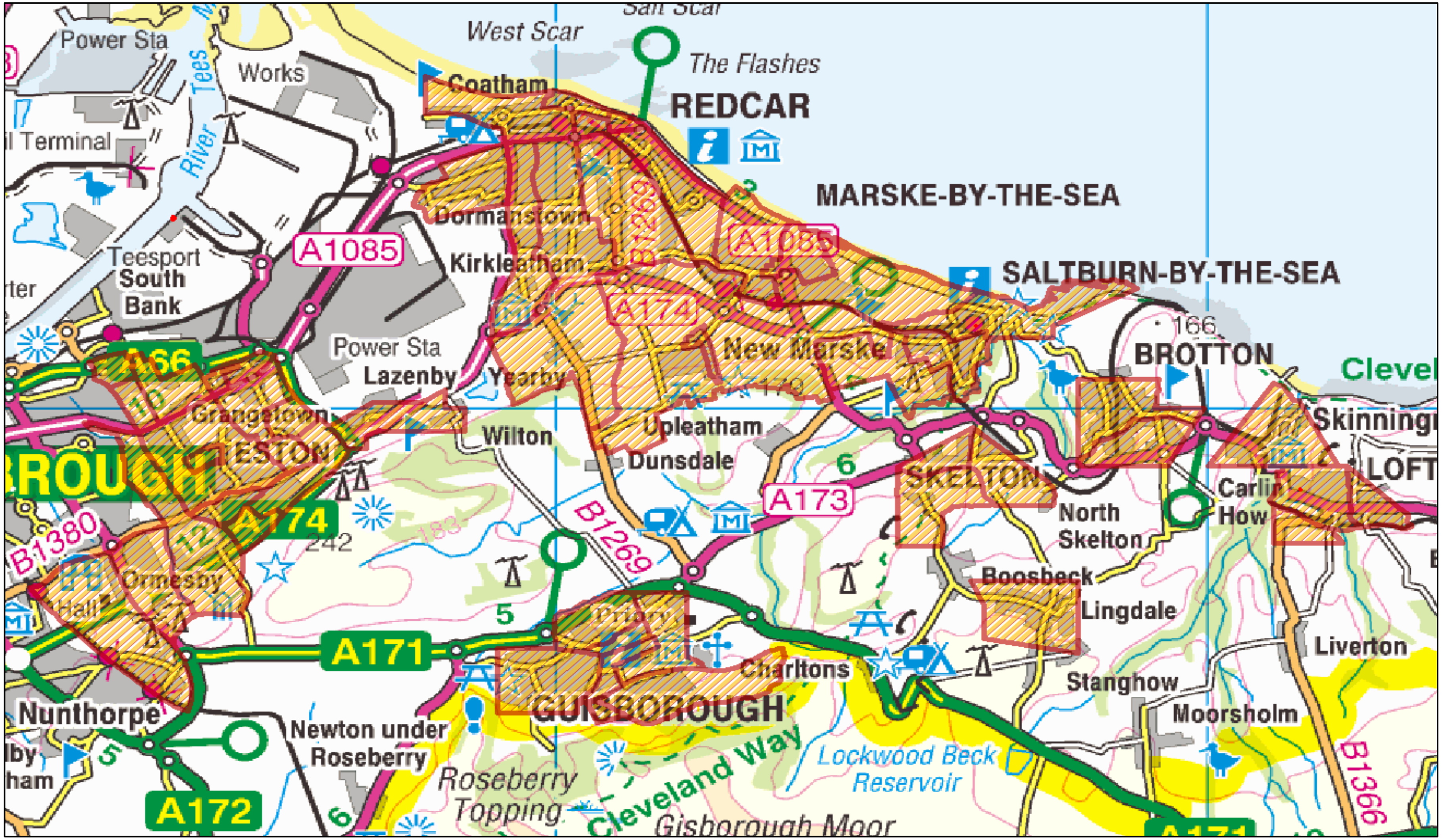
= **9.8**

Appendix D: Map of Monitoring Locations

Appendix D.1: Diffusion Tube Monitoring Network 2019



Appendix D.2: Smoke Control Areas within Redcar and Cleveland



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[6] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values’
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
SCA	Smoke Control Area
TEA	Triethylamine

APPENDIX II
BSG ECOLOGY: P20-1004
sHRA & AIR QUALITY IMPACTS ON SSSI REPORT

ECL Ref: ECL.007.04.01/ADM
February 2022
Version: Issue 1a

BSG ecology

Grangetown Energy Recovery Facility

Report to Inform a Habitats Regulations Assessment

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Client	FCC Environment
Project	Grangetown Energy Recovery Facility
Report title	Report to Inform a Habitats Regulations Assessment
Draft version/final	FINAL
File reference	P20-1004 Grangetown Prairie shadow HRA.docx

	Name	**Position**	**Date**
Originated	Steven Betts	Associate Director	23 August 2021
Reviewed	Roger Buisson	Associate Director	26 August 2021
Reviewed	James Gillespie	Director	31 August 2021
Updated	Steven Betts	Associate Director	25 January 2022
Approved for issue to client	Steven Betts	Associate Director	25 January 2022
Issued to client	Steven Betts	Associate Director	25 January 2022

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Nothing in this report constitutes legal opinion. If legal opinion is required the advice of a qualified legal professional should be secured. Observations relating to the state of built structures or trees have been made from an ecological point of view and, unless stated otherwise, do not constitute structural or arboricultural advice.

Contents

1 Introduction

Overview

1.1 Outline planning consent has been granted for the construction of an Energy Recovery Facility (ERF) and associated development at a site known as Grangetown Prairie (planning reference R/2019/0767/OOM).

1.2 The planning process included consultation with Natural England that confirmed that a Habitats Regulations Assessment was required because of the site's proximity to, and potential to impact on, the following European designated sites: Teesmouth and Cleveland Coast SPA and Ramsar. An HRA Screening Report (see Section 5 for further explanation of the 'screening' process) was subsequently prepared (JBA Consulting, 2019) and submitted alongside the planning application. The Screening Report concluded that '*no likely significant effects were identified from the proposed works*' and that '*the HRA process for the project will not be required to proceed to an Appropriate Assessment*'.

1.3 In correspondence dated 20 January 2020 (reference 304948, Andrew Whitehead, Team Leader - Sustainable Development, Marine & Wildlife Licensing Northumbria Area Team) Natural England objected to the proposed development and advised Redcar and Cleveland Borough Council that they considered that it was '*not possible to conclude that the proposal is unlikely to result in significant effects on the European sites in question*'. Consequently the need to carry out an 'appropriate assessment' was considered to be triggered. In particular, Natural England requested that an air quality assessment was completed that considered the operation of the ERF and the effects of emissions on designated site habitats and species, i.e., the qualifying features of the European designated sites.

1.4 In subsequent correspondence to Redcar and Cleveland Borough Council dated 26 March 2020 (reference 312932, Andrew Whitehead, Team Leader - Sustainable Development, Marine & Wildlife Licensing Northumbria Area Team) Natural England withdrew their objection to the proposed development, advising that they no longer believed that the proposal was likely to have a significant effect on the European sites in question. This conclusion was reached following the submission of further information in the form of an 'appropriate assessment' (JBA Consulting, 2020).

1.5 Following the withdrawal of Natural England's objection, outline planning consent was granted. Condition 3 of the decision notice states:

1.6 '*Upon the approval of the Reserved Matters, and prior to the implementation of the approved scheme, the development shall be the subject of an updated Habitats Regulations Assessment and additional supplementary air quality assessment. The HRA and additional air quality assessment shall confirm, based on the approved detail of the development and its processes, the conclusions of the Environmental Impact Assessment and Air Quality Assessment that the development will not give rise to significant adverse impacts on designated sites. Where significant impacts not previously identified are assessed to arise from the approved detailed scheme, the additional information shall set out those mitigation measures to be employed to minimise or eliminate such impacts*.'

1.7 This document presents the results of a further HRA (a shadow HRA[1]), which will provide information that will help Redcar and Cleveland Council to discharge its duties as the 'competent authority' as defined under Regulation 63(1) of the Conservation of Habitats and Species Regulations 2017[2] (as amended - hereafter referred to as the 'Habitats Regulations').

1.8 It should be noted that it has not been possible to visit the site during the preparation of this assessment due to ongoing remediation work. This is not considered to be a limitation as previous surveys have established site conditions prior to this work commencing. The loss of habitats and disturbance associated with these works is likely to have reduced the value of the site to qualifying features (birds) associated with the Teesmouth and Cleveland Coast SPA and Ramsar site.

[1] Under the Conservation of Habitats and Species Regulations 2017 the 'competent authority' is responsible for completing a Habitats Regulations Assessment (HRA). If an HRA is carried out by a third party with the objective of it being adopted by the competent authority, this is often referred to as a shadow HRA.

[2] Following the UK's exit from the European Union, the 2017 Regulations have been amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

Site description

1.9 The site (the 'Site') is located on land to the east of John Boyle Road and to the west of Tees Dock Road, Grangetown, Redcar and Cleveland. The central Ordnance Survey Grid Reference (OSGR) for the site is NZ543213. The location of the Site is shown on Figure 1 in Section 12.

1.10 BSG Ecology understands from FCC Environment that Site remediation works have been carried out by South Tees Development Corporation (STDC). This has resulted in the removal of all vegetation within the Site.

Project Description

1.11 FCC Environment is one of three bidders in a confidential bidding process looking to secure a long-term contract to build and operate an Energy from Waste facility with the Joint Authorities. The Tees Valley Authorities (TVA), Durham County Council and Newcastle City Council (the Councils) have joined together to create an opportunity for a contractor to design, build, finance and operate (DBFO) a new Energy Recovery Facility (ERF) to be located in the Tees Valley on a mandated site owned by the South Tees Development Corporation (STDC).

1.12 The mandated site is on a large industrial brownfield site within the Redcar and Cleveland Borough Council administrative area: this is the site of the former British Steel works in Grangetown, an area known as Grangetown Prairie. The site is approximately 25 acres in total.

1.13 Outline planning consent has been granted by Redcar and Cleveland Borough Council (planning reference R/2019/0767/OOM) for an ERF facility that could treat 450,000 tonnes per annum of waste and export up to 49.9 MWH of electricity. The developed site will also include landscaping, internal access roads and car parking areas.

Report Structure

1.14 This report documents the HRA for the proposed Energy Recovery Facility. It identifies, analyses and quantifies (where possible) potential negative impacts on the relevant European sites. The report is structured as follows:

- Chapter One: sets out the purpose of the report and provides an overview of the project.
- Chapter Two: describes the Habitats Regulations Assessment process.
- Chapter Three: sets out the scope of the assessment and how this has been derived.
- Chapter Four: identifies the European sites that may potentially be impacted by the project, together with ecological information about each site.
- Chapter Five: sets out the screening for any Likely Significant Effects.
- Chapter Six: describes the Appropriate Assessment, which includes mitigation measures where appropriate.
- Chapter Seven: presents the conclusions of the assessment.

Consultation

1.15 FCC Environment has engaged with Natural England through the Discretionary Advice Service (DAS), which involved a meeting on 24 November 2021 between Nick Lightfoot and Lewis Pemberton (Natural England), David Molland (FCC), Tim Heard, Sarah Burley and Sara Maile (ECL), Steven Betts (BSG Ecology) and Sam Thistlethwaite (Identity Consult Planning).

1.16 Natural England provided the following advice in relation to the draft shadow HRA that had been sent to them in advance of the meeting:

- Modelling locations TCC10, 11, 12 and 13 are considered to be the most sensitive ecological receptors due to the habitats that are present, i.e., mudflats (at Seal Sands), saltmarsh and sand dunes.
- The mudflats at Seal Sands provide an important feeding area for SPA and Ramsar qualifying birds and eutrophication is currently resulting in the formation of algal mats that make feeding difficult for some species.
- Saltmarsh may be used by some SPA and Ramsar qualifying birds for feeding and so needs to be considered in the HRA.
- Sand dune is not important for SPA and Ramsar qualifying birds but is important as a qualifying feature of the Teesmouth and Cleveland Coast SSSI (this habitat does not need to be considered within the HRA).
- Table 8 of the draft HRA refers to the release of waterborne non-synthetic compounds as being unlikely. Further explanation is required as to why this is unlikely.
- The HRA needs to consider deposition to the River Tees and estuary and nutrient enrichment of the water.

Contributors

1.17 The report has been prepared by Steven Betts, who has worked in the ecological sector for more than 27 years. During this time he has contributed to a wide range of projects, both as author and technical reviewer. This has included the preparation of and contributions to numerous HRAs for projects that have included an energy recovery facility, housing developments, powerline projects, solar schemes and wind farms.

1.18 The report has been reviewed by Dr Roger Buisson. Roger is a highly experienced professional ecologist with over 30 years' experience. He has managed or contributed to numerous projects that have included a requirement for HRA.

1.19 Further details of the experience and qualifications of the above can be found at http://www.bsg-ecology.com/people/.

2 Habitats Regulations Assessment

Legislation and policy

2.1 This section describes the legislation and policy as it applies now that the UK has left the European Union.

2.2 Guidance from Defra has been provided on the application of the relevant legislation in the post-Brexit period in their policy paper published on 01 January 2021 available at https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017.

2.3 The Conservation of Habitats and Species Regulations 2017 (as amended) provide for the protection of particular habitats, plants and animals through the creation of, and specific decision-making procedures applied to, the 'national site network' (Regulation 3 'Interpretation'). This 'national site network' includes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that were designated or classified both in that period when the UK was a member of the EU and designated since the UK has left the EU.

2.4 It is UK Government policy (in England this is identified in paragraph 181 of the National Planning Policy Framework, 2021) that all competent authorities should treat candidate SACs (cSACs) and potential SPAs (pSPAs) as being within the provisions of the Conservation of Habitats and Species Regulations 2017 (as amended).

2.5 In this report the term 'European Sites' is used to refer collectively to SACs, cSACs, SPAs and pSPAs. Although they are referred to as the 'national site network' in those recently amended parts of the Habitats Regulations, the decision-making procedures concerning HRA, as set out in Regulation 63, continue to refer to them as 'European Sites' (as does much of the available guidance) and for that reason in this report they are referred to collectively as European Sites.

Habitats Regulations Assessment process

2.6 The requirements of the Habitats Regulations with regard to the implications of plans or projects are set out within Regulation 63 of the Habitats Regulations. The step-based approach implicit within this regulation is referred to as a 'Habitats Regulations Assessment', which is the term that has been used throughout this report.

2.7 It is a requirement of any public body (referred to as a competent authority within the Habitats Regulations) to undertake a Habitats Regulations Assessment (HRA) when they are proposing to carry out a project, implement a plan or authorise another party to carry out a plan or project. Competent authorities are required to record the process undertaken, ensuring that there will be no adverse effects on the integrity of any European Site, as a result of a plan or project whether alone or in combination with other plans or projects. In this case the competent authority is Redcar and Cleveland Borough Council.

Assessment stages

2.8 The assessment of a plan or project goes through a number of stages, with guidance having been published to aid competent authorities fulfil their responsibilities (e.g., Defra, 2021). Those stages are summarised in Table 1 below.

***Table 1**: Stages in the Habitats Regulations Assessment process*

Stage	Description	Legislative Context
Purpose	Determines if the purpose of the plan or project is directly connected with, or necessary, to the management of a European Site. If it is, then no further assessment is necessary	Regulation 63(1)(b)
Scoping	The identification of any European Site that might be within scope of a HRA, i.e., those European Sites should be taken forward to the screening stage based on a wide consideration of spatial and ecological factors. Such European Sites may be located within the plan or project area but may also include sites located in neighbouring authority areas.	
Screening	Assessment of whether a plan or project, either alone or in combination with other plans or projects, is likely to have a significant effect on any European Sites' qualifying features (habitats and species) and the achievement of the European Site's conservation objectives. This is also known as the 'test of likely significant effect' (ToLSE).	Regulation 63(1)(a)
Appropriate Assessment	Consideration of the impacts of the proposals to determine whether or not it is possible to conclude with certainty that the project will not result in any adverse effect on the integrity of any European Site, either alone or in combination with other plans or projects and with reference to the European Site's conservation objectives. This is also known as the test of 'adverse effect on integrity' (AEoI). At this stage consent may be granted for the plan or project if it is possible to conclude with certainty that the proposal will not result in any adverse effect on the integrity of any European Site, either alone or in combination with other plans or projects.	Regulation 63(5)
If it cannot be concluded with certainty that the proposal will not result in any adverse effect on the integrity of any European Site then proceed to:		
Assessment of alternative solutions	Assess whether there is an alternative solution to the plan or project, i.e., one that avoids adverse effects on European Sites. If no such alternative solution exists, the process continues to an assessment of whether there are 'imperative reasons of overriding public interest' (IROPI) for the plan or project to proceed.	Regulation 64(1)
Assessment of IROPI	Assess whether a plan or project can be justified as being needed for 'imperative reasons of overriding public interest' (IROPI).	Regulation 64(1)
Compensatory measures	Identify and secure any necessary compensatory measures to ensure that the overall coherence of the 'national site network' is protected.	Regulation 68

Applying Case law to the HRA process

2.9 The Court of Justice of the European Union (CJEU) and UK Court judgments have identified that in the HRA process the assessment may not have lacunae (gaps or omissions) and must contain complete, precise and definitive findings capable of removing all reasonable scientific doubt as to the effects of the proposed works on the European Site concerned. Court judgments have identified that in the HRA process all aspects of the plan or project which can, by themselves or in combination with other plans or projects, affect the conservation objectives of European Sites concerned must be identified in the light of the best scientific knowledge available in the field.

2.10 A CJEU judgment in 2018 (People Over Wind and Sweetman, 12 April 2018, C-323/17) has provided clarification as to when avoidance or reduction (i.e., mitigation) measures can be considered within the HRA process. The headline for the case is:

> "*In the light of all the foregoing considerations, the answer to the question referred is that Article 6(3) of the Habitats Directive must be interpreted as meaning that, in order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site*".

2.11 This case means that a competent authority cannot rely on avoidance or reduction measures that allow a conclusion of 'no likely significant effect' to be reached: instead, it is necessary to accept that there is a 'likely significant effect' in the absence of these measures, and move to the next stage, i.e., appropriate assessment, at which point such mitigation measures can be considered. This judgment is accounted for in this report.

2.12 A further CJEU judgment (Holohan & Ors. v An Bord Pleanála, 7 November 2018, C-461/17) provides further clarification about the HRA process, requiring that all habitats and species associated with a European Site (irrespective of whether or not they are qualifying features) must be considered in the assessment if impacts on those non-qualifying habitats or species are liable to affect the conservation objectives of the European Site through, for instance, effects on ecological processes or food chains. This judgment is also accounted for in this report.

2.13 It is noted that relevant case law still applies following the UK's departure from the EU, and that the 2017 Regulations amendments in The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, will apply.

Functionally linked land

2.14 A development has the potential to impact a European site either directly, for example as a result of land-take, or indirectly, for example as a result of changes in air quality. When assessing impacts it is important to note that impacts need to be considered on 'functionally linked land'. Functionally linked land can be defined as follows (Chapman & Tyldesley, 2016):

2.15 '*the term 'functional linkage' refers to the role or 'function' that land or sea beyond the boundary of a European site might fulfil in terms of ecologically supporting the populations for which the site was designated or classified. Such land is therefore 'linked' to the European site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status*.'

2.16 In this report consideration has been given to whether or not the proposed development will impact land that is functionally linked to a European site.

3 Scope of the Assessment

Overview

3.1 There are no standard criteria for determining the spatial scope of an HRA and so the decision to include or exclude European sites from an assessment needs to be supported by application of the source-pathway-receptor conceptual model, which highlights whether there is any potential pathway that connects the development to any European sites. In this case the spatial scope of the assessment is informed by identifying the impacts that could potentially arise as a result of the development, assessing the spatial and temporal scope of those impacts and understanding the effects on sensitive receptors that might arise.

Potential impact mechanisms

3.2 Potential impacts that may arise from the construction phase of the proposed development have been identified as follows:

- Degradation of habitats as a result of excavation work, material storage and mobile plant tracking; such impacts will be limited in their extent to the Site with no construction activity proposed outside the Site boundary.
- Degradation of habitats arising from pollution, in particular airborne (e.g., dust) and water-borne (e.g., silt) pollutants; such impacts will be limited in their extent to the Site and the adjacent area.

3.3 Impacts that may arise during the operational phase of the proposed development will be limited to changes in air quality arising from the operation of the energy recovery facility. No further degradation of habitat arising from excavation work, material storage and mobile plant tracking etc is likely during this phase of the development.

3.4 The decommissioning phase of the proposed development is expected to result in similar impacts to those described for the construction phase of the development. Air quality impacts will be limited to dust generated during the decommissioning works, with other aerial discharges having ceased prior to this phase of the development. Habitat degradation will be limited to the landscaped habitats that have developed within the Site during its operational life.

Scope of the assessment

3.5 The Zone of Influence (ZoI) for the proposed development is the area over which ecological features may be affected by biophysical changes as a result of the proposed work and associated activities. This may extend beyond the Site boundary. The ZoI has been used to determine the extent of the desk study, baseline ecological surveys and biological / non-biological (air quality) assessments.

3.6 During the construction stage of the proposed development the ZoI is considered to be the Site and a buffer area around it within which impacts may occur depending upon the sensitivity of the ecological receptors being considered. In this assessment the following ZoIs have been adopted:

- Degradation of habitats (habitat loss and disturbance) – This will be limited to the Site and immediate environs, i.e., a precautionary ZoI of 100 m. Consideration needs to be given to direct impacts on European sites and to impacts on land that is functionally linked to a European site (see Section 2.14 et seq.).
- Degradation of habitats (airborne pollution) - Air quality impacts due to dust production may potentially impact on sensitive ecological features. Current guidance (Holman *et al*, 2014) advises that construction-related dust impacts only need to be considered for important ecological features within 50 m of the proposed development boundary. Guidance on mineral developments (IAQM, 2016) advises that a significant effect from dust is unlikely beyond 400 m of the proposed development boundary (this higher figure has been adopted on a precautionary basis for the purposes of the HRA).

- Degradation of habitats (waterborne pollution) – Water-borne pollutants, such as silt, fuel and oils, have the potential to impact on habitats downstream of the pollution source. Whilst this type of pollution can potentially be wide-ranging, its effects will be limited to the receiving watercourse. A watercourse runs alongside the western boundary of the Site and this flows into culverts to the north and south. It is likely that this drains into the Tees Estuary to the north of the Site. At this point any pollutant is likely to be subject to some dilution, mixing and dispersal, although this may be reduced within the confines of an estuarine environment. Approximately 7 km downstream the River Tees discharges to the open sea, at which point dilution, mixing and dispersal are likely to be significant. For this reason 7 km has been set as the ZoI.

3.7 During the operation phase a ZoI of 10 km has been adopted. As the proposed development will generate less than 50 MW, the ZoI for the project is taken to be 10 km from the proposed works location to follow DEFRA air emission guidance (DEFRA, 2016).

3.8 In summary, the following potential types of adverse effect, with their associated ZoI, have been considered in this assessment:

- Degradation of habitats (habitat loss and disturbance) (ZoI is 100 m from the Site);
- Degradation of habitats (airborne pollution - dust) (ZoI is 400 m from the Site);
- Degradation of habitats (waterborne pollution) (ZoI is 7 km from the Site);
- Degradation of habitats (airborne pollution – gaseous and particulate pollutants) (ZoI is 10 km from the Site.

3.9 Taking into account these impact mechanisms and the ZoIs that have been adopted for the assessment, the HRA has considered impacts on the following European sites:

- Teesmouth and Cleveland Coast SPA;
- Teesmouth and Cleveland Coast Ramsar;
- North York Moors SAC; and
- North York Moors SPA.

3.10 No other European sites have been identified where the impacts and effects of the proposed development need to be considered.

4 Information on the Relevant European Sites

4.1 Set out below is information relating to the Teesmouth and Cleveland Coast SPA (Table 2), Teesmouth and Cleveland Coast Ramsar (Table 3), North York Moors SAC (Table 4) and North York Moors SPA (Table 5) and the reference sources of information used. The following information is provided for each site:

- Site name and code
- Year classified/designated/listed
- Area
- Qualifying interest features
- Conservation objectives
- Distance between nearest component of European Site and the quarry
- Sources of information

***Table 2**: Teesmouth and Cleveland Coast SPA*

Site name: Teesmouth and Cleveland Coast SPA
Site code: UK9006061
Year designated: Designated on 1 April 2005
Area: 12210.62 ha
Component SSSIs: Durham Coast SSSI, Teesmouth and Cleveland Coast SSSI.
Qualifying interest features: The site qualifies under Article 4 of the Birds Directive (2009/147/EC) as it regularly supports more than 1% of the Great Britain populations of the following species listed in Annex I of the EC Birds Directive: • Avocet (*Recurvirostra avosetta*), Breeding • Sandwich tern (*Thalasseus sandvicensis*), Non-breeding • Little tern (*Sternula albifrons*), Breeding • Common tern (*Sterna hirundo*), Breeding • Ruff (*Calidris pugnax*), Non-breeding The site also regularly supports more than 1% of the biogeographic population of two regularly occurring migratory species not listed in Annex I of the EC Birds Directive: • Redshank (*Tringa totanus*), Non-breeding • Knot (*Calidris canutus*), Non-breeding The site qualifies under Article 4 of the Birds Directive (2009/147/EC) as it is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season: • Waterbird assemblage, Non-breeding – average number of individuals 26,014
Conservation objectives: Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features, • The structure and function of the habitats of the qualifying features, • The supporting processes on which the habitats of the qualifying features rely, • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.
Distance: The development site is 1.4 km from the nearest part of the SPA.

Site name: Teesmouth and Cleveland Coast SPA
Sources of information: Site citation - http://publications.naturalengland.org.uk/file/4903947418730496 JNCC Natura 2000 Data Form - http://publications.naturalengland.org.uk/file/3209673 (2012) Conservation Objectives - http://publications.naturalengland.org.uk/file/4849489020190720 Regulation 33 Conservation Advice - http://publications.naturalengland.org.uk/file/3208616 (2012) Site Improvement Plan – http://publications.naturalengland.org.uk/publication/5803888850501632

***Table 3**: Teesmouth and Cleveland Coast Ramsar*

Site name: Teesmouth and Cleveland Coast Ramsar
Site code: UK0019859
Year designated: Designated on 15 August 1995
Area: 1247.31 ha
Component SSSIs: Durham Coast SSSI, Teesmouth and Cleveland Coast SSSI.
Qualifying interest features: The site qualifies under Ramsar criterion 5 because it supports: • An assemblage of international importance – 9,528 waterfowl (5 year peak mean 1998/99-2002/2003). The site qualifies under Ramsar criterion 6 because it supports the following species/populations, which occur at levels of international importance: • Redshank (*Tringa totanus*), Non-breeding • Knot (*Calidris canutus*), Non-breeding
Conservation objectives: There are no specific conservation objectives for the Ramsar site; however, as the site is of importance for species that are also qualifying features of the SPA, it has been assumed that the SPA conservation objectives are also relevant for the Ramsar site. Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring: • The extent and distribution of qualifying natural habitats and habitats of qualifying species. • The structure and function (including typical species) of qualifying natural habitats. • The structure and function of the habitats of qualifying species. • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely. • The populations of qualifying species, and, • The distribution of qualifying species within the site.
Distance: The development site is 1.7 km from the nearest part of the Ramsar site.

Site name: Teesmouth and Cleveland Coast Ramsar
Sources of information: Site citation - https://jncc.gov.uk/jncc-assets/RIS/UK11068.pdf JNCC Natura 2000 Data Form – n/a Conservation Objectives – n/a Conservation Objectives Supplementary Advice – n/a Site Improvement Plan – n/a Proposed targets for SAC Conservation Objectives – n/a

***Table 4**: North York Moors SAC*

Site name: North York Moors SAC
Site code: UK0030228
Year designated: Designated on 1 April 2005
Area: 44053.29 ha
Component SSSI: North York Moors SSSI.
Qualifying interest features: Qualifying habitats: The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I: • 4010 Northern Atlantic wet heaths with *Erica tetralix*. • 4030 European dry heaths Qualifying habitats: Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • 7130 Blanket bogs (* if active bog) * Priority feature
Conservation objectives: Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring: • The extent and distribution of the qualifying natural habitats, • The structure and function (including typical species) of the qualifying natural habitats, and, • The supporting processes on which the qualifying natural habitats rely.
Distance: The development site is 9.4 km from the nearest part of the SAC.
Sources of information: Site citation - http://publications.naturalengland.org.uk/file/5868610203418624 JNCC Natura 2000 Data Form - https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030228.pdf Conservation Objectives - http://publications.naturalengland.org.uk/file/5052053512781824 Conservation Objectives Supplementary Advice - http://publications.naturalengland.org.uk/file/5324037278662656 Site Improvement Plan – http://publications.naturalengland.org.uk/publication/6110322049941504

***Table 5**: North York Moors SPA*

Site name: North York Moors SPA
Site code: UK0019859
Year designated: 12 May 2000
Area: 44,087.68 ha
Component SSSIs: North York Moors SSSI.
Qualifying interest features: Qualifying species: The site qualifies under article 4.1 of the Directive (79/409/EEC) as it is used regularly by 1% or more of the Great Britain population of the following two species listed in Annex I in any season: • Merlin *Falco columbarius* • Golden Plover *Pluvialis apricaria* Non-qualifying species of interest: In addition, the site supports a rich upland breeding bird assemblage which includes Short-eared owl *Asio flammeus*, peregrine *Falco peregrinus* and hen harrier *Circus cyaneus* (all Annex I species), together with redshank *Tringa totanus*, red grouse *Lagopus lagopus scoticus* and a nationally important population of curlew *Numenius arquata*.
Conservation objectives: Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features, • The structure and function of the habitats of the qualifying features, • The supporting processes on which the habitats of the qualifying features rely, • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.
Distance: The development site is 9.4 km from the nearest part of the SPA.
Sources of information: Site citation - http://publications.naturalengland.org.uk/file/4889831448510464 JNCC Natura 2000 Data Form - https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020325.pdf Conservation Objectives - http://publications.naturalengland.org.uk/file/4525396477607936 Conservation Objectives Supplementary Advice - http://publications.naturalengland.org.uk/file/6752904849653760 Site Improvement Plan – http://publications.naturalengland.org.uk/publication/6110322049941504

Teesmouth and Cleveland Coast SPA / Ramsar: site condition

4.2 Natural England has not published the results of a comprehensive condition assessment for the Teesmouth and Cleveland Coast SPA and Ramsar site and it is not known if such an assessment has been carried out.

4.3 Natural England publishes condition assessments for SSSIs, the Teesmouth and Cleveland Coast SSSI being the component SSSI for the Teesmouth and Cleveland Coast SPA / Ramsar that is located closest to the proposed development site. Whilst this information can be helpful in terms of establishing the baseline conditions of a European site, in this case the condition assessment is incomplete for the Teesmouth and Cleveland Coast SSSI. The summary data available for the SSSI indicates that 0.77% is in 'favourable' condition, 9.98% is in 'unfavourable declining' condition and 89.25% is 'not recorded'. Two management units are reported to be in 'unfavourable declining' condition due to declining numbers of certain species: unit 8 (Seal Sands) and unit 26 (Bran Sands).

Teesmouth and Cleveland Coast SPA / Ramsar: site vulnerabilities

4.4 Known threats and pressures on the SPA (as listed on the JNCC Natura 2000 Data Form) are 'Outdoor sports and leisure activities, recreational activities' (G01), 'Pollution to surface waters (limnic & terrestrial, marine & brackish)' (H01), 'Human induced changes in hydraulic conditions' (J02), 'Industrial or commercial areas' (E02) and 'Fishing and harvesting aquatic resources' (F02). The Site Improvement Plan (Natural England, 2014a) lists the following threats and pressures: physical modification; public access/disturbance; land-take; water pollution; fisheries (commercial and recreational); undergrazing; inappropriate water levels; predation; coastal squeeze; change to site conditions; air pollution (specifically the effects of nitrogen deposition on little tern).

North York Moors SAC / SPA: site condition

4.5 Natural England has not published the results of a comprehensive condition assessment for the SAC but it has published a summary of the 'Monitored features on unit' for the SAC[3], and this provides a summary assessment for each qualifying feature in each management unit within the component SSSI.

4.6 The content of the 'Monitored features on unit' table can be summarised as follows:

- H4010 Northern Atlantic wet heaths with *Erica tetralix* is in 'favourable' condition in management units 19, 39, 98, 99 and 166. The habitat is reported to be in 'unfavourable recovering' condition in all other management units where it occurs, with the exception of management unit 186 where it is in 'unfavourable' condition.
- H4030 European dry heaths is in 'favourable' condition in management units 5, 15, 17, 23, 27, 39, 68, 98, 99, 166 and 187. The habitat is reported to be in 'unfavourable recovering' condition in all other management units where it occurs, with the exception of management units 4, 32, 96 and 186 where it is in 'unfavourable' condition, and management unit 72 where it is in 'unfavourable declining' condition.
- H7130 Blanket bog is reported to be in 'unfavourable recovering' condition in all management units where it occurs, with the exception of management unit 186 where it is in 'unfavourable' condition.

4.7 No condition assessment has been published for the North York Moors SPA (i.e., for the habitats that support the qualifying features – birds). As the SPA shares the same boundary as the SAC, the monitoring data summarised above is considered to apply.

North York Moors SAC / SPA: site vulnerabilities

4.8 Known threats and pressures on the SAC (as listed on the JNCC Natura 2000 Data Form) are 'Changes in abiotic conditions' (M01), 'Air pollution, air-borne pollutants' (H04), 'Invasive non-native species' (I01), 'Interspecific floral relations' (K04) and 'Fire and fire suppression' (J01).

[3] 'Monitored features on unit' is published as a summary table that can be accessed at https://designatedsites.naturalengland.org.uk/SiteSACFeaturesMatrix.aspx?SiteCode=UK0030228&SiteName=North%20York%20Moors%20SAC. No information is provided about the data that has informed this assessment and when it was collected.

4.9 Known threats and pressures on the SPA are 'Invasive non-native species' (I01), 'Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.)' (F03), 'Changes in abiotic conditions' (M01), 'Fire and fire suppression' (J01) and 'Air pollution, air-borne pollutants' (H04).

4.10 The Site Improvement Plan (Natural England, 2014b) lists the following threats and pressures for the SAC and SPA: climate change; air pollution (atmospheric nitrogen deposition); disease; invasive species; rotational burning; mineral and waste planning; game management; changes in species distribution; agriculture; energy production; wildfire/arson.

Qualifying Features Present in Vicinity of Proposed Works

4.11 Summary information on the European site qualifying features that have been recorded in the vicinity of the site is presented in a previous HRA that supported Outline planning application reference R/2019/0767/OOM (JBA Consulting, 2020). No ecological survey of the site and the surrounding area has been completed in 2021 due to ongoing remediation work, which has meant that the site could not be accessed. For this reason the original summary information presented in JBA Consulting (2020) is reproduced below.

4.12 '*An ecological assessment of the site was undertaken by Hartlepool Borough Council (HBC) in August 2019 and a further assessment was undertaken by HBC and JBA Consulting in November 2019, in which no qualifying species were identified using or flying over the proposed works site (HBC, 2019), however this data is limited due to only two visits being undertaken throughout the year.*

4.13 *A further desk-based assessment was undertaken after the site visit gathering data from the Environmental Records Information Centre North East, Durham Bird Club and Teesmouth Bird Club. The results of the assessment identified no qualifying species within 2 km of the proposed works site most likely due to large areas surrounding the site being inaccessible to the public (including the site itself).*

4.14 *No habitats were recorded on site during the site visit that would be suitable or provide support for foraging or breeding species related to the European designated sites. The area is highly industrial with no suitable habitats or land functionally linked to the European designated sites apparent in the vicinity of the proposed works site*.'

4.15 '*Industrial buildings are dominant in the landscape with areas of brownfield present in the gaps where developments have become derelict or been demolished in the past. Mudflats and intertidal substrate foreshores are present within the designated sites around 1.6 km and 1.5 km away respectively from the proposed works site*.'

Habitat sensitivity

4.16 Habitats are sensitive to deposition of pollutants carried in the air, which may result in eutrophication and acidification. Deposition occurs both in the form of dry deposition and wet deposition and the exposure to pollutants through deposition is described with reference to Critical Loads and Critical Levels. Critical loads are defined as (Holman *et al*., 2019):

4.17 "*Deposition flux of an air pollutant below which significant harmful effects on sensitive ecosystems do not occur, according to present knowledge. Usually measured in units of kilograms per hectare per year (kg/ha/yr)*."

4.18 Critical levels are defined as (Holman *et al*., 2019):

4.19 "*The concentration of an air pollutant above which adverse effects on ecosystems may occur based to present knowledge*."

4.20 The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of the relevant pollutant deposited per hectare per year (for example for nitrogen the unit is kg N/ha/yr) and kilo-equivalents H+ ions deposited per hectare per year (keq/ha/yr).

4.21 The unit of 'equivalent' (eq) is used, rather than a unit of mass, for the purposes of assessing acidification from multiple pollutants. The unit eq. (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from, for example, sulphur, oxidised and reduced N, as well as base cations.

4.22 Critical loads are set by the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution. Natural England site-specific critical loads for SPA, SAC and SSSI sites in England are established from The Working Group on Effects of the UNECE Convention on Long Range Transboundary Air Pollution. The information is available via the Air Pollution Information Service (APIS, http://www.apis.ac.uk/) which contains information on applicable critical loads for various habitats and species.

4.23 The critical loads used in this assessment are presented in Table 6 and Table 7. These include a range for each site. The lower end of the range has been used for a conservative assessment.

4.24 Natural England has advised (letter received from Nick Lightfoot dated 13 January 2022, reference: DAS A002818 / 371306) that the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), it is more appropriate to adopt a Critical Load range of 10-15 kgN/ha/yr (instead of 8-10 kgN/ha/yr for acid type dunes).

***Table 6**: Nitrogen Nutrient Critical Loads (source: Air Pollution Information Service (APIS)) *denotes priority habitats*

Site	**Habitat / Ecosystem**	**N Critical Load (CL) range (kg N/ha/yr)**
Teesmouth and Cleveland Coast SPA / Ramsar	Shifting coastal dunes*	10-20
	Coastal stable dune grasslands - acid type*	8-10
	Coastal stable dune grasslands - calcareous type*	10-15
	Pioneer, low-mid mid-upper saltmarshes	20-30
North York Moors SPA / SAC	Raised and blanket bogs	5-10
	Northern wet heath: *Erica tetralix* dominated	10-20
	Dry Heaths	10-20

4.25 Information presented on the APIS website indicates that dune habitats are an important habitat as they have the potential to support qualifying features of the Teesmouth and Cleveland Coast SPA / Ramsar. Dunes may potentially be used by breeding tern species (see Tables 2 and 3); however, these habitats are not likely to be of importance for other SPA / Ramsar qualifying features.

4.26 The information on the Natural England designated sites website[4] provides information on the key breeding grounds of terns. This states that little terns have had breeding sites at Crimdon Denemouth (15 km north of the Site) and more recently at Seaton Carew (7 km north of the Site); common terns have breeding grounds on the coast, beside inland freshwater-bodies (RSPB Saltholme, 4 km north-west of the Site; No. 4 Brinefield south of Greatham Creek, 4.5 km north-west of the Site; and on rafts at Cowpen Marsh, 6 km north-west of the Site, and Portrack Marsh, 7.5 km west of the Site). There are no breeding sites in the immediate vicinity of the Tees Estuary.

4.27 Whilst a Critical Load range of 8-10 kg N/ha/yr has been used for 'Coastal stable dune grasslands - acid type', this is a precautionary approach as there is no evidence that this habitat is used by breeding terns in a location where air quality impacts are predicted.

***Table 7**: Acid Deposition Critical Loads for qualifying features (habitats) or habitats that support qualifying features (birds)*

Site	**Habitat**	**Acidity CLminN-CLmaxN (keq /ha/yr)**	**Acidity CLmaxS (keq /ha/yr)**
Teesmouth and Cleveland Coast Ramsar/SPA/SSSI	Acid grassland	MinCLminN: 0.223 | MaxCLminN: 0.438 MinCLMaxN: 1.998 | MaxCLMaxN: 4.508	MinCLMaxS: 1.56 | MaxCLMaxS: 4.07
	Calcareous grassland	MinCLminN: 0.856 |MaxCLminN: 1.071 MinCLMaxN: 4.856 | MaxCLMaxN: 5.071	CLmaxS: 4
North York Moors SPA/SAC	Bogs	MinCLminN: 0.321 | MaxCLminN: 0.321 MinCLMaxN: 0.504 | MaxCLMaxN: 0.705	MinCLMaxS: 0.183 | MaxCLMaxS: 0.384
	Dwarf shrub heath	MinCLminN: 0.499 | MaxCLminN: 1.25 MinCLMaxN: 0.792 | MaxCLMaxN: 4.962	MinCLMaxS: 0.15 |MaxCLMaxS: 4.07

APIS advises that where the total acid nitrogen deposition is greater than the Nmin, the sum of acid nitrogen, sulphur and hydrochloric (and other contributors like hydrofluoric) acid deposition should be compared against the Nmax value

[4] https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9006061&SiteName=teesmouth&SiteNameDisplay=Teesmouth%20and%20Cleveland%20Coast%20SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=7&HasCA=1#SiteInfo

5 Identification of any Likely Significant Effects

The 'Screening' process

5.1 The term 'screening' is routinely adopted to describe the initial stages of the Habitats Regulations Assessment. The purpose of screening is to:

- Identify all aspects of the project that are not likely to have a significant effect on a European site, either alone or in combination with other plans or projects. These can then be screened out from further assessment.
- Identify those aspects of the project where it is likely to have a significant effect on a European site, either alone or in combination with other plans or projects. These aspects will require 'appropriate assessment' and mitigation measures may need to be introduced.

Likely significant effects

5.2 Current guidance defines a 'likely' effect as one that cannot be ruled out on the basis of objective information. In the Waddenzee case the European Court of Justice provides further clarity on this point, advising that a project should be subject to appropriate assessment '*if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects*'[5]. Therefore, 'likely' should be interpreted as a significant effect that, objectively, cannot be ruled out.

5.3 An effect may be significant if it undermines the conservation objectives for the European site. The assessment of whether a potential effect is significant for the site's interest features must consider, amongst other things, the characteristics and specific environmental conditions of the site concerned. The Advocate General's Opinion for the Sweetman case C-127/02[6] provides further clarification, stating that consideration of the likelihood of a significant effect is simply a case of determining whether the plan or project is capable of having a significant effect.

5.4 As previously noted the judgment CJEU judgment C-323/17 (People Over Wind) means that it is not possible to rely on mitigation measures that allow a conclusion of 'no likely significant effect' to be reached. This judgment has been taken into account in this assessment.

Testing for likely significant effects of the project alone

5.5 The following section of this report presents a screening of likely significant effects. This fulfils the requirement of Regulation 63 of the Habitats Regulations that a proposed project is assessed to determine whether or not it is likely to have a significant effect on the qualifying features (species and habitats) of any European Site, either alone or in combination with other plans or projects.

5.6 As part of the screening process, it is noted that the project is not directly connected with or necessary to the management of any European Site.

5.7 A previous HRA that supported Outline planning application reference R/2019/0767/OOM (JBA Consulting, 2020) included an assessment of likely significant effects for various potential impacts that could arise as a result of the proposed development. The results of this assessment are summarised in Table 8 and the results of the previous assessment have been updated to consider the results of this assessment.

[5] See paragraph 45 of European Court of Justice case C-127/02 dated 7th September 2004, 'the Waddenzee ruling'.
[6] Sweetman v. An Bord Pleanála, Case C-258/11, CJEU judgment 11 April 2013.

Table 8: *Assessment of likely significant effects (JBA Consulting, 2020)*

Impact	**Rational**
Teesmouth and Cleveland Coast SPA / Ramsar	
Noise/vibration disturbance	Due to the distance of the SPA from the proposed works area (1.6 km and 1.4 km respectively) it is not anticipated that the qualifying features of the SPA will be impacted. No Likely Significant Effect
Visual disturbance	Due to the distance of the SPA from the proposed works area and the roads in the area already being subjected to large volumes of traffic, it is not anticipated that the qualifying features of the SPA will be impacted. No Likely Significant Effect
Introduction of synthetic compounds – Normal operating conditions (Emissions)	The assessment (JBA Consulting, 2020) concluded that the Process Contribution (PC) was 3.3% of the Air Quality Assessment Level (AQAL) and therefore could not be screened out as insignificant. However, baseline annual mean NOx concentrations at the Teesmouth and Cleveland Coast exceeded the critical level regardless of the emissions from the proposed development. The conclusion of this assessment has been applied to the screening of likely significant effects for the proposed development. **Likely Significant Effect**
Introduction of synthetic compounds – Abnormal or emergency operating conditions (Emissions)	Potential releases of synthetic compounds into both the atmosphere and the water environment during abnormal or emergency operating conditions may cause an adverse impact on breeding and foraging bird species. However, baseline annual mean NOx concentrations at the Teesmouth and Cleveland Coast exceed the critical level regardless of the emissions associated with the proposed development. The PC was found to be 3.3% of the AQAL and therefore could not be screened out as insignificant. The conclusion of this assessment has been applied to the screening of likely significant effects for the proposed development. **Likely Significant Effect**
Introduction of non-synthetic compounds – Normal operating conditions	The proposed development site has been subject to remediation, which has now been completed. When this is taken into account alongside statutory facility design requirements, it is highly unlikely that non-synthetic compounds will be released into the water environment during the construction and operation of the facility. No Likely Significant Effect

Impact	Rational
Introduction of non-synthetic compounds – Abnormal or emergency operating conditions	The proposed development site has been subject to extensive remediation, which has now been completed. When this is taken into account alongside statutory facility design requirements, it is highly unlikely that non-synthetic compounds will be released into the water environment during the construction and operation of the facility, including abnormal or emergency operating conditions. It is expected that the facility design shall include backup measures in case of an emergency thereby ensuring that normal operation conditions are achieved. Therefore, potential releases of non-synthetic compounds into both the atmosphere and the water environment are unlikely, and it therefore follows that such releases are unlikely to cause an adverse impact on breeding and foraging bird species. No Likely Significant Effect
Changes in nutrient loading from waste discharge	Nutrient loading from waste discharge in the watercourse is not anticipated. The proposed facility will not require any such discharges to be made. No Likely Significant Effect
Changes in organic loading from waste discharge	Organic loading from waste discharge in the watercourse is not anticipated. The proposed facility will not require any such discharges to be made. No Likely Significant Effect
Introduction of Invasive Non native Species (INNS)	It is not anticipated that the project will cause the direct spread of INNS to the SPA as site remediation is taking place resulting in the clearance of all vegetation. No INNS have been reported as being present within the site during previous survey (INCA, 2019). No Likely Significant Effect
Air pollution – Construction Activities / Traffic	Elevations in vehicle movements during construction or decommissioning are expected to be temporary. During the operation of the facility, exact levels of traffic movements are unknown; however, no significant effects are considered likely taking into account the already high levels of traffic within the area. Traffic related air pollution it is not expected to cause an adverse impact on breeding and foraging bird species within the sensitive sites. No Likely Significant Effect

Impact	Rational
North York Moors SAC / SPA	
Introduction of synthetic compounds	Due to the distance from the proposed works area[7], any accidental releases of synthetic compounds into the atmosphere are unlikely to cause an adverse impact on the SAC habitats. Modelling shows no significant effects are likely. No Likely Significant Effect
Introduction of non-synthetic compounds	Due to the distance from the proposed works area, any accidental releases of non-synthetic compounds into the atmosphere are unlikely to cause an adverse impact on the SAC habitats. Modelling shows no significant effects are likely. No Likely Significant Effect
Introduction of Invasive Non native Species	It is not anticipated that the project will cause the direct spread of INNS to the SAC / SPA due to the separation distance and the fact that site remediation has resulted in vegetation clearance within the site. No INNS have been reported as being present within the site during previous survey (INCA, 2019). No Likely Significant Effect
Air pollution	Natural England data on impact zones estimates that impacts on the SAC will not occur beyond 5 km. Thus, due to the distance from the proposed works area, air pollution is unlikely to cause an adverse impact on the SAC habitats. Modelling shows no significant effects are likely No Likely Significant Effect

Potential In-combination Effects: local planning

5.8 A previous HRA that supported Outline planning application reference R/2019/0767/OOM (JBA Consulting, 2020) included a review of planning applications that could be viewed via the Redcar and Cleveland Borough Council planning portal (https://planning.redcar-cleveland.gov.uk/) and the Hartlepool Borough Council planning portal (http://eforms.hartlepool.gov.uk/portal/servlets/ApplicationSearchServlet). This review of planning applications has been updated as part of this assessment.

5.9 A total of eight projects have been identified that could potentially act in-combination with the proposed ERF facility. An assessment of these applications is summarised in Table 9.

[7] The site is 1.4 km from the nearest part of the SPA and 1.7 km from the nearest part of the Ramsar site.

***Table 9**: Projects considered as part of the assessment of in-combination effects*

Development type / planning reference	**Assessment**
Power Station Development (R/2018/0098/FF) Approx. 550 m south-east of the Grangetown ERF site.	Examination of aerial imagery (Google Earth Pro) shows that the facility has been constructed. The only in-combination effects anticipated from this project is air pollution (including the introduction of synthetic and non-synthetic compounds into the atmosphere) during the operational stage.
Power Station Development (R/2008/0671/EA) Approx. 1.5 km north of the Grangetown ERF site.	Examination of aerial imagery (Google Earth Pro) shows that the facility has been constructed. The only in-combination effects anticipated from this project is air pollution (including the introduction of synthetic and non-synthetic compounds into the atmosphere) during the operational stage.
Demolition of South Bank Works Temporary Storage Facility (R/2019/0427/FFM) Includes the Grangetown ERF site.	An ecology report (INCA, 2019) concluded that no significant effects were likely on European sites and their qualifying features. Measures are proposed to mitigation pollution related impacts on the Tees Estuary and associated habitats. No in-combination effects are likely.
Train Maintenance and Fuelling Facility (R/2019/0245/SC) Approx. 1.6 km to the north-east of the Grangetown ERF site.	The proposed Maintenance and Fuelling Facility is 2.4 km from the estuary and is separated from the estuary by existing development. Current land use and operational activities lead to the conclusion that the site and adjacent land are unlikely to be functionally linked to a European site. No in-combination effects are likely.
Northern Gateway Container Terminal (R/2006/0433/OO) Approx. 2.0 km to the north-east of the Grangetown ERF site.	The ecological assessments that supported the planning application concluded that no intertidal mudflats would be lost as a result of the development. No significant effects were identified for SPA / Ramsar bird species feeding in the estuary or using the site itself for feeding or roosting. No in-combination effects are likely for disturbance related impacts. In-combination effects on air quality may arise as a result of increased ship movements.
Peak Resources Refinery (R/2017/0876/FFM) Approx. 1.4 km to the east of the Grangetown ERF site	The ES for the development concluded that construction activities on the site are not considered to present a risk of disturbance to species at the SPA / Ramsar. Standard mitigation for the control/avoidance of pollution events would be implemented to prevent potential adverse effects and the site is over 3 km from the SPA / Ramsar. The proposed development was considered to have no significant effects on Teesmouth and Cleveland Coast SPA / Ramsar. No in-combination effects are likely.
Residential Development (R/2014/0372/OOM) Approx. 460 m to the south-west of the Grangetown ERF site	Natural England advised that the proposal is unlikely to have a significant effect on any European site and can therefore be screened out from any requirement for further assessment. They advised that due to the location of the proposed site in relation to the nearest designated sites, together with its setting surrounded by existing residential and industrial development, the proposed site is not likely to have significant value as functional land for SPA interest features. No in-combination effects are likely.

Potential In-combination effects: major infrastructure projects

5.10 A previous HRA that supported Outline planning application reference R/2019/0767/OOM (JBA Consulting, 2020) considered in-combination effects arising from four major infrastructure projects (since JBA Consulting, 2020, was prepared, no new projects have been brought forward in the NSIP decision making process[8]). These are summarised as follows:

Tees Combined Cycle Power Plant (CCPP)

5.11 A gas fired combined cycle gas turbine (or CCGT) power station will be located at the site of the former Teesside Power Station on Greystone Road, Grangetown at OSGR NZ 56642 20384 approximately 2.5 km south-east of the ERF proposed site (https://infrastructure.planninginspectorate.gov.uk/projects/north-east/tees-ccpp/).

5.12 The HRA for this project concluded that there were no likely significant effects on the Teesmouth and Cleveland Coast SPA / Ramsar or the North York Moors SAC / SPA from the proposed development. A Development Consent Order was granted on 05 April 2019 for this project. No in-combination effects are likely.

York Potash Harbour Facilities Order

5.13 This development includes the installation of wharf/jetty facilities, associated dredging operations, and construction of a storage building and connecting conveyor. The development will be located at Bran Sand, Teesport at OSGR NZ 55035 24937 approximately 3.6 km north of the ERF proposed site (https://infrastructure.planninginspectorate.gov.uk/projects/north-east/york-potash-harbour-facilities-order/).

5.14 An 'Appropriate Assessment' has been undertaken because of likely significant effects arising from the proposed development. The applicant's HRA Report concluded that the Harbour Facility application alone, and in-combination with other plans and projects, would not adversely affect the integrity of the Teesmouth and Cleveland Coast SPA and Ramsar sites. Natural England agreed with this conclusion. A Development Consent Order for the York Potash Harbour Facilities Order was granted on 20 July 2016. No in-combination effects are likely.

Teesside Cluster Carbon Capture and Usage project

5.15 A 'full chain' carbon capture, utilisation and storage (CCUS) project, comprising a combined cycle gas turbine electricity generating station, is to be located in the vicinity of the Sahaviriya Steel Industries (SSI) Steel Works Site, Redcar at OSGR NZ 56971 25200 approximately 4.6 km north-east of the ERF proposed site (https://infrastructure.planninginspectorate.gov.uk/projects/northeast/teesside-cluster-carbon-capture-and-usage-project/).

5.16 An HRA has not been completed for this project, but an assessment of impacts on European designated sites is recommended in the Scoping Opinion. As a result it is not possible to predict any likely significant effects on the European designated sites.

Conclusion of screening assessment

5.17 Taking into account the identified impact mechanisms and applying the precautionary principle, it has been assumed that changes in air quality resulting from the proposed development are likely to have a significant effect on some of the qualifying features of the Teesmouth and Cleveland Coast SPA and Ramsar. It therefore follows that the requirement for an 'appropriate assessment' under Regulation 63(5) of the Habitats Regulations is triggered.

5.18 No other likely significant effects have been identified for the development when considered alone and in-combination with other plans and projects and with reference to Teesmouth and Cleveland Coast SPA and Ramsar.

[8] The PINS NSIP website (https://infrastructure.planninginspectorate.gov.uk/projects/) has been reviewed as part of this assessment and no new projects have been identified in the vicinity of the proposed ERF.

5.19 No likely significant effects have been identified for the development when considered alone and in-combination with other plans and projects and with reference to the North York Moors SAC and SPA. These sites have therefore been screened out of the appropriate assessment.

6 Appropriate Assessment

Scope of the Appropriate Assessment

6.1 The appropriate assessment has been informed by the results of an air quality assessment completed by Environmental Compliance Limited (ECL, 2021). The European sites that have been screened into the appropriate assessment are Teesmouth and Cleveland Coast SPA and Ramsar site.

6.2 The Conservation Objectives for the two European Sites are described in Section 4 (Tables 2 and 3). The assessment has taken into account the Holohan v An Bord Pleanala ECJ case (C-462/17), which requires that an assessment considers habitats and species, within or outside of a European site boundary, if they are necessary for the conservation of the qualifying features (habitat types and species) of a European site.

Summary of the air quality modelling approach

6.3 An air quality assessment has been carried out by ECL using the latest version of the ADMS modelling package to determine the impact of emissions to air on local European sites, from the proposed ERF's two emission points (referred to as A1, NZ 54379 21412, and A2, NZ 54381 21408). The results presented in the tables below are for a modelled stack height of 90 m for both the A1 and the A2 emission points.

6.4 The assessment was undertaken on the basis of a worst-case scenario, which involves the following assumptions:

- The release concentrations of the pollutants will be at the permitted emission limit values ("ELVs") on a 24 hour basis, 365 days of the year. In practice, when the plant is operating, the release concentrations will be below the ELVs, and, for most pollutants, considerably so. Taking shutdowns for planned maintenance into account, the plant will not operate for 365 days.
- The highest predicted pollutant ground level concentrations ("GLCs") for the six years of meteorological data (five years, 2016 – 2020 inclusive, from the Loftus recording station and one year, 2020, of site-specific numerical weather prediction ("NWP") data) for each averaging period (annual mean, hourly, etc.) have been used.

6.5 The maximum predicted annual mean GLCs of oxides of nitrogen (NOx), sulphur dioxide (SO_2), hydrogen fluoride (HF) and ammonia (NH3) were compared with the Critical Levels for the Protection of Ecosystems or Vegetation detailed in the Environment Agency's online guidance[9].

6.6 Using ADMS, the rates of deposition for acids (nitrogen and sulphur, as kilo-equivalents) and nutrient nitrogen were predicted for all relevant habitat sites. These rates were then compared to the critical loads for the type and location of each habitat (in the interest of being conservative, the habitat with the lowest lower critical load has been selected).

6.7 Modelling points (specific locations shown on Figure 2) were selected to include key sensitive ecological receptors (see Table 10 and associated table notes). Modelling points TCC10 to TCC13 have been included specifically to assess air quality impacts on coastal priority habitats.

Air quality modelling data

Overview

6.8 The air quality modelling undertaken by ECL considered a number of different ecological receptors, which are listed in Table 10.

6.9 The Critical Loads for deposition that have been used in the assessment are presented in Tables 6 and 7 for each of the ecological receptors (designated sites) that have been considered.

[9] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

***Table 10**: Ecological Receptors Considered for the Assessment (see Figure 2)*

ECL Receptor Ref.	Name [a]	Designation [a]	Easting (X) [a]	Northing (Y) [a]	Distance from Source [b] (m)	Heading (degrees)
NYM1	North York Moors	SAC, SPA	458895	512978	9565	152
TCC1	Teesmouth and Cleveland Coast [c]	SPA, SSSI	453277	522462	1524	314
TCC2			454760	523212	1842	12
TCC3			454282	523483	2075	357
TCC4			452203	521269	2181	266
TCC5		SPA, Ramsar	453002	522482	1745	308
TCC6			452430	521870	2003	283
TCC7			451970	521355	2410	269
TCC8			454304	524213	2804	358
TCC9			455670	524302	3167	24
TCC10			450882	522960	3825	294
TCC11			453572	525627	4294	349
TCC12			451681	525099	4570	324
TCC13			456614	525978	5085	26
TCC14[d]		SSSI	453880	526160	4776	354

Notes to Table 10

(a) The European sites included were identified using the Multi-Agency Geographic Information System for the Countryside ("MAGIC") portal and via the EA's pre-application advice Nature and Heritage Conservation Screening Report (reference EPR/ZP3309LW/A001).

(b) Distances are measured as the crow flies from the approximate nearest point of the boundary of the ecological receptor / coastal priority habitat location to the 'Source'. The 'Source' is the approximate halfway location between the two emission points associated with the incinerator – location coordinates: 454379 (X), 521410 (Y).

(c) Please note that, as the Teesmouth and Cleveland Coast SPA/Ramsar covers a large area and is broken up into many different segments, depending on the designation and coastal priority habitat, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(d) For details of TCC14 see Section 6.48 'Revised Modelling'.

Airborne NO_X, SO_2 and NH_3 concentrations

6.10 A summary of site-specific baseline concentrations of NO_X, SO_2 and NH_3, as provided by APIS, is presented in Table 11. In Table 12 background nutrient nitrogen and acid deposition concentrations are provided, as provided by APIS. Background concentrations for each ecological receptor have been obtained at the same point as listed in Table 10, i.e., the closest grid square to the point of the site used in the assessment.

6.11 Comparison of the baseline data presented in Tables 11 and 12 with the Critical Load ranges presented in Tables 6 and 7 reveals that there is already exceedance of the Critical Load for most pollutants when considered in the absence of the proposed development.

***Table 11**: Baseline Concentrations of NO_X, SO_2 and NH_3*

ECL Receptor Reference	Name and Designation(s)	Background Concentration [(a)]			
		NO_X (µg/m³)		SO_2 (µg/m³)	NH_3 (µg/m³)
		Annual Mean	24 Hour Mean [(b)]	Annual Mean	Annual Mean
NYM1	North York Moors – SAC, SPA	8.67	10.23	0.91	1.95
TCC1	Teesmouth and Cleveland Coast – SPA, SSSI [(c)]	25.65	30.27	3.05	1.6
TCC2		35.78	42.22		
TCC3					
TCC4		28.89	34.09		
TCC5	Teesmouth and Cleveland Coast – SPA and Ramsar [(c)]	25.65	30.27	3.05	1.6
TCC6		28.89	34.09		
TCC7		27.59	32.56		
TCC8		49.1	57.94		
TCC9		27.93	32.96	3.89	1.42
TCC10		21.62	25.51	3.05	1.6
TCC11		41.45	48.91	2.38	1.71
TCC12		19.51	23.02	2.38	1.71
TCC13		21.52	25.39	0 [(d)]	0.89
TCC14[(e)]	SSSI	24.14	28.49	2.38	1.71

Notes to Table 11

(a) Background concentrations for the relevant ecological habitats have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).

(b) The 24-hour mean baseline concentration is twice the annual mean multiplied by a factor of 0.59, in accordance with the H1 guidance.

(c) Please note that, as the Teesmouth and Cleveland Coast SPA/Ramsar covers a large area and is broken up into many different segments, depending on the designation and coastal priority habitat, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(d) With APIS reporting a concentration of 0 µg/m, it is suspected this value is erroneous. In the interest of being conservative the SO2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m will be used for calculating the SO2 PECs for TCC13.

(e) For details of TCC14 see Section 6.48 'Revised Modelling'.

***Table 12**: Background Nutrient Nitrogen and Acid Deposition*

ECL Receptor Reference	Name and Designation(s)	Nutrient Nitrogen Background (kgN/ha/yr) [(a)]	Acid Deposition Background - (keq/ha/yr) [(b)]		
			Total	Nitrogen	Sulphur
NYM1	North York Moors – SAC, SPA	14.98	1.46	1.36	0.18
TCC1	Teesmouth and Cleveland Coast – SPA, SSSI [(b)]	8.96	1.19	1.03	0.2
TCC2		8.96	1.19	1.03	0.2
TCC3		8.96	1.19	1.03	0.2
TCC4		8.96	1.19	1.03	0.2
TCC5	Teesmouth and Cleveland Coast – SPA and Ramsar [(b]	8.96	1.19	1.03	0.2
TCC6		8.96	1.19	1.03	0.2
TCC7		8.96	1.19	1.03	0.2
TCC8		8.96	1.19	1.03	0.2
TCC9		8.4	1.2	1.01	0.23
TCC10		8.96	1.19	1.03	0.2
TCC11		10.78	1.31	1.07	0.28
TCC12		10.78	1.31	1.07	0.28

ECL Receptor Reference	Name and Designation(s)	Nutrient Nitrogen Background (kgN/ha/yr) [(a)]	Acid Deposition Background - (keq/ha/yr) [(b)]		
			Total	Nitrogen	Sulphur
TCC13		9.1	0.95	0.75	0.25
TCC14[(d)]	SSSI	10.78	1.31	1.07	0.28

Notes to Table 12

(a) Background concentrations for nutrient nitrogen deposition have been taken from the APIS website (specifically the *APIS GIS map tool*) for the relevant grid square. The concentrations provided are the grid averages, with 2018 selected as the midyear for all sites with the exception of TCC13 (with 2016 being the latest available midyear).

(b) Background concentrations for acid deposition have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).

(c) Please note that, as the Teesmouth and Cleveland Coast SPA/Ramsar covers a large area and is broken up into many different segments, depending on the designation, to account for any variations to the predicted PCs with changing meteorological effects – multiple boundary points have been selected in numerous compass directions from the proposed Installation.

(d) For details of TCC14 see Section 6.48 'Revised Modelling'.

Deposition parameters - sensitive habitats

6.12 Deposition of nitrogen and acids at European sites was also included in the assessment. The pollutant deposition rates (as detailed in AQTAG06) for grassland were utilised for all European sites considered.

6.13 For acidification impacts, the deposition of oxides of nitrogen, ammonia, sulphur dioxide and hydrogen chloride are considered. For nutrient nitrogen, the deposition of the oxides of nitrogen and ammonia are included.

Table 13: Pollutant Emission Rates – Daily ELVs

Pollutant	ELV [(a)(b)] (mg/Nm^3)	A1 & A2 (g/s)
NOx as NO_2	120	5.06
SO_2	30	1.27
HCl	6	0.253
HF	1	0.0422
NH_3	10	0.422

Notes to Table 13

(a) Concentrations are at reference conditions i.e., 273K, 1 atmosphere, 11% oxygen, dry.

(b) Unless stated otherwise, the BAT-AEL[10]s have been used (new plant, high end).

Assessment of significance of impact guidelines – ecological receptors, Critical Levels and/or Loads

6.14 EA Operational Instruction 67_12[11] states that a detailed assessment is required where modelling predicts that the long-term Process Contribution (PC) is greater than 1% for European sites, and the Predicted Environmental Concentration (PEC) is greater than 70% for European sites.

6.15 For short-term emissions, modelling is required at European sites where the PC is greater than 10% of the critical level.

6.16 Following detailed assessment, if the PEC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no adverse effect for European Sites.

6.17 Information presented on the APIS website for the Teesmouth and Cleveland Coast SPA indicates that Sandwich tern and little tern are the only species that are sensitive to nutrient nitrogen effects on the broad habitat that they rely on. Effects on northern shoveler are considered to be site-specific but they are typically found in greatest numbers in several locations around the North Tees Marshes.

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10 Best Available Technique – Associated Emission Level

11 EA Operational Instruction 67_12 Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation, V2, 27.3.15.

6.18 The broad habitat for shoveler is listed as supralittoral sediment and the relevant nitrogen critical load class is considered for coastal stable dune grasslands. The potential effects on northern shoveler relate to food chain effects with nutrient inputs affecting the freshwater habitats that support the invertebrate/zooplankton that shoveler feed on. Modelling point TCC10 covers freshwater habitats and so the results of modelling at this point have been used to determine whether or not effects on shoveler need to be considered.

6.19 Examination of the coastal priority habitat mapping available on the MAGIC website indicates that dune grassland only occurs along the coast and not at any of the air quality modelling point (it is c.1.8 km north of TCC9). Table 26 shows that intertidal mudflat is the only coastal priority habitat that occurs within the middle and inner estuary (and consequently at or near any of the air quality modelling points): this habitat is not considered to be sensitive to nitrogen inputs.

6.20 Information presented on the APIS website for the SPA indicates that Sandwich tern and little tern are the only species sensitive to NOx effects on the broad habitat (effects on northern shoveler are considered to be site-specific and have not been considered here for the reasons set out previously). The broad habitat is listed as supralittoral sediment. As noted above, examination of the coastal priority habitat mapping available on the MAGIC website indicates that intertidal mudflat is the only coastal priority habitat that occurs within the middle and inner estuary (and consequently at or near any of the air quality modelling points): this habitat is not considered to be sensitive to nitrogen inputs (see Table 26).

6.21 APIS does not provide data for the Ramsar site but as this site is designated for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. The ‘noteworthy’ plant species associated with the Ramsar site are not likely to be associated with intertidal mudflats (and consequently are not likely to occur at any of the air quality modelling locations in the estuary) – they are species that are typically associated with sand dune or saltmarsh or coastal grazing marsh habitats (modelling points have been selected to include locations where these habitats occur).

6.22 Table 14 shows that for NOx exceedance of the long-term PC is predicted at modelling points TCC2 (1.59%), TCC3 (1.003%) and TCC9 (1.28%). The data show that the background levels already exceed the long-term Critical Level in the absence of development. Table 16 similarly shows exceedance of the long-term PC for NH3 at modelling points TCC2 (1.33%) and TCC9 (1.07%). Table 26 shows that no coastal priority habitats are likely to be affected by NOx, with intertidal mudflats being the only coastal priority habitat near any modelling points. It is therefore concluded that the process contribution is very small in a situation where background levels are already elevated and sensitive habitats are not present at (or near) those modelling points where exceedance is predicted.

6.23 Table 17 shows predicted exceedances for hydrogen fluoride, with exceedance of the 1% threshold possible at all modelling points except TCC11. The predicted exceedance ranges from 1.07% to 3.74%; however, even though hydrogen fluoride exceedance of the 1% threshold is predicted at all but one modelling location, the predicted levels still fall well below the weekly critical level even when current baseline levels are factored in. Reports in the public domain for similar assessments have used the 10% significance criterion for both the weekly and daily hydrogen fluoride PCs (Tim Heard, ECL, pers. comm.). As the guidance is somewhat vague and does not explicitly state whether the weekly CL should be treated as long-term or not, to adopt a conservative approach ECL has assessed the weekly PCs against the stricter 1% screening criterion.

6.24 As noted above, no coastal priority habitats are likely to be affected by hydrogen fluoride, with intertidal mudflats being the only coastal priority habitat near any modelling points.

6.25 Table 18 shows predicted exceedance for nitrogen deposition at modelling points TCC1, TCC2, TCC3, TCC5, TCC6, TCC8, TCC9 and TCC13. Predicted exceedance of the lower CL ranges from 1.23% to 2.62%. Predicted exceedance of the upper CL ranges from 1.03% to 2.10%. The data show that the background levels already exceed the lower CL, i.e., there is exceedance in the absence of development.

Table 15 below shows that there is no predicted exceedance for SO2 at any modelling points. Similarly, Table 19 below shows that there is no predicted exceedance for acid deposition at any modelling points.

***Table 14**: Comparison of Maximum Predicted Oxides of Nitrogen PCs with Critical Levels at European Sites*

ECL Receptor Ref.	Receptor Name	Long Term PC (µg/m³)	Long Term Critical Level (CL) (µg/m³)	Long Term PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Short Term PC (µg/m³)	Short Term Critical Level (CL) (µg/m³)	Short Term PC as a % of the CL (µg/m³)
NYM1	North York Moors - SAC / SPA	0.0404	30	0.13%	n/a	n/a	n/a	0.530	75	0.71%
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.229		0.76%	n/a	n/a	n/a	4.66		6.21%
TCC2		**0.477**		**1.59%**	35.78	36.26	**121%**	4.04		5.39%
TCC3		**0.301**		**1.003%**		36.08	**120%**	3.60		4.80%
TCC4		0.133		0.44%	n/a	n/a	n/a	2.75		3.67%
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.217		0.72%	n/a	n/a	n/a	4.63		6.17%
TCC6		0.228		0.76%	n/a	n/a	n/a	3.36		4.48%
TCC7		0.123		0.41%	n/a	n/a	n/a	2.43		3.24%
TCC8		0.213		0.71%	n/a	n/a	n/a	2.50		3.34%
TCC9		0.383		**1.28%**	27.93	28.31	94%	2.12		2.83%
TCC10		0.119		0.40%	n/a	n/a	n/a	1.64		2.19%
TCC11		0.105		0.35%	n/a	n/a	n/a	1.33		1.77%
TCC12		0.0722		0.24%	n/a	n/a	n/a	1.26		1.68%
TCC13		0.246		0.82%	n/a	n/a	n/a	1.46		1.95%

6.26 A summary of maximum predicted GLCs of oxides of nitrogen at the identified European sites is presented in Table 14. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.27 It can be seen from the data in Table 14 that the daily mean oxides of nitrogen PCs are all less 10% of the respective critical level and therefore, are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered. For the annual mean oxides of nitrogen PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2, TCC3 and TCC9. Consequently, PECs will need to be calculated for these receptors.

6.28 Making use of the relevant background NO_X concentration, the PECs for TCC2, TCC3 and TCC9 are 36.26 µg/m³, 36.08 µg/m³ and 28.31 µg/m³, respectively. The PECs as a percentage of the annual critical level would therefore be 121% (TCC2), 120% (TCC3) and 94% (TCC9). Whilst it can be assumed for TCC9 that there will be no adverse effect (i.e., the PEC is less than 100% of the critical level), the PECs for both TCC2 and TCC3 are potentially significant.

***Table 15**: Comparison of Maximum Predicted SO_2 PCs with Critical Levels at European Sites*

ECL Receptor Ref.	Receptor Name	Long Term PC (µg/m³)	Long Term Critical Level (CL) (µg/m³)	Long Term PC as a % of the CL (µg/m³)
NYM1	North York Moors - SAC / SPA	0.0101	20	0.05%
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.0574		0.29%
TCC2		0.120		0.60%
TCC3		0.0755		0.38%
TCC4		0.0333		0.17%
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0545		0.27%
TCC6		0.0573		0.29%
TCC7		0.0307		0.15%
TCC8		0.0536		0.27%
TCC9		0.0962		0.48%
TCC10		0.0262		0.13%
TCC11		0.0226		0.11%
TCC12		0.0153		0.08%
TCC13		0.0518		0.26%

6.29 A summary of maximum predicted GLCs of sulphur dioxide at the identified European sites are presented in Table 15. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs. In Table 15, any significant impacts are highlighted in bold.

6.30 It can be seen from the data in Table 15 that the annual mean sulphur dioxide PCs are all less than 1% of the critical level and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

***Table 16**: Comparison of Maximum Predicted NH_3 PCs with Critical Levels at European Sites*

ECL Receptor Ref.	Receptor Name	NH_3 (annual mean) - When Lichens and Bryophytes are not present					
		Long Term PC ($\mu g/m^3$)	**Long Term Critical Level (CL) ($\mu g/m^3$)**	**Long Term PC as a % of the CL ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**PEC ($\mu g/m^3$)**	**PEC as %age of CL**
NYM1	North York Moors - SAC / SPA	0.00337	3	0.11%	n/a	n/a	n/a
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.0191		0.64%	n/a	n/a	n/a
TCC2		**0.0398**		**1.33%**	1.60	1.64	55%
TCC3		0.0251		0.84%	n/a	n/a	n/a
TCC4		0.0111		0.37%	n/a	n/a	n/a
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0181		0.60%	n/a	n/a	n/a
TCC6		0.0190		0.63%	n/a	n/a	n/a
TCC7		0.0102		0.34%	n/a	n/a	n/a
TCC8		0.0178		0.59%	n/a	n/a	n/a
TCC9		**0.0320**		**1.07%**	1.42	1.45	48%
TCC10		0.00812		0.27%	n/a	n/a	n/a
TCC11		0.00701		0.23%	n/a	n/a	n/a
TCC12		0.00471		0.16%	n/a	n/a	n/a
TCC13		0.0159		0.53%	n/a	n/a	n/a

6.31 A summary of maximum predicted GLCs of ammonia at the identified European sites are presented in Table in 16. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.32 It can be seen from the data in Table 16 that the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the European sites assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2 and TCC9. Consequently, PECs will need to be calculated for these receptors.

6.33 The relevant background NH_3 concentrations for TCC2 and TCC9 are 1.64 $\mu g/m^3$ and 1.45 $\mu g/m^3$, respectively. The PECs as a percentage of the annual critical level would therefore be 55% (TCC2) and 48% (TCC9). It can therefore be assumed that there will be no adverse effect on the European sites assessed (i.e., the PECs are less than 100% of the critical level).

***Table 17**: Comparison of Maximum Predicted HF PCs with Critical Levels at European Sites*

ECL Receptor Ref.	Receptor Name	Weekly PC (µg/m³)	Weekly Critical Level (CL) (µg/m³)	Weekly PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Daily PC (µg/m³)	Daily Critical Level (CL) (µg/m³)	Daily PC as a % of the CL (µg/m³)
NYM1	North York Moors - SAC / SPA	0.00238	0.5	0.48%	n/a	n/a	n/a	0.00442	5	0.09%
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	**0.0146**		**2.92%**	0.003*	0.02	4%	0.0389		0.78%
TCC2		**0.0187**		**3.74%**		0.02	4%	0.0337		0.67%
TCC3		**0.0120**		**2.40%**		0.02	3%	0.0300		0.60%
TCC4		**0.0118**		**2.37%**		0.01	3%	0.0229		0.46%
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0149**		**2.98%**		0.02	4%	0.0386		0.77%
TCC6		**0.0145**		**2.90%**		0.02	4%	0.0280		0.56%
TCC7		**0.0104**		**2.07%**		0.01	3%	0.0203		0.41%
TCC8		**0.00864**		**1.73%**		0.01	2%	0.0209		0.42%
TCC9		**0.00808**		**1.62%**		0.01	2%	0.0177		0.35%
TCC10		**0.00651**		**1.30%**		0.01	2%	0.0140		0.28%
TCC11		0.00452		0.90%	n/a	n/a	n/a	0.0115		0.23%
TCC12		**0.00514**		**1.03%**	0.003*	0.01	2%	0.0106		0.21%
TCC13		**0.00533**		**1.07%**		0.01	2%	0.0126		0.25%

Notes to Table 17

*Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005µg/m³ with an elevated background of 0.003µg/m³ where there are local anthropogenic emission sources [(12)].

6.34 A summary of maximum predicted GLCs of hydrogen fluoride at the identified European sites are presented in Table 17. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.35 It can be seen from the data in Table 17 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

(12) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

6.36 For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC1-TCC10 (inclusive) and TCC12 and TCC13 - and are therefore potentially significant. NYM1 and TCC11 are less than 1% of the critical level therefore no further assessment is required.

6.37 For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m^3 with an elevated background of 0.003 µg/m^3 where there are local anthropogenic emission sources (13). In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m^3) will be used for the purposes of calculating the PECs.

6.38 The maximum weekly HF PC occurs at TCC2 and therefore the worst-case PEC would be 0.0217 µg/m^3 (or 4.34% of the weekly critical level). It can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level). Consequently, the same can be concluded for all other locations considered.

(13) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

***Table 18**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at European Sites*

ECL Receptor Ref.	Description	Habitat Type	Nitrogen Deposition Rate (kgN/Ha/yr)	Lower Critical Load (kgN/Ha/yr)	Upper Critical Load (kgN/Ha/yr)	PC as a Percentage of Lower Critical Load	PC as a Percentage of Upper Critical Load	Background (kgNha/yr)	PEC (kgN/ ha/yr)	PEC as %age of Lower Critical Load	PEC as %age of Upper Critical Load
NYM1	North York Moors - SAC	Blanket Bogs - Raised and blanket bogs	0.0159	5	10	0.32%	0.16%	n/a	n/a	n/a	n/a
	North York Moors - SPA	European Golden Plover - Reproducing - Montane habitats	0.0159	5	10	0.32%	0.16%	n/a	n/a	n/a	n/a
TCC1	Teesmouth and Cleveland Coast - SPA	Sandwich Tern - Concentration - Supralittoral sediment - Coastal stable dune grasslands (acid type)	**0.110**	8	10	**1.37%**	**1.10%**	8.96	9.07	**113%**	91%
TCC2			**0.210**			**2.62%**	**2.10%**		9.17	**115%**	92%
TCC3			**0.143**			**1.79%**	**1.43%**		9.10	**114%**	91%
TCC4			0.0652			0.82%	0.65%	n/a	n/a	n/a	n/a
TCC1 - TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal	N/A								
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	Sandwich Tern / Little Tern - Supralittoral sediment (acidic type)	**0.103**	8	10	**1.29%**	**1.03%**	8.96	9.06	**113%**	91%
TCC6			**0.110**			**1.38%**	**1.10%**		9.07	**113%**	91%
TCC7			0.0598			0.75%	0.60%	n/a	n/a	n/a	n/a
TCC8			**0.0980**			**1.23%**	0.98%	8.96	9.06	**113%**	
TCC9			**0.174**			**2.18%**	**1.74%**	8.4	8.57	**107%**	86%
TCC10			0.0542			0.68%	0.54%	n/a	n/a	n/a	n/a
TCC11			0.0470			0.59%	0.47%	n/a	n/a	n/a	n/a
TCC12			0.0318			0.40%	0.32%	n/a	n/a	n/a	n/a
TCC13			**0.107**			**1.34%**	**1.07%**	9.1	9.21	**115%**	92%

6.39 A summary of maximum predicted nutrient nitrogen deposition rates at the identified European Sites and SSSIs are presented in Table 18. It should be noted that the habitat with the lowest lower and upper critical load has been selected. As noted in section 4.24, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

6.40 In Table 18, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

6.41 It can be seen from the data in Table 18 that there are predicted exceedances for nitrogen deposition at a number of modelling points, although this is based on the more cautious assessment for Coastal stable dune grasslands (acid type). When the appropriate Critical Load range is considered for Coastal stable dune grasslands (calcareous type), there is only exceedance of the lower Critical Load at modelling points TCC1, TCC2, TCC3, TCC5, TCC6, TCC9 and TCC 13. There is only exceedance of the upper Critical Load at modelling points TCC2 and TCC9. Using the more conservative Critical Load range there are no PECs greater than 100%.

6.42 It should be noted that, as APIS does not provide data for Ramsar sites, as the Ramsar site is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, the SPA habitat interest and feature with the lowest lower critical load assigned to it has also been selected for the Ramsar site considered.

6.43 It is worth noting that the background levels are already elevated and exceed the lower critical load in the absence of the development.

***Table 19**: Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at European Sites*

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CLMaxN (keq/ha/yr)	CLMaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	0.00113	1.36	0.00119	0.18	0.321	0.504	0.183	1.36	0.181	0.46%	n/a	n/a
NYM1	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	0.00113	1.36	0.00119	0.18	0.178	0.471	0.150	1.36	0.181	0.49%	n/a	n/a
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	0.00781	1.03	0.00833	0.20	0.223	1.998	1.56	1.04	0.208	0.81%	n/a	n/a
TCC2		0.0162	1.03	0.0173	0.20	0.223	1.998	1.56	1.05	0.217	**1.68%**	1.26	63%
TCC3		0.0102	1.03	0.0109	0.20	0.223	1.998	1.56	1.04	0.211	**1.05%**	1.25	63%
TCC4		0.00464	1.03	0.00495	0.20	0.223	1.998	1.56	1.03	0.205	0.48%	n/a	n/a

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC1 – TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal											
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.00734	1.03	0.00783	0.20	0.223	1.998	1.56	1.04	0.208	0.76%	n/a	n/a
TCC6		0.00786	1.03	0.00838	0.20	0.223	1.998	1.56	1.04	0.208	0.81%	n/a	n/a
TCC7		0.00426	1.03	0.00453	0.20	0.223	1.998	1.56	1.03	0.205	0.44%	n/a	n/a
TCC8		0.00698	1.03	0.00742	0.20	0.223	1.998	1.56	1.04	0.207	0.72%	n/a	n/a
TCC9		0.0124	1.01	0.0132	0.23	0.223	1.998	1.56	1.02	0.243	**1.28%**	1.27	63%
TCC 10		0.00386	1.03	0.00411	0.20	0.223	1.998	1.56	1.03	0.204	0.40%	n/a	n/a
TCC 11		0.00335	1.07	0.00354	0.28	0.223	1.998	1.56	1.07	0.284	0.34%	n/a	n/a
TCC 12		0.00226	1.07	0.00239	0.28	0.223	1.998	1.56	1.07	0.282	0.23%	n/a	n/a
TCC 13		0.00763	0.75	0.00808	0.25	0.223	1.998	1.56	0.758	0.258	0.79%	n/a	n/a

Notes to Table 19

PC N = Process contribution from nitrogen and ammonia (dry deposition only)

PC S = Process contribution from sulphur (dry deposition) and hydrogen chloride (wet and dry deposition)

PEC = Predicted environmental concentration

BG = Background concentration

CL = Critical Load

6.44 A summary of maximum predicted acid deposition rates at the identified European Sites and SSSIs are presented in Table 19, with the deposition velocities for grassland utilised for all European sites assessed.

6.45 In Table 19, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

6.46 It can be seen from the data in Table 19 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points, with the exception of TCC2, TCC3 and TCC9.

6.47 Following the calculation of the PECs, for the modelled points with potentially significant PCs on acid deposition rates, it can be seen from the data in Table 19 that the PECs are all less than 100% of the critical load (i.e., for TCC2, TCC3 and TCC9). It can therefore be assumed that there will be no adverse effects on these sites.

Revised Modelling

6.48 In January 2022 ECL repeated the modelling work for the proposed ERF using different input parameters (ECL, 2022). This was in response to a decision by FCC Environment to design, build and operate the ERF based on these new parameters. Specifically the revised modelling was based on an Emissions Limit Value (ELV) for NOx of 100 mg/Nm^3 (reduced from an ELV for NOx of 120 mg/Nm^3 – see Table 13).

6.49 In addition, a new modelling point – TCC14 – was added (OSGR NZ 53880 26160). This modelling point is located within the SSSI immediately to the north of modelling point TCC11: it covers a location where saltmarsh and sand dune is present.

6.50 The revised modelling shows a slight reduction in the PCs for the scenarios where the NH_3 is at the BAT-AEL. For the scenarios where the NH_3 emission rate (at the HZI confirmed normal operating scenario concentration of 3.5 mg/Nm^3) a slight increase is observed due to the lowering of the NO_X from 120 mg/Nm^3 to 100mg/Nm^3. Overall the results are fairly similar to the previous results discussed earlier in this report. For the modelled point TCC14 it displays similar PCs to that of the nearby TCC11: the PCs are slightly greater at TCC11 with the ERF modelled in isolation and are greater at TCC14 for the cumulative scenario.

6.51 The revised modelling data (Table 24 in ECL, 2022) show that the annual mean sulphur dioxide PCs are all less than 1% of the critical level and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

6.52 The revised modelling data (Table 25 in ECL, 2022) show that the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the modelling points assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2 and TCC9. Consequently, PECs will need to be calculated for these receptors. The relevant background NH_3 concentrations (see Table 6 in ECL, 2022) for TCC2 and TCC9 are 1.64 µg/m^3 and 1.45 µg/m^3, respectively. The PECs as a percentage of the annual critical level would therefore be 55% (TCC2) and 48% (TCC9). It can therefore be assumed that there will be no adverse effect on the ecological sites assessed (i.e., the PECs are less than 100% of the critical level).

6.53 The revised modelling data show negligible change for hydrogen fluoride compared to the data presented in Table 17. It can therefore be assumed that there will be no adverse effect on the ecological sites assessed.

6.54 The revised modelling data (Table 27 in ECL, 2022) show that there are predicted exceedances for Nitrogen deposition at modelling points TCC1, TCC2, TCC3, TCC5, TCC6, TCC9 and TCC13, with the remaining sites screening out as insignificant. At these modelling locations the lower Critical Load is exceeded for Coastal stable dune grasslands (calcareous type) (i.e., a Critical Load range of 10-15 kgN/ha/yr). However, the upper Critical Load is only exceeded at TCC2 and TCC9, both locations only supporting mudflat habitats. The PECs have been calculated for the modelling points where exceedance is identified and all are less than 100% of the critical level. It can therefore be assumed that there will be no adverse effect on the ecological sites assessed.

6.55 The revised modelling data (Table 28 in ECL, 2022) show that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points, with the exception of TCC2, TCC3 and TCC9. Following the calculation of the PECs for the modelled points with potentially significant PCs on acid deposition rates, all PECs are less than 100% of the critical load (i.e., for TCC2, TCC3 and TCC9). It can therefore be assumed that there will be no adverse effects on these sites.

In-combination assessment

6.56 ECL has carried out a cumulative assessment, the methods and detailed results being presented in a separate report (ECL, 2022).

6.57 In addition to the effect of the proposed ERF, there are several other developments in the surrounding area which may have an effect on ecological receptors when considered in combination. Existing emissions within the area are considered to already be accounted for in background air quality data.

6.58 The developments that ECL were aware of (at time of writing), but which have been excluded from the assessment are as follows:

- Potential new Energy from Waste ("EfW") site opening in 2026 at the former SSI steelworks site, which is situated approximately 1.6 km east-north-east from the proposed FCC Installation. This information was obtained from pre-release statements only and no further data are available: consequently this development has not been considered.
- Dockside Road (1) and Dockside Road (2) Teeside Renewable Energy Centre, operated by PD Ports, is expected to be operational within the next few years. Situated approximately 1.7 km to the west of the proposed development, this information was obtained from pre-release statements only and no further data are available: consequently this development has not been considered.
- Wilton 11 EfW, operated by Suez / Sembcorp is situated approximately 2.1 km east from the proposed development. Despite being operational since around 2018, no data are publicly available in relation to the input data required to model the site. An information request has been sent by ECL to the EA; however, at time of writing no suitable data were available.
- Haverton Hill household waste recycling centre and North East Energy Recovery Centre, both operated by Suez, are located approximately 6.5 km to the west from the proposed development. It is considered by ECL, given their distance from the proposed development, that it will not be necessary to include them in the cumulative assessment.
- Tees Eco Energy, which is currently proposed (planning and permitting granted). This site is situated approximately 6.7 km to the west from the proposed development. It is considered, given the distance of Tees Eco Energy from the proposed development, that it will not be necessary to be include it in the cumulative assessment.

6.59 The development that has been included in the cumulative assessment is the Redcar Energy Centre ("REC"). The REC will be situated at land formerly occupied by Redcar Bulk Terminal (approximately 4.8 km to the north of the proposed development) and is due to be commissioned circa 2024 to 2025. Consequently, the emissions arising from the two stacks associated with its two process lines have been incorporated into the cumulative impact assessment undertaken as part of this study. This has been carried out making use of the emissions data disclosed in the air quality chapter submitted as part of the planning application documentation for REC[14].

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[14] Planning Application Reference Number: R/2020/0411/FFM. Available online via: https://planning.redcar-cleveland.gov.uk/Planning/Display?applicationNumber=R%2F2020%2F0411%2FFFM

***Table 20**: Comparison of Maximum Predicted Oxides of Nitrogen PCs with Critical Levels at European Sites – In-combination*

ECL Receptor Ref.	Receptor Name	Long Term PC (µg/m³)	Long Term Critical Level (CL) (µg/m³)	Long Term PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Short Term PC (µg/m³)	ShortTerm Critical Level (CL) (µg/m³)	Short Term PC as a % of the CL (µg/m³)
NYM1	North York Moors - SAC / SPA	0.0654	30	0.22%	n/a	n/a	n/a	0.696	75	0.93%
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.295		0.98%	n/a	n/a	n/a	4.68		6.24%
TCC2		**0.662**		**2.21%**	35.780	36.44	**121%**	4.06		5.42%
TCC3		**0.433**		**1.44%**		36.21	**121%**	3.60		4.81%
TCC4		0.183		0.61%	n/a	n/a	n/a	2.75		3.66%
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.276		0.92%	n/a	n/a	n/a	4.64		6.18%
TCC6		0.279		0.93%	n/a	n/a	n/a	3.37		4.49%
TCC7		0.172		0.57%	n/a	n/a	n/a	2.43		3.24%
TCC8		**0.396**		**1.32%**	49.10	49.50	**165%**	3.35		4.47%
TCC9		**0.674**		**2.25%**	27.930	28.60	95%	6.05		8.07%
TCC10		0.159		0.53%	n/a	n/a	n/a	1.69		2.26%
TCC11		0.253		0.84%	n/a	n/a	n/a	4.29		5.72%
TCC12		0.145		0.48%	n/a	n/a	n/a	2.01		2.68%
TCC13		**0.861**		**2.87%**	21.52	22.38	75%	5.18		6.91%

6.60 A summary of maximum predicted GLCs of oxides of nitrogen at the identified European sites is presented in Table 20. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.61 It can be seen from the data in Table 20 that the daily mean oxides of nitrogen PCs are all less than 10% of the respective critical level and therefore, are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

6.62 For the annual mean oxides of nitrogen PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2, TCC3, TCC8, TCC9 and TCC13. Consequently, the PECs have been calculated for these receptors.

6.63 Using the background NO_X concentrations the PEC assessment for TCC2, TCC3, TCC8, TCC9 and TCC13 is shown in Table 20.

6.64 It can be seen from the results in Table 20, that whilst it can be assumed for TCC9 and TCC13 that there will be no adverse effect (i.e., the PECs are less than 100% of the critical level), the PECs for TCC2, TCC3 and TCC8 are potentially significant.

6.65 The data show that the ambient background levels at TCC2, TCC3 and TCC8 already exceed the long-term critical level in the absence of the development (i.e., a concentration that is 119% of the critical level at TCC2 and TCC3 and a concentration that is 164% of the critical at TCC8).

6.66 The results of revised modelling carried out by ECL in 2022 (Table 43 in ECL, 2022) show that no adverse effect can be assumed for TCC9, TCC13 and TCC14 (i.e., the PECs are less than 100% of the critical level); however, the PECs for TCC2, TCC3 and TCC8 are potentially significant (as the PECs are 121%, 121% and 165% respectively). The data show that the ambient background levels at TCC2, TCC3 and TCC8 already exceed the long-term critical level in the absence of the development (i.e., a concentration that is 119% of the critical level at TCC2 and TCC3 and a concentration that is 164% of the critical at TCC8).

***Table 21**: Comparison of Maximum Predicted SO_2 PCs with Critical Levels at European Sites – In-combination*

ECL Receptor Ref.	Receptor Name	Long Term PC (µg/m³)	Long Term Critical Level (CL) (µg/m³)	Long Term PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL
NYM1	North York Moors - SAC / SPA	0.0164	20	0.08%	n/a	n/a	n/a
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.0739		0.37%	n/a	n/a	n/a
TCC2		0.166		0.83%	n/a	n/a	n/a
TCC3		0.109		0.54%	n/a	n/a	n/a
TCC4		0.0460		0.23%	n/a	n/a	n/a
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0691		0.35%	n/a	n/a	n/a
TCC6		0.0699		0.35%	n/a	n/a	n/a
TCC7		0.0430		0.22%	n/a	n/a	n/a
TCC8		0.0991		0.50%	n/a	n/a	n/a
TCC9		0.169		0.84%	n/a	n/a	n/a
TCC10		0.0399		0.20%	n/a	n/a	n/a
TCC11		0.0634		0.32%	n/a	n/a	n/a
TCC12		0.0362		0.18%	n/a	n/a	n/a
TCC13		**0.215**		**1.08%**	2.38	2.60	13%

6.67 A summary of maximum predicted GLCs of sulphur dioxide at the identified European sites are presented in Table 21. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.68 It can be seen from the data in Table 21 that, with the exception of TCC13, the annual mean sulphur dioxide PCs are all less than 1% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

6.69 For the annual mean sulphur dioxide PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC13. It should be noted that the latest background SO_2 concentration at TCC13, as reported by APIS, is 0 µg/m³. However, it is suspected this value is erroneous and in the interest of being conservative the SO_2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m³ has been used for calculating the SO_2 PEC for TCC13.

6.70 Consequently, with a PEC of 2.60 µg/m³ (or 13% of the critical level) at TCC13, it can be assumed there will be no adverse effect (i.e., the PEC is less than 100% of the critical level). The revised modelling data from 2022 show a similar result (ECL, 2022).

***Table 22**: Comparison of Maximum Predicted NH_3 PCs with Critical Levels at European Sites – In-combination*

ECL Receptor Ref.	Receptor Name	NH_3 (annual mean) - When Lichens and Bryophytes are NOT present					
		Long Term PC ($\mu g/m^3$)	**Long Term Critical Level (CL) ($\mu g/m^3$)**	**Long Term PC as a % of the CL ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**PEC ($\mu g/m^3$)**	**PEC as %age of CL**
NYM1	North York Moors - SAC / SPA	0.00545	3	0.18%	n/a	n/a	n/a
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	0.0246		0.82%	n/a	n/a	n/a
TCC2		**0.0552**		**1.84%**	1.60	1.66	55%
TCC3		**0.0361**		**1.20%**	1.60	1.64	55%
TCC4		0.0153		0.51%	n/a	n/a	n/a
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	0.0230		0.77%	n/a	n/a	n/a
TCC6		0.0232		0.77%	n/a	n/a	n/a
TCC7		0.0143		0.48%	n/a	n/a	n/a
TCC8		**0.0330**		**1.10%**	1.60	1.63	54%
TCC9		**0.0561**		**1.87%**	1.42	1.48	49%
TCC10		0.0133		0.44%	n/a	n/a	n/a
TCC11		0.0211		0.70%	n/a	n/a	n/a
TCC12		0.0121		0.40%	n/a	n/a	n/a
TCC13		**0.0717**		**2.39%**	0.89	0.962	32%

6.71 A summary of maximum predicted GLCs of ammonia at the identified European sites are presented in Table 22. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.72 It can be seen from the data in Table 22 that the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the European sites assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC2, TCC3, TCC8, TCC9 and TCC13. Consequently, PECs will need to be calculated for these receptors.

6.73 Using the relevant background NH_3 concentrations, the PEC assessment for TCC2, TCC3, TCC8, TCC9 and TCC13 is shown in Table 22. As displayed by the results in Table 22 it can be assumed that there will be no adverse effect on the European sites assessed (i.e., the PECs are all less than 100% of the critical level).

6.74 The revised modelling data from 2022 show a similar result (ECL, 2022 – Tables 45 and 46). For all modelling points it can be assumed that there will be no adverse effect on the ecological sites assessed (i.e., the PECs are all less than 100% of the critical level).

***Table 23**: Comparison of Maximum Predicted HF PCs with Critical Levels at European Sites – In-combination*

ECL Receptor Ref.	Receptor Name	Weekly PC (µg/m³)	Weekly Critical Level (CL) (µg/m³)	Weekly PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Daily PC (µg/m³)
NYM1	North York Moors - SAC / SPA	0.00383	0.5	0.77%	n/a	n/a	n/a	0.00579
TCC1	Teesmouth and Cleveland Coast - SPA (+ SSSI)	**0.0146**		**2.92%**	0.003 *	0.0176	3.52%	0.0390
TCC2		**0.0186**		**3.73%**		0.0216	4.33%	0.0339
TCC3		**0.0121**		**2.42%**		0.0151	3.02%	0.0301
TCC4		**0.0120**		**2.41%**		0.0150	3.01%	0.0229
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	**0.0150**		**3.00%**		0.0180	3.60%	0.0387
TCC6		**0.0148**		**2.95%**		0.0178	3.55%	0.0281
TCC7		**0.0107**		**2.13%**		0.0137	2.73%	0.0203
TCC8		**0.0133**		**2.66%**		0.0163	3.26%	0.0277
TCC9		**0.0177**		**3.55%**		0.0207	4.15%	0.0500
TCC10		**0.00656**		**1.31%**		0.00956	1.91%	0.0141
TCC11		**0.0135**		**2.70%**		0.0165	3.30%	0.0355
TCC12		**0.00769**		**1.54%**		0.0107	2.14%	0.0166
TCC13		**0.0177**		**3.55%**		0.0207	4.15%	0.0428

Notes to Table 23

*Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005µg/m³ with an elevated background of 0.003µg/m³ where there are local anthropogenic emission sources [(15)].

6.75 A summary of maximum predicted GLCs of hydrogen fluoride at the identified European sites are presented in Table 23. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsars and SSSIs. Any significant impacts are highlighted in bold.

6.76 It can be seen from the data in Table 23 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all SACs, SPAs, SSSIs and Ramsar sites considered.

(15) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

6.77 For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC1- TCC13, inclusive, and are therefore potentially significant. For NYM1 the long-term significance criteria has not been exceeded (being less than 1% of the critical level).

6.78 For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m^3 with an elevated background of 0.003 µg/m^3 where there are local anthropogenic emission sources [(16)]. In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m^3) will be used for the purposes of calculating the PECs.

6.79 The maximum weekly HF PC occurs at TCC2 and therefore the worst-case PEC would be 0.0216 µg/m^3 (or 4.33% of the weekly critical level). It can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

6.80 The revised modelling data from 2022 show a similar result (ECL, 2022). As above, it can be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

(16) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

***Table 24**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at European Sites – In-combination*

ECL Receptor Ref.	Description	Habitat Type	Nitrogen Deposition Rate (kgN/Ha/yr)	Lower Critical Load (kgN/Ha/yr)	Upper Critical Load (kgN/Ha/yr)	PC as a Percentage of Lower Critical Load	PC as a Percentage of Upper Critical Load	Background (kgNha/yr)	PEC (kgN/ha/yr)	PEC as %age of Lower Critical Load	PEC as %age of Upper Critical Load
NYM1	North York Moors - SAC	Blanket Bogs - Raised and blanket bogs	0.0254	5	10	0.51%	0.25%	n/a	n/a	n/a	n/a
	North York Moors - SPA	European Golden Plover - Reproducing - Montane habitats	0.0254	5	10	0.51%	0.25%	n/a	n/a	n/a	n/a
TCC1	Teesmouth and Cleveland Coast - SPA	Sandwich Tern - Concentration - Supralittoral sediment - Coastal stable dune grasslands (acid type)	**0.139**	8	10	**1.73%**	**1.39%**	8.96	9.10	**114%**	91%
TCC2			**0.287**			**3.59%**	**2.87%**		9.25	**116%**	92%
TCC3			**0.201**			**2.51%**	**2.01%**		9.16	**115%**	92%
TCC4			**0.0857**			**1.07%**	0.86%		9.05	**113%**	90%
TCC1 - TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal	N/A								
TCC5	Teesmouth and Cleveland Coast - SPA / Ramsar	Sandwich Tern / Little Tern - Supralittoral sediment (acidic type)	**0.129**	8	10	**1.61%**	**1.29%**	8.96	9.09	**114%**	91%
TCC6			**0.132**			**1.65%**	**1.32%**		9.09	**114%**	91%
TCC7			**0.0797**			**1.00%**	0.80%		9.04	**113%**	90%
TCC8			**0.183**			**2.29%**	**1.83%**		9.14	**114%**	91%
TCC9			**0.314**			**3.93%**	**3.14%**	8.4	8.71	**109%**	87%
TCC10			0.0688			0.86%	0.69%	n/a	n/a	n/a	n/a
TCC11			**0.118**			**1.48%**	**1.18%**	10.78	10.90	**136%**	**109%**
TCC12			0.0630			0.79%	0.63%	n/a	n/a	n/a	n/a
TCC13			**0.421**			**5.26%**	**4.21%**	9.1	9.52	**119%**	95%

6.81 A summary of maximum predicted nutrient nitrogen deposition rates at the identified European Sites and SSSIs are presented in Table 24. It should be noted that the habitat with the lowest lower and upper critical load has been selected. As noted in section 4.24, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

6.82 In Table 24, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

6.83 It can be seen from the data in Table 24 that there are predicted exceedances for nitrogen deposition at a number of modelling points, although this is based on the more cautious assessment for Coastal stable dune grasslands (acid type). When the appropriate Critical Load range is considered for Coastal stable dune grasslands (calcareous type), there is exceedance of the lower Critical Load at all modelling points except TCC4, TCC7, TCC10 and TCC 12. There is only exceedance of the upper Critical Load at modelling points TCC2, TCC3, TCC8, TCC9 and TCC13. Using the more conservative Critical Load range there are no PECs greater than 100% except at TCC11 (109%).

6.84 It should be noted that, as APIS does not provide data for Ramsar sites, as the Ramsar site is noted for the same bird species as the SPA, it is reasonable to assume that the site should be treated in the same way. Consequently, the SPA habitat interest and feature with the lowest lower critical load assigned to it has also been selected for the Ramsar site considered.

6.85 It is worth noting that the background levels are already elevated and exceed the lower critical load in the absence of the development.

6.86 The revised modelling completed in 2022 shows similar results (Table 48 in ECL, 2022). There are predicted exceedances for lower critical load for Nitrogen deposition at modelling points TCC1-TCC3 (inclusive), TCC5, TCC6, TCC8, TCC9, TCC11, TCC13 and TCC14, with the remaining sites screening out as insignificant (a Critical Load range of 10-15 kgN/ha/yr has been considered). There are only predicted exceedances for the upper critical load for Nitrogen deposition at modelling points TCC2, TCC3, TCC8, TCC9, TCC13 and TCC14.

6.87 The PEC as a percentage of the lower Critical Load is only exceeded at TCC11 and TCC14 (109%). No PECs as a percentage of the upper Critical Load are exceeded. At these modelling points the baseline already exceeds the lower Critical Load.

***Table 25**: Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at European Sites – Cumulative*

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
NYM1	North York Moors – SAC (Blanket Bogs – Raised and blanket bogs)	0.00181	1.36	0.00190	0.18	0.321	0.504	0.183	1.36	0.182	0.74%	n/a	n/a
	North York Moors – SPA (European Golden Plover – Reproducing – Montane habitats)	0.00181	1.36	0.00190	0.18	0.178	0.47	0.150	1.36	0.182	0.79%	n/a	n/a
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	0.00988	1.03	0.0105	0.20	0.223	1.998	1.56	1.04	0.211	1.02%	1.25	63%
TCC2		0.0222	1.03	0.0237	0.20	0.223	1.998	1.56	1.05	0.224	2.30%	1.28	64%
TCC3		0.0143	1.03	0.0152	0.20	0.223	1.998	1.56	1.04	0.215	1.48%	1.26	63%
TCC4		0.00610	1.03	0.00648	0.20	0.223	1.998	1.56	1.04	0.206	0.63%	n/a	n/a

***Table 25** (cont.): Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at European Sites – Cumulative*

ADMS Ref.	Site Details	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC1 – TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal											
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.00917	1.03	0.00977	0.20	0.223	1.998	1.56	1.04	0.210	0.95%	n/a	n/a
TCC6		0.00939	1.03	0.0100	0.20	0.223	1.998	1.56	1.04	0.210	0.97%	n/a	n/a
TCC7		0.00567	1.03	0.00602	0.20	0.223	1.998	1.56	1.04	0.206	0.59%	n/a	n/a
TCC8		0.0130	1.03	0.0139	0.20	0.223	1.998	1.56	1.04	0.214	**1.35%**	1.26	63%
TCC9		0.0224	1.01	0.0238	0.23	0.223	1.998	1.56	1.03	0.254	**2.31%**	1.29	64%
TCC 10		0.00490	1.03	0.00520	0.20	0.223	1.998	1.56	1.03	0.205	0.51%	n/a	n/a
TCC 11		0.00842	1.07	0.00894	0.28	0.223	1.998	1.56	1.08	0.289	0.87%	n/a	n/a
TCC 12		0.00448	1.07	0.00475	0.28	0.223	1.998	1.56	1.07	0.285	0.46%	n/a	n/a
TCC 13		0.0299	0.75	0.0318	0.25	0.223	1.998	1.56	0.78	0.282	**3.09%**	1.06	53%

Notes to Table 25

PC N = Process contribution from nitrogen and ammonia (dry deposition only)

PC S = Process contribution from sulphur (dry deposition) and hydrogen chloride (wet and dry deposition)

PEC = Predicted environmental concentration

BG = Background concentration

CL = Critical Load

6.88 A summary of maximum predicted acid deposition rates at the identified European Sites and SSSIs are presented in Table 25, with the deposition velocities for grassland utilised for all European sites assessed.

6.89 In Table 25, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

6.90 It can be seen from the data in Table 25 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points, with the exception of TCC1 - TCC3 (inclusive), TCC8, TCC9 and TCC13.

6.91 Following the calculation of the PECs, for the modelled points with potentially significant PCs on acid deposition rates, it can be seen from the data in Table 25 that the PECs are all less than 100% of the critical load It can therefore be assumed that there will be no adverse effects on these sites.

6.92 The revised modelling data from 2022 show a similar result (ECL, 2022). As above, it can be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

Discretionary Advice Service Consultation with Natural England

6.93 A meeting was held with Natural England on 24 November 2021 during which ECL advised that NH_3 was the main contributor to nitrogen deposition arising from the proposed development. ECL noted that the modelling approach that had been adopted, where emission rates for NOx and NH_3 had been calculated from Best Available Technique – Associated Emission Levels (BAT-AELs), was likely to have over-estimated actual NH_3 emissions. It was therefore agreed that further modelling would be carried out using actual emissions data from a similar operational facility at the Resource and Energy Recovery Centre at Millerhill, Edinburgh. Further details of the modelling approach are provided in a separate report (ECL, 2022).

6.94 The revised modelling has considered the habitats with the lowest lower and upper critical loads, i.e., a precautionary approach has been adopted. The results of the revised modelling using data from the Millerhill facility show that the revised NH_3 emission rates at all modelling points are less than 1% of the critical load (Table 26). In accordance with published guidance[17], the impacts can therefore be considered insignificant.

***Table 26**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC13 (Installation Only)*

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	8	10	0.0524	0.655%	0.524%	n/a	n/a
TCC2				0.0964	1.21%	0.964%	8.96	9.06 (113% of lower critical load)
TCC3				0.0637	0.796%	0.637%	n/a	n/a
TCC4				0.0285	0.356%	0.285%	n/a	n/a

17 Environment Agency online guidance advises that if the short-term PC is less than 10% of the short-term environmental standard and the long-term PC is less than 1% of the long-term environmental standard it can be screened out as insignificant. See https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pcs.

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)
TCC1 – TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal						
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	8	10	0.0482	0.603%	0.482%	n/a	n/a
TCC6				0.0469	0.586%	0.469%	n/a	n/a
TCC7				0.0260	0.325%	0.260%	n/a	n/a
TCC8				0.0437	0.546%	0.437%	n/a	n/a
TCC9				0.0786	0.983%	0.786%	n/a	n/a
TCC10	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	8	10	0.0239	0.298%	0.239%	n/a	n/a
TCC11				0.0216	0.270%	0.216%	n/a	n/a
TCC12				0.0164	0.205%	0.164%	n/a	n/a
TCC13				0.0492	0.615%	0.492%	n/a	n/a
TCC14				0.0204	0.254%	0.204%	n/a	n/a

Notes to Table 26

Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

6.95 It can be seen from the data in Table 26 that the maximum nutrient nitrogen deposition rates due to the ERF's PCs, with the revised NH_3 emission rates, are now less than 1% of the critical load at all the modelled points, except TCC2. For TCC2, a small exceedance of the lower critical load is predicted (i.e., with a PC approximately 0.21% above the significance criteria). It is worth noting that the background level for TCC2 is already elevated and exceeds the lower critical load in the absence of the development.

6.96 ECL has created isopleths based on the revised modelling data (ECL, 2021). Figure 3 (reproduced from ECL, 2021) provides the nutrient nitrogen deposition rates in the area surrounding the modelled points.

6.97 In addition, Figure 4 has been included to allow for comparison to be made between the NH_3 emissions at the revised concentration and the NH_3 emissions at the BAT-AELs.

6.98 In Figures 3 and 4, the ecological receptors are represented by the pink annotated pins and the Installation as the red annotated circle. The results displayed are for the worst-case met year for the maximum GLC.

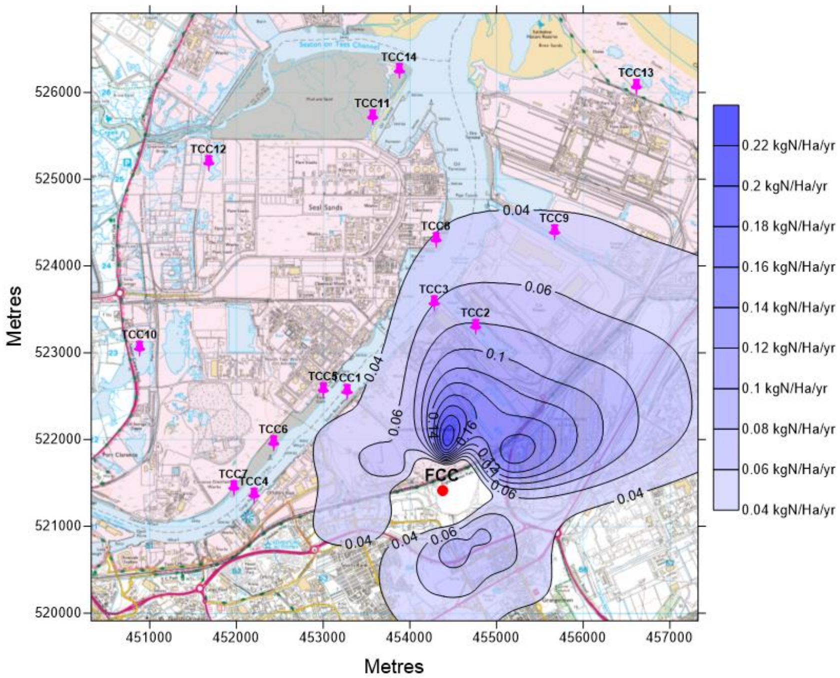


Figure 3*: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (Revised NH_3 Emission Rate) – Met Year 2020 (Source: ECL, 2021)*

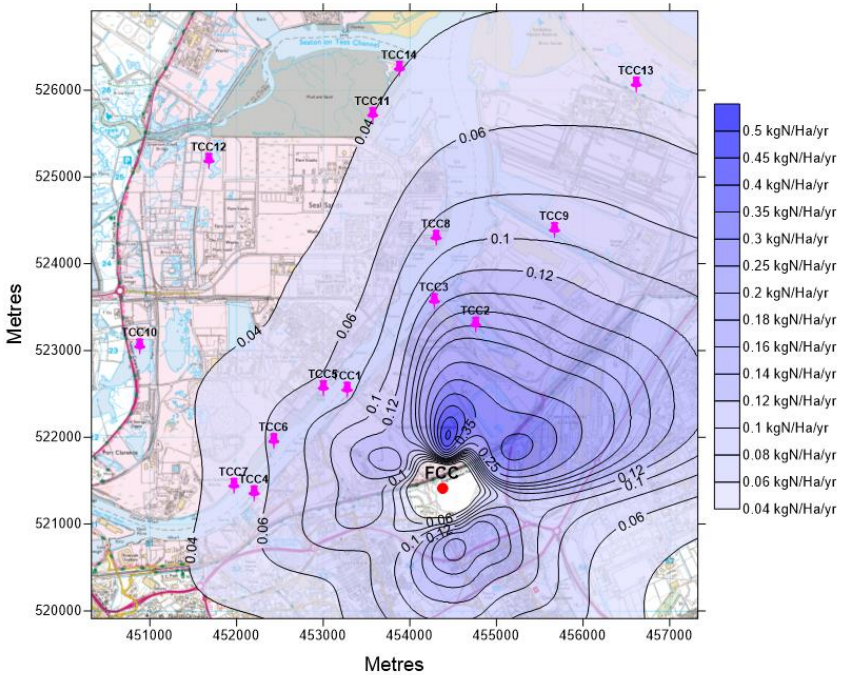


Figure 4*: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (NO_X & NH_3 at BAT-AELs) – Met Year 2020 (Source: ECL, 2021)*

6.99 Modelling of the proposed facility in combination with the Redcar Energy Centre (REC) shows that there are exceedances predicted for nitrogen deposition at modelling points TCC2, 3, 8, 9, 11 and 13 (Table 27). It should be noted that emission rates for NOx and NH_3 had been calculated from BAT-AELs for REC, and are also likely to have over-estimated actual NH_3 emissions.

***Table 27**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC1 – TCC13 (Installation + REC)*

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate (a) (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	8	10	0.0810	**1.01%**	0.810%	n/a	9.04	**113%**	90%
TCC2				0.176	**2.20%**	**1.76%**	8.96	9.14	**114%**	91%
TCC3				0.138	**1.72%**	**1.38%**		9.10	**114%**	91%
TCC4				0.0522	0.653%	0.522%	n/a	n/a	n/a	n/a
TCC1 – TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal								
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	8	10	0.0741	0.927%	0.741%	n/a	n/a	n/a	n/a
TCC6				0.0679	0.849%	0.679%	n/a	n/a	n/a	n/a
TCC7				0.0478	0.597%	0.478%	n/a	n/a	n/a	n/a
TCC8				0.137	**1.71%**	**1.37%**	8.96	9.10	**114%**	91%
TCC9				0.223	**2.78%**	**2.23%**	8.4	8.62	**108%**	86%
TCC10	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	8	10	0.0397	0.496%	0.397%	n/a	n/a	n/a	n/a
TCC11				0.0919	**1.15%**	0.919%	10.78	10.87	**136%**	**109%**

ADMS Ref.	Site Details	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC12				0.0475	0.593%	0.475%	n/a	n/a	n/a	n/a
TCC13				0.382	**4.77%**	**3.82%**	9.1	9.48	**119%**	95%
TCC14	SSSI	8	10	0.125	**1.56%**	**1.25%**	10.78	10.91	**136%**	**109%**

Notes to Table 27

Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

6.100 In Table 27, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

6.101 The data presented in Table 27 show that there are predicted exceedances for nitrogen deposition at modelling points TCC1 - TCC3 (inclusive), TCC8, TCC9, TCC11, TCC13 and TCC14, with the remaining sites screening out as insignificant. Where there are predicted exceedances of the critical load, these range from 1.01% to 4.77% of the lower critical load and 1.25% to 3.82% of the upper critical load. It is important to note that the background levels are already elevated and exceed the lower critical load in the absence of the development (as well as the upper critical load for TCC11).

6.102 It should be noted that the habitat with the lowest lower and upper critical load has been selected and used as the basis for the above assessment. As noted in section 4.24, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

6.103 When the appropriate Critical Load range is considered for Coastal stable dune grasslands (calcareous type), there is only exceedance of the lower Critical Load at modelling points TCC2, TCC3, TCC8, TCC9, TCC13 and TCC14. There is only exceedance of the upper Critical Load at modelling points TCC2, TCC9 and TCC13. Using the more conservative Critical Load range the only PEC that is greater than 100% is at TCC11 and TCC14 (109%).

6.104 The proposed development operating in isolation does not lead to a breach of the relevant nutrient nitrogen critical loads for any of the modelled points assessed. It is only the cumulative impact of both installations operating simultaneously that result in the exceedances shown in Table 27.

6.105 Table 28 demonstrates the predicted nutrient nitrogen deposition rates associated with the three scenarios that have been modelled by ECL, i.e., the Installation in isolation, REC in isolation and the cumulative scenario of the Installation's and REC's emissions.

***Table 28**: Predicted Nutrient Nitrogen Deposition Rates at Sensitive Habitat Sites (TCC1 – TCC13) For Three Scenarios*

ADMS Ref.	Site Details	Nutrient Nitrogen Deposition Rate [a] [b] (kgN/ha/yr)		
		Installation Only	REC Only	Installation + REC
TCC1	Teesmouth and Cleveland Coast – SPA (Sandwich Tern – Concentration – Supralittoral sediment – Coastal stable dune grassland (acid type))	0.0524	0.0501	0.0810
TCC2		0.0964	0.0799	0.176
TCC3		0.0637	0.0838	0.138
TCC4		0.0285	0.0333	0.0522
TCC1 – TCC4	Teesmouth and Cleveland Coast - SSSI	No information currently held / accessible via APIS' portal		
TCC5	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.0482	0.0465	0.0741
TCC6		0.0469	0.0375	0.0679
TCC7		0.0260	0.0321	0.0478
TCC8		0.0437	0.0986	0.137
TCC9	Teesmouth and Cleveland Coast – SPA / Ramsar (Sandwich Tern / Little Tern – Supralittoral sediment (acidic type))	0.0786	0.144	0.223
TCC10		0.0239	0.0310	0.0397
TCC11		0.0216	0.0714	0.0919
TCC12		0.0164	0.0356	0.0475
TCC13		0.0492	0.356	0.382
TCC14		0.0204	0.105	0.125

Notes to Table 28
(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).
(b) The NO_X and NH_3 emission rates for both the Installation and REC are as discussed in Section 10 of ECL (2022).

6.106 The results presented in Table 28 show that, overall, the predicted nutrient nitrogen deposition rates for the REC are greater than those for the Installation.

6.107 ECL (2022) note that the '*greater predicted deposition rate associated with the REC scenario is largely due to REC's closer proximity to a number of the specified ecological points (TCC9, TCC11 and TCC13, in particular)*'. In addition, they also note that '*the emission rates for REC are based on the BAT-AELs*' and therefore it follows that '*When accounting for normal day to day operation, it is anticipated that the actual emission rates for REC, particularly in regard to NH_3, are likely to be lower, as is the case with the FCC Installation*'.

6.108 ECL has produced isopleths (Figure 5) for nutrient nitrogen deposition rates for the installation in combination with REC. In addition, Figure 6 has been included to allow for comparisons to be made between the cumulative emissions with the Installation's actual NH_3 concentration, compared to the BAT-AELs.

6.109 In Figures 5 and 6, the ecological receptors are represented by the pink annotated pins and the Installation and REC as the red annotated circles. The results displayed are for the worst-case met year for the maximum GLC.

Figure 5*: Nutrient Nitrogen Deposition (N + NH3 (dry)) – Installation (with revised NH3) + REC – NWP 2020 (Source: ECL, 2021)*

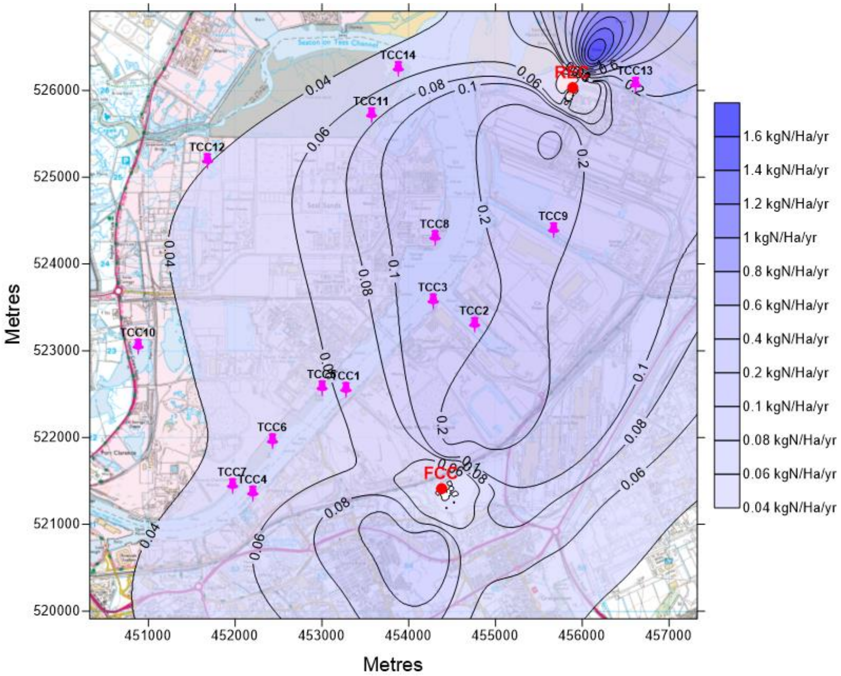
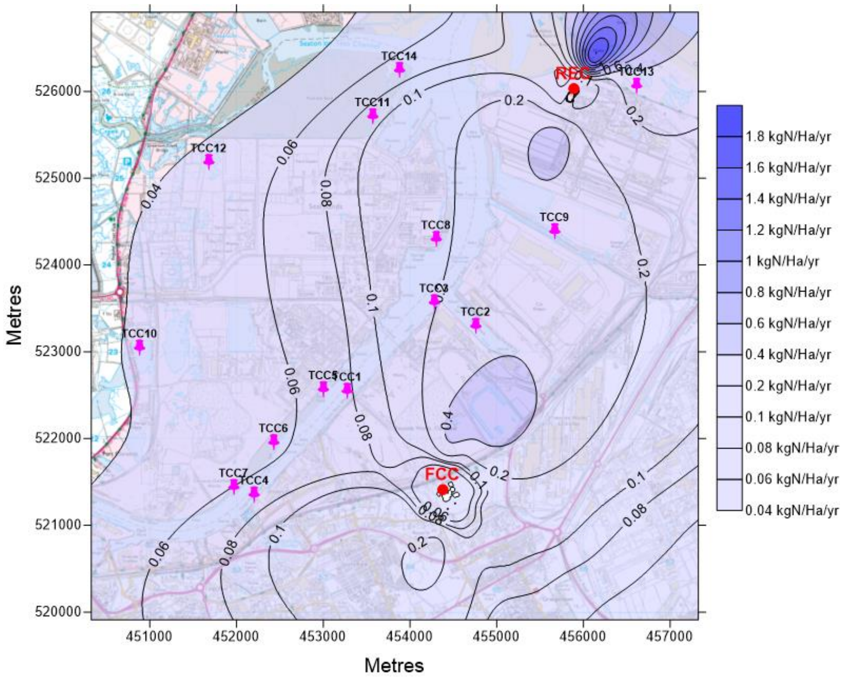


***Figure 6**: Nutrient Nitrogen Deposition (N + NH3 (dry)) – Installation + REC (BAT-AELs) – NWP 2020 (Source: ECL, 2021)*



Habitat sensitivity at modelling point

6.110 Table 29 provides an evaluation of the points where modelling has identified a potential exceedance of a critical load or level. In each case the habitats present are identified and related to the qualifying features (birds) of the SPA and Ramsar site. The locations of all air quality modelling points are shown on Figure 2.

6.111 Mapping presented on the MAGIC website shows the locations of coastal priority habitats in relation to the site. It should be noted that the only coastal priority habitat that occurs within the inner and central estuary is intertidal mudflats – all other coastal priority habitats are located at the coast or the extreme outer part of the estuary.

Grangetown Energy Recovery Facility

Assessment of air quality impacts on Teesmouth and Cleveland Coast SSSI

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Client	FCC Environment
Project	Grangetown Energy Recovery Facility
Report title	Assessment of air quality impacts on Teesmouth and Cleveland Coast SSSI
Draft version/final	FINAL
File reference	P20-1004 Grangetown Prairie Air Quality Impacts on SSSI.docx

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Contents

1 Introduction

Overview

1.1 Outline planning consent has been granted for the construction of an Energy Recovery Facility (ERF) and associated development at a site known as Grangetown Prairie (planning reference R/2019/0767/OOM).

1.2 Air quality modelling has been completed by Environmental Compliance Limited (ECL) and this has revealed that air quality changes may affect parts of the Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI). This report therefore considers the impact of the proposed ERF on the SSSI.

Site description

1.3 The site (the 'Site') is located on land to the east of John Boyle Road and to the west of Tees Dock Road, Grangetown, Redcar and Cleveland. The central Ordnance Survey Grid Reference (OSGR) for the site is NZ543213. The location of the Site is shown on Figure 1 in Section 12.

1.4 BSG Ecology understands from FCC Environment that Site remediation works have been carried out by South Tees Development Corporation (STDC). This has resulted in the removal of all vegetation within the Site.

Project Description

1.5 FCC Environment is one of three bidders in a confidential bidding process looking to secure a long-term contract to build and operate an Energy from Waste facility with the Joint Authorities. The Tees Valley Authorities (TVA), Durham County Council and Newcastle City Council (the Councils) have joined together to create an opportunity for a contractor to design, build, finance and operate (DBFO) a new Energy Recovery Facility (ERF) to be located in the Tees Valley on a mandated site owned by the South Tees Development Corporation (STDC).

1.6 The mandated site is on a large industrial brownfield site within the Redcar and Cleveland Borough Council administrative area: this is the site of the former British Steel works in Grangetown, an area known as Grangetown Prairie. The site is approximately 25 acres in total.

1.7 Outline planning consent has been granted by Redcar and Cleveland Borough Council (planning reference R/2019/0767/OOM) for an ERF facility that could treat 450,000 tonnes per annum of waste and export up to 49.9 MWH of electricity. The developed site will also include landscaping, internal access roads and car parking areas.

Consultation

1.8 FCC Environment has engaged with Natural England through the Discretionary Advice Service (DAS), which involved a meeting on 24 November 2021 between Nick Lightfoot and Lewis Pemberton (Natural England), David Molland (FCC), Tim Heard, Sarah Burley and Sara Maile (ECL), Steven Betts (BSG Ecology) and Sam Thistlethwaite (Identity Consult Planning).

1.9 Natural England provided the following advice in relation to the potential impacts of the ERF on the Teesmouth and Cleveland Coast SSSI:

- Modelling locations TCC10, 11, 12 and 13 (see Figure 2) are considered to be the most sensitive ecological receptors due to the habitats that are present, i.e., mudflats (at Seal Sands), saltmarsh and sand dunes.
- The mudflats at Seal Sands provide an important feeding area for birds and eutrophication is currently resulting in the formation of algal mats that make feeding difficult for some species.
- Saltmarsh and sand dune are important as qualifying features of the Teesmouth and Cleveland Coast SSSI.

Contributors

1.10 The report has been prepared by Steven Betts, who has worked in the ecological sector for more than 27 years. During this time he has contributed to a wide range of projects, both as author and technical reviewer. This has included the preparation of and contributions to numerous HRAs for projects that have included an energy recovery facility, housing developments, powerline projects, solar schemes and wind farms.

1.11 The report has been reviewed by Roger Buisson, Associate Director at BSG Ecology. Roger has worked for over 30 years assessing the impacts of man's activities on natural habitats and species, including the preparation of, and contributions to, EIAs and HRAs for energy recovery facilities, port and harbour infrastructure, underground cable routes, renewable energy projects (onshore and offshore wind and solar) and housing developments.

1.12 Further details of the experience and qualifications of the above can be found at http://www.bsg-ecology.com/people/.

2 Scope of the Assessment

2.1 The nearest part of the Teesmouth and Cleveland Coast SSSI is approximately 1.4 km to the north-west of the Site. Consequently, no significant impacts on the SSSI are likely to arise during the construction phase of the proposed development due to the separation distance. In particular, degradation of habitats arising from pollution, in particular airborne (e.g., dust) and water-borne (e.g., silt) pollutants, are likely to be limited in their extent to the Site and the adjacent area.

2.2 Impacts that may arise during the operational phase of the proposed development will be limited to changes in air quality arising from the operation of the ERF. No further degradation of habitat arising from excavation work, material storage and mobile plant tracking etc is likely during this phase of the development.

2.3 The decommissioning phase of the proposed development is expected to result in similar impacts to those described for the construction phase of the development, i.e., no significant impacts on the SSSI are likely to arise during this phase of the works.

Zone of Influence

2.4 The Zone of Influence (ZoI) for the proposed development is the area over which ecological features may be affected by biophysical changes as a result of the proposed work and associated activities. This may extend beyond the Site boundary. The ZoI has been used to determine the extent of the desk study, baseline ecological surveys and biological / non-biological (air quality) assessments.

2.5 During the construction stage of the proposed development the ZoI is considered to be the Site and a buffer area around it within which impacts may occur depending upon the sensitivity of the ecological receptors being considered. In this assessment the following ZoIs have been adopted:

- Degradation of habitats (habitat loss and disturbance) – This will be limited to the Site and immediate environs, i.e., a precautionary ZoI of 100 m. As the nearest part of the SSSI is approximately 1.4 km away from the Site, habitat degradation as a result of the proposed development is highly unlikely.
- Degradation of habitats (airborne pollution) - Air quality impacts due to dust production may potentially impact on sensitive ecological features. Current guidance (Holman *et al*, 2014) advises that construction-related dust impacts only need to be considered for important ecological features within 50 m of the proposed development boundary. Guidance on mineral developments (IAQM, 2016) advises that a significant effect from dust is unlikely beyond 400 m of the proposed development boundary (this higher figure has been adopted on a precautionary basis for the purposes of the assessment). As the nearest part of the SSSI is approximately 1.4 km away from the Site, habitat degradation as a result of the proposed development is highly unlikely.
- Degradation of habitats (waterborne pollution) – Waterborne pollutants, such as silt, fuel and oils, have the potential to impact on habitats downstream of the pollution source. Whilst this type of pollution can potentially be wide-ranging, its effects will be limited to the receiving watercourse. A watercourse runs alongside the western boundary of the Site and this flows into culverts to the north and south. It is likely that this drains into the Tees Estuary to the north of the Site. At this point any pollutant is likely to be subject to some dilution, mixing and dispersal, although this may be reduced within the confines of an estuarine environment. Approximately 7 km downstream the River Tees discharges to the open sea, at which point dilution, mixing and dispersal are likely to be significant. As the Site has already been subject to remediation, the release of contaminants during the construction phase is unlikely. As contractors will be required to adhere to best practice guidance for mitigating impacts on watercourses, it is considered that there is a low likelihood of pollutants, including silt, reaching the River Tees, which is approximately 1.4 km to the north-west of the Site. A ZoI of 1 km has therefore been adopted for the assessment.

2.6 During the operation phase a ZoI of 10 km has been adopted for the consideration of airborne pollutants emitted by the ERF. As the proposed development will generate less than 50 MW, the ZoI for the project is taken to be 10 km from the proposed works location to follow DEFRA air emission guidance (DEFRA, 2016).

2.7 In summary, the following potential types of adverse effect, with their associated ZoI, have been considered in this assessment:

- Degradation of habitats (habitat loss and disturbance) (ZoI is 100 m from the Site);
- Degradation of habitats (airborne pollution - dust) (ZoI is 400 m from the Site);
- Degradation of habitats (waterborne pollution) (ZoI is 1 km from the Site);
- Degradation of habitats (airborne pollution – gaseous and particulate pollutants) (ZoI is 10 km from the Site.

2.8 Taking into account the evaluation of these impact mechanisms and the associated ZoIs, this assessment only considers air quality impacts on the Teesmouth and Cleveland Coast SSSI during the operational phase of the ERF. Impacts on European sites are considered in a separate report (BSG Ecology, 2022).

3 Information on the Teesmouth and Cleveland Coast SSSI

Qualifying features

3.1 The Teesmouth and Cleveland Coast SSSI is of special interest for the following nationally important features that occur within and are supported by the wider mosaic of coastal and freshwater habitats:

Geology:

- Jurassic geology;
- Quaternary geology;

Habitats:

- sand dunes;
- saltmarshes;

Species:

- breeding harbour seals *Phoca vitulina*;
- breeding avocet *Recurvirostra avosetta*, little tern *Sternula albifrons* and common tern *Sterna hirundo*;
- a diverse assemblage of breeding birds of sand dunes, saltmarsh and lowland open waters and their margins;
- non-breeding shelduck *Tadorna tadorna*, shoveler *Spatula clypeata*, gadwall *Mareca strepera*, ringed plover *Charadrius hiaticula*, knot *Calidris canutus*, ruff *Calidris pugnax*, sanderling *Calidris alba*, purple sandpiper *Calidris maritima*, redshank *Tringa totanus* and Sandwich tern *Thalasseus sandvicensis*;
- an assemblage of more than 20,000 waterbirds during the non-breeding season.

3.2 In Section 2 the scope of the assessment is described as being limited to consideration of air quality impacts during the operational phase of the development. Changes in air quality are not likely to impact on the geological interest of the SSSI and so this has been scoped out of the assessment.

3.3 Similarly, changes in air quality are not likely to result in direct impacts on any of the species that are qualifying features of the SSSI (http://www.apis.ac.uk/, accessed 11 January 2022). For this reason the listed species have been scoped out of the assessment; however, the habitats that support these species have been considered, specifically mudflats, sand dunes and saltmarsh. Should a deterioration in habitat condition be identified by the assessment then consideration would be given to the assessment of potential indirect impacts on species through their dependence on particular habitats and the food sources that those habitats support.

Site condition

3.4 Natural England has published the results of a condition assessment for the Teesmouth and Cleveland Coast SSSI. The summary data available for the SSSI indicates that 0.77% is in 'favourable' condition, 9.98% is in 'unfavourable declining' condition and 89.25% is 'not recorded'. Two management units are reported to be in 'unfavourable declining' condition due to declining numbers of certain species: unit 8 (Seal Sands) and unit 26 (Bran Sands).

3.5 Examination of priority habitat mapping on the MAGIC website (www. magic.defra.gov.uk, accessed 11 January 2022) shows that saltmarsh is present in SSSI management units 8 and 9. A condition assessment is only available for management unit 8, which is reported to be 'unfavourable declining' due to coastal squeeze and pollution.

3.6 Habitat mapping on the MAGIC website (www. magic.defra.gov.uk, accessed 11 January 2022) shows that sand dune is present in SSSI management units 28 and 29. A condition assessment is not available for either management unit.

Habitat sensitivity

3.7 Habitats may be sensitive to deposition of pollutants carried in the air, which may result in eutrophication and acidification. Deposition occurs both in the form of dry deposition and wet deposition and the exposure to pollutants through deposition is described with reference to Critical Loads and Critical Levels. Critical loads are defined as (Holman *et al*., 2019):

3.8 "*Deposition flux of an air pollutant below which significant harmful effects on sensitive ecosystems do not occur, according to present knowledge. Usually measured in units of kilograms per hectare per year (kg/ha/yr)*."

3.9 Critical levels are defined as (Holman *et al*., 2019):

3.10 "*The concentration of an air pollutant above which adverse effects on ecosystems may occur based to present knowledge*."

3.11 The critical loads used in this assessment are presented in Tables 1 and 2. These include a range for each site. The lower end of the range has been used for a conservative assessment.

3.12 Natural England has advised (letter received from Nick Lightfoot dated 13 January 2022, reference: DAS A002818 / 371306) that most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), it is more appropriate to adopt a Critical Load range of 10-15 kgN/ha/yr (instead of 8-10 kgN/ha/yr for acid type dunes).

Table 1*: Nitrogen Nutrient Critical Loads (source: Air Pollution Information Service (APIS)) *denotes priority habitats*

Habitat / Ecosystem	N Critical Load (CL) range (kg N/ha/yr)
Shifting coastal dunes*	10-20
Coastal stable dune grasslands - acid type*	8-10
Coastal stable dune grasslands - calcareous type*	10-15
Pioneer, low-mid mid-upper saltmarshes	20-30

***Table 2**: Acid Deposition Critical Loads for habitats that support qualifying features (birds)*

Habitat	**Acidity CLminN-CLmaxN (keq /ha/yr)**	**Acidity CLmaxS (keq /ha/yr)**
Acid grassland	MinCLminN: 0.223 | MaxCLminN: 0.438 MinCLMaxN: 1.998 | MaxCLMaxN: 4.508	MinCLMaxS: 1.56 | MaxCLMaxS: 4.07
Calcareous grassland	MinCLminN: 0.856 |MaxCLminN: 1.071 MinCLMaxN: 4.856 | MaxCLMaxN: 5.071	CLmaxS: 4

APIS advises that where the total acid nitrogen deposition is greater than the Nmin, the sum of acid nitrogen, sulphur and hydrochloric (and other contributors like hydrofluoric) acid deposition should be compared against the Nmax value.

No Critical Load/Level data are available for saltmarsh, APIS advising that 'The likely contribution of acidification to this breakdown is not understood but the risks from acid deposition compared with eutrophication are probably small, based on available evidence.'

No Critical Load/Level data data are available for sand dunes, APIS advising that 'The majority of dune systems in the UK are calcareous, well buffered and low in heavy metals so should be tolerant of acid deposition.'

4 Impact Assessment

Summary of the air quality modelling approach

4.1 An air quality assessment has been carried out by ECL (ECL, 2022) using the latest version of the ADMS modelling package to determine the impact of emissions to air on local European sites and their underpinning SSSIs, from the proposed ERF's two emission points (referred to as A1, NZ 54379 21412, and A2, NZ 54381 21408). The results presented in the tables below are for a modelled stack height of 90 m for both the A1 and the A2 emission points (see Figure 2).

4.2 The assessment was undertaken on the basis of a worst-case scenario, which involves the following assumptions:

- The release concentrations of the pollutants will be at the permitted emission limit values ("ELVs") on a 24 hour basis, 365 days of the year. In practice, when the plant is operating, the release concentrations will be below the ELVs, and, for most pollutants, considerably so. Taking shutdowns for planned maintenance into account, the plant will not operate for 365 days.
- The highest predicted pollutant ground level concentrations ("GLCs") for the six years of meteorological data (five years, 2016 – 2020 inclusive, from the Loftus recording station and one year, 2020, of site-specific numerical weather prediction ("NWP") data) for each averaging period (annual mean, hourly, etc.) have been used.

4.3 The maximum predicted annual mean GLCs of oxides of nitrogen (NOx), sulphur dioxide (SO_2), hydrogen fluoride (HF) and ammonia (NH3) were compared with the Critical Levels for the Protection of Ecosystems or Vegetation detailed in the Environment Agency's online guidance[1].

4.4 Using ADMS, the rates of deposition for acids (nitrogen and sulphur, as kilo-equivalents) and nutrient nitrogen were predicted for all relevant habitat sites. These rates were then compared to the critical loads for the type and location of each habitat (in the interest of being conservative, the habitat with the lowest lower critical load has been selected).

4.5 Modelling points (specific locations shown on Figure 2) were selected to include key sensitive ecological receptors (see Table 3 and associated table notes). Modelling points TCC10 to TCC13 have been included specifically to assess air quality impacts on coastal priority habitats: TCC10 is a saline lagoon located at Saltholme; TCC11 is saltmarsh and sand dune; TCC12 is saltmarsh; and TCC13 is sand dune. All of these modelling points are located within the boundary of the SSSI.

Air quality modelling data

Overview

4.6 The air quality modelling undertaken by ECL considered a number of different ecological receptors, which are listed in Table 3. As previously noted, modelling points TCC10 to TCC13 are the focus of this assessment as they relate to priority habitats that form part of the qualifying interest of the Teesmouth and Cleveland Coast SSSI.

4.7 The Critical Loads for deposition that have been used in the assessment are presented in Tables 1 and 2 for the habitat that have been considered.

[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Table 3*: Ecological Receptors Considered for the Assessment (see Figure 2)*

ECL Receptor	Easting (X) [(a)]	Northing (Y) [(a)]	Distance from Source [(b)] (m)	Heading (degrees)
TCC10	450882	522960	3825	294
TCC11	453572	525627	4294	349
TCC12	451681	525099	4570	324
TCC13	456614	525978	5085	26

Notes to Table 3
(a) The European sites included were identified using the Multi-Agency Geographic Information System for the Countryside ("MAGIC") portal and via the EA's pre-application advice Nature and Heritage Conservation Screening Report (reference EPR/ZP3309LW/A001).
(b) Distances are measured as the crow flies from the approximate nearest point of the boundary of the ecological receptor / coastal priority habitat location to the 'Source'. The 'Source' is the approximate halfway location between the two emission points associated with the incinerator – location coordinates: 454379 (X), 521410 (Y).

Airborne NO_X, SO_2 and NH_3 concentrations

4.8 A summary of site-specific baseline concentrations of NO_X, SO_2 and NH_3, as provided by APIS, is presented in Table 4. Background concentrations for each ecological receptor have been obtained at the same point as listed in Table 3, i.e., the closest grid square to the point of the site used in the assessment. Comparison of the baseline data presented in Tables 4 and 5 with the Critical Load ranges presented in Tables 1 and 2 reveals that there is already exceedance of the Critical Load for most pollutants when considered in the absence of the proposed development.

Table 4*: Baseline Concentrations of NO_X, SO_2 and NH_3*

ECL Receptor Reference	Background Concentration [(a)]			
	NO_X (µg/m³)		SO_2 (µg/m³)	NH_3 (µg/m³)
	Annual Mean	24 Hour Mean [(b)]	Annual Mean	Annual Mean
TCC10	21.62	25.51	3.05	1.6
TCC11	41.45	48.91	2.38	1.71
TCC12	19.51	23.02	2.38	1.71
TCC13	21.52	25.39	0 [(c)]	0.89

Notes to Table 4
(a) Background concentrations for the relevant ecological habitats have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).
(b) The 24-hour mean baseline concentration is twice the annual mean multiplied by a factor of 0.59, in accordance with the H1 guidance.
(c) With APIS reporting a concentration of 0 µg/m, it is suspected this value is erroneous. In the interest of being conservative the SO2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m will be used for calculating the SO2 PECs for TCC13.

Table 5: Background Nutrient Nitrogen and Acid Deposition

ECL Receptor Reference	Nutrient Nitrogen Background (kgN/ha/yr) [(a)]	Acid Deposition Background - (keq/ha/yr) [(b)]		
		Total	Nitrogen	Sulphur
TCC10	8.96	1.19	1.03	0.2
TCC11	10.78	1.31	1.07	0.28
TCC12	10.78	1.31	1.07	0.28
TCC13	9.1	0.95	0.75	0.25

Notes to Table 5

(a) Background concentrations for nutrient nitrogen deposition have been taken from the APIS website (specifically the *APIS GIS map tool*) for the relevant grid square. The concentrations provided are the grid averages, with 2018 selected as the midyear for all sites with the exception of TCC13 (with 2016 being the latest available midyear).

(b) Background concentrations for acid deposition have been taken from the APIS website for the closest grid square to the site (data year: 2017-2019).

Deposition parameters - sensitive habitats

4.9 Deposition of nitrogen and acids at European sites was also included in the assessment. The pollutant deposition rates (as detailed in AQTAG06) for grassland were utilised for all European sites considered.

4.10 For acidification impacts, the deposition of oxides of nitrogen, ammonia, sulphur dioxide and hydrogen chloride are considered. For nutrient nitrogen, the deposition of the oxides of nitrogen and ammonia are included.

Table 6: Pollutant Emission Rates – Daily ELVs

Pollutant	ELV [(a)(b)] (mg/Nm^3)	A1 & A2 (g/s)
NOx as NO_2	120	5.06
SO_2	30	1.27
HCl	6	0.253
HF	1	0.0422
NH_3	10	0.422

Notes to Table 6

(a) Concentrations are at reference conditions i.e., 273K, 1 atmosphere, 11% oxygen, dry.

(b) Unless stated otherwise, the BAT-AEL[2]s have been used (new plant, high end).

Assessment of significance of impact guidelines – ecological receptors, Critical Levels and/or Loads

4.11 EA Operational Instruction 67_12[3] states that a detailed assessment is required where modelling predicts that the long-term Process Contribution (PC) is greater than 1% for European sites, and the Predicted Environmental Concentration (PEC) is greater than 70% for European sites. This guidance has been adopted for the assessment in relation to the SSSI.

4.12 For short-term emissions, modelling is required at European sites where the PC is greater than 10% of the critical level.

4.13 Following detailed assessment, if the PEC is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no adverse effect for the receiving site.

4.14 Information presented on the APIS website for the Teesmouth and Cleveland Coast SSSI indicates that sand dunes and saltmarsh, which are habitats that may be used by some of the birds associated with the SSSI, are sensitive to nutrient nitrogen effects.

4.15 For northern shoveler and gadwall APIS reports that there is no comparable habitat with an established critical load estimate available. Furthermore the habitat that supports these species is typically P limited. The potential effects on northern shoveler and gadwall relate to food chain effects with nutrient inputs affecting the freshwater habitats that support the invertebrate/zooplankton that shoveler feed on. Modelling point TCC10 covers freshwater habitats and so the results of modelling at this point have been used to determine whether or not effects on shoveler need to be considered.

4.16 Examination of the coastal priority habitat mapping available on the MAGIC website indicates that dune grassland only occurs along the coast and not at any of the air quality modelling point (it is c.1.8 km north of TCC9). Table 22 shows that intertidal mudflat is the only coastal priority habitat that occurs within the middle and inner estuary (and consequently at or near any of the air quality modelling points): this habitat is not considered to be sensitive to nitrogen inputs.

[2] Best Available Technique – Associated Emission Level

[3] EA Operational Instruction 67_12 Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation, V2, 27.3.15.

4.17 Information presented on the APIS website for the SSSI indicates that Sandwich tern, common tern and little tern are associated with dune habitat; however, there are no known dune nest sites located within the area that might be impacted by the operation of the ERF. Consequently, impacts on tern species are not considered further in this report.

4.18 Information presented on the APIS website for the SSSI indicates that sanderling, knot, ringed plover, avocet, redshank and shelduck are all associated with saltmarsh habitat. Modelling point TCC11 covers this habitat, which is present in SSSI management units 8 and 9. Breeding ruff is associated with hay meadows, which does not appear to be present within the study area (https://magic.defra.gov.uk/, accessed 11 January 2022). Wintering ruff is likely to be associated with saltmarsh habitat.

4.19 Information presented on the APIS website for the SSSI indicates that purple sandpiper is associated with littoral rock habitat, which is not sensitive to nitrogen deposition. Similarly APIS reports that grey seal is associated with inshore sublittoral rock, which is not sensitive to nitrogen deposition.

4.20 Examination of the coastal priority habitat mapping available on the MAGIC website indicates that intertidal mudflat is the only coastal priority habitat that occurs within the middle and inner estuary (and consequently at or near most of the air quality modelling points): this habitat is not considered to be sensitive to nitrogen inputs.

4.21 Table 7 shows that no NOx exceedance of the long-term PC is predicted at modelling points TCC10, TCC11, TCC12 and TCC13. The data show that the background levels already exceed the long-term Critical Level in the absence of development.

4.22 Table 9 similarly shows no exceedance of the long-term PC for NH3 at modelling points TCC10, TCC11, TCC12 and TCC13.

4.23 Table 10 shows predicted exceedances for hydrogen fluoride, with exceedance of the 1% threshold possible at all modelling points except TCC11. The predicted exceedance ranges from 1.07% to 3.74%; however, even though hydrogen fluoride exceedance of the 1% threshold is predicted at all but one modelling location, the predicted levels still fall well below the weekly critical level even when current baseline levels are factored in. Reports in the public domain for similar assessments have used the 10% significance criterion for both the weekly and daily hydrogen fluoride PCs (Tim Heard, ECL, pers. comm.). As the guidance is somewhat vague and does not explicitly state whether the weekly CL should be treated as long-term or not, to adopt a conservative approach ECL has assessed the weekly PCs against the stricter 1% screening criterion.

4.24 Table 11 shows predicted exceedance for nitrogen deposition at modelling point TCC13. Predicted exceedance of the lower CL is 1.07%. Predicted exceedance of the upper CL is 1.34%. The data show that the background levels already exceed the lower CL, i.e., there is exceedance in the absence of development.

4.25 Table 8 below shows that there is no predicted exceedance for SO2 at any modelling points. Similarly Table 12 below shows that there is no predicted exceedance for acid deposition at any modelling points.

Table 7*: Comparison of Maximum Predicted Oxides of Nitrogen PCs with Critical Levels at receptor locations TCC10-13*

ECL Receptor Ref.	Long Term PC (µg/m^3)	Long Term Critical Level (CL) (µg/m^3)	Long Term PC as a % of the CL (µg/m^3)	Background (µg/m^3)	PEC (µg/m^3)	PEC as %age of CL	Short Term PC (µg/m^3)	Short Term Critical Level (CL) (µg/m^3)	Short Term PC as a % of the CL (µg/m^3)
TCC10	0.119	30	0.40%	n/a	n/a	n/a	1.64	75	2.19%
TCC11	0.105		0.35%	n/a	n/a	n/a	1.33		1.77%
TCC12	0.0722		0.24%	n/a	n/a	n/a	1.26		1.68%
TCC13	0.246		0.82%	n/a	n/a	n/a	1.46		1.95%

4.26 A summary of maximum predicted GLCs of oxides of nitrogen at the modelling points is presented in Table 7. In accordance with the H1 guidance, the significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsar sites and SSSIs. Any significant impacts are highlighted in bold.

4.27 It can be seen from the data in Table 7 that the daily mean oxides of nitrogen PCs are all less 10% of the respective critical level and therefore, are not significant at all receptor locations. For the annual mean oxides of nitrogen PCs, the impact is also not significant (i.e., greater than 1% of the long-term critical level).

Table 8*: Comparison of Maximum Predicted SO_2 PCs with Critical Levels at receptor locations TCC10-13*

ECL Receptor Ref.	Long Term PC (µg/m^3)	Long Term Critical Level (CL) (µg/m^3)	Long Term PC as a % of the CL (µg/m^3)
TCC10	0.0262	20	0.13%
TCC11	0.0226		0.11%
TCC12	0.0153		0.08%
TCC13	0.0518		0.26%

4.28 A summary of maximum predicted GLCs of sulphur dioxide at the modelling points are presented in Table 8. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsar sites and SSSIs. In Table 8, any significant impacts are highlighted in bold.

4.29 It can be seen from the data in Table 8 that the annual mean sulphur dioxide PCs are all less than 1% of the critical level and therefore are not significant at all modelling points.

***Table 9**: Comparison of Maximum Predicted NH_3 PCs with Critical Levels at receptor locations TCC10-13*

ECL Receptor Ref.	NH_3 (annual mean) - When Lichens and Bryophytes are not present					
	Long Term PC (µg/m³)	**Long Term Critical Level (CL) (µg/m³)**	**Long Term PC as a % of the CL (µg/m³)**	**Background (µg/m³)**	**PEC (µg/m³)**	**PEC as %age of CL**
TCC10	0.00812	3	0.27%	n/a	n/a	n/a
TCC11	0.00701		0.23%	n/a	n/a	n/a
TCC12	0.00471		0.16%	n/a	n/a	n/a
TCC13	0.0159		0.53%	n/a	n/a	n/a

4.30 A summary of maximum predicted GLCs of ammonia at the modelling points are presented in Table in 9. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for SPAs, SACs, Ramsar sites and SSSIs. Any significant impacts are highlighted in bold.

4.31 It can be seen from the data in Table 9 that the annual mean ammonia PCs are all less than 1% of the critical level at the modelling locations. The impact is not significant (i.e., greater than 1% of the long-term critical level) at any modelling point.

***Table 10**: Comparison of Maximum Predicted HF PCs with Critical Levels at receptor locations TCC10-13*

ECL Receptor Ref.	Weekly PC (µg/m³)	Weekly Critical Level (CL) (µg/m³)	Weekly PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Daily PC (µg/m³)	Daily Critical Level (CL) (µg/m³)	Daily PC as a % of the CL (µg/m³)
TCC10	**0.00651**	0.5	**1.30%**	0.003*	0.01	2%	0.0140	5	0.28%
TCC11	0.00452		0.90%	n/a	n/a	n/a	0.0115		0.23%
TCC12	**0.00514**		**1.03%**	0.003*	0.01	2%	0.0106		0.21%
TCC13	**0.00533**		**1.07%**		0.01	2%	0.0126		0.25%

Notes to Table 10

*Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005µg/m³ with an elevated background of 0.003µg/m³ where there are local anthropogenic emission sources [(4)].

(4) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

4.32 A summary of maximum predicted GLCs of hydrogen fluoride at the modelling points are presented in Table 10. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for SPAs, SACs, Ramsar sites and SSSIs. Any significant impacts are highlighted in bold.

4.33 It can be seen from the data in Table 10 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all modelling points.

4.34 For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC10, TCC12 and TCC13 - and are therefore potentially significant. TCC11 is less than 1% of the critical level therefore no further assessment is required.

4.35 For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m^3 with an elevated background of 0.003 µg/m^3 where there are local anthropogenic emission sources [(5)]. In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m^3) will be used for the purposes of calculating the PECs.

4.36 The maximum weekly HF PC are all less than 1% of the weekly critical level. It can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

***Table 11**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at receptor locations TCC10-13*

ECL Receptor Ref.	Nitrogen Deposition Rate (kgN/Ha/yr)	Lower Critical Load (kgN/Ha/yr)	Upper Critical Load (kgN/Ha/yr)	PC as a Percentage of Lower Critical Load	PC as a Percentage of Upper Critical Load	Background (kgNha/yr)	PEC (kgN/ha/yr)	PEC as %age of Lower Critical Load	PEC as %age of Upper Critical Load
TCC10	0.0542	8	10	0.68%	0.54%	n/a	n/a	n/a	n/a
TCC11	0.0470			0.59%	0.47%	n/a	n/a	n/a	n/a
TCC12	0.0318			0.40%	0.32%	n/a	n/a	n/a	n/a
TCC13	**0.107**			**1.34%**	**1.07%**	9.1	9.21	**115%**	92%

4.37 A summary of maximum predicted nutrient nitrogen deposition rates at the receptor locations related to the SSSI are presented in Table 11. It should be noted that the habitat with the lowest lower and upper critical load has been selected. As noted in section 3.12, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

(5) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

4.38 In Table 11, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

4.39 It can be seen from the data in Table 11 that there are predicted exceedances for nitrogen deposition at modelling point TCC13, with the remaining sites screening out as insignificant. This is based on the more cautious assessment for Coastal stable dune grasslands (acid type). When the appropriate Critical Load range is considered for Coastal stable dune grasslands (calcareous type), there is only exceedance of the lower Critical Load (1.07%). Using the more conservative Critical Load range there are no PECs greater than 100%.

4.40 It is worth noting that the background levels are already elevated and exceed the lower critical load in the absence of the development.

***Table 12**: Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at receptor locations TCC10-13*

ADMS Ref.	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC 10	0.00386	1.03	0.00411	0.20	0.223	1.998	1.56	1.03	0.204	0.40%	n/a	n/a
TCC 11	0.00335	1.07	0.00354	0.28	0.223	1.998	1.56	1.07	0.284	0.34%	n/a	n/a
TCC 12	0.00226	1.07	0.00239	0.28	0.223	1.998	1.56	1.07	0.282	0.23%	n/a	n/a
TCC 13	0.00763	0.75	0.00808	0.25	0.223	1.998	1.56	0.758	0.258	0.79%	n/a	n/a

Notes to Table 12

PC N = Process contribution from nitrogen and ammonia (dry deposition only)

PC S = Process contribution from sulphur (dry deposition) and hydrogen chloride (wet and dry deposition)

PEC = Predicted environmental concentration

BG = Background concentration

CL = Critical Load

4.41 A summary of maximum predicted acid deposition rates at the modelling points are presented in Table 12, with the deposition velocities for grassland utilised for all modelling points assessed.

4.42 In Table 12, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's) of the critical load are highlighted in bold.

4.43 It can be seen from the data in Table 12 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points.

Revised Modelling

4.44 In January 2022 ECL repeated the modelling work for the proposed ERF using different input parameters (ECL, 2022). This was in response to a decision by FCC Environment to design, build and operate the ERF based on these new parameters. Specifically the revised modelling was based on an Emissions Limit Value (ELV) for NOx of 100 mg/Nm^3 (reduced from an ELV for NOx of 120 mg/Nm^3 – see Table 6).

4.45 In addition, a new modelling point – TCC14 – was added (OSGR NZ 53880 26160). This modelling point is located within the SSSI immediately to the north of modelling point TCC11: it covers a location where saltmarsh and sand dune is present.

4.46 The revised modelling shows a slight reduction in the PCs for the scenarios where the NH_3 is at the BAT-AEL. For the scenarios where the NH_3 emission rate (at the HZI confirmed normal operating scenario concentration of 3.5 mg/Nm^3) a slight increase is observed due to the lowering of the NO_X from 120 mg/Nm^3 to 100mg/Nm^3. Overall, the results are fairly similar to the previous results discussed earlier in this report. For the modelled point TCC14 it displays similar PCs to that of the nearby TCC11: the PCs are slightly greater at TCC11 with the ERF modelled in isolation and are greater at TCC14 for the cumulative scenario.

4.47 The revised modelling data (Table 24 in ECL, 2022) show that the annual mean sulphur dioxide PCs are all less than 1% of the critical level and therefore are not significant at all monitoring points considered.

4.48 The revised modelling data (Table 25 in ECL, 2022) show that the annual mean ammonia PCs are all less than 1% of the critical level at modelling points TCC10-TCC14. The PECs as a percentage of the annual critical level are all less than 100% of the critical level. It can therefore be assumed that there will be no adverse effect on the ecological sites assessed.

4.49 The revised modelling data show negligible change for hydrogen fluoride compared to the data presented in Table 10. It can therefore be assumed that there will be no adverse effect on the ecological sites assessed.

4.50 The revised modelling data (Table 27 in ECL, 2022) show that there are predicted exceedances for Nitrogen deposition at modelling points TCC13, with the remaining sites screening out as insignificant. At these modelling locations the lower Critical Load is exceeded for Coastal stable dune grasslands (calcareous type) (i.e., a Critical Load range of 10-15 kgN/ha/yr). However, the upper Critical Load is not exceeded at any monitoring points. The PECs have been calculated for the modelling points where exceedance is identified and all are less than 100% of the critical level. It can therefore be assumed that there will be no adverse effect on the ecological sites assessed.

4.51 The revised modelling data (Table 28 in ECL, 2022) show that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points. Following the calculation of the PECs for the modelled points with potentially significant PCs on acid deposition rates, all PECs are less than 100% of the critical load. It can therefore be assumed that there will be no adverse effects on these sites.

In-combination assessment

4.52 ECL has carried out a cumulative assessment, the methods and detailed results being presented in a separate report (ECL, 2021).

4.53 In addition to the effect of the proposed ERF, there are several other developments in the surrounding area which may have an effect on ecological receptors when considered in combination. Existing emissions within the area are considered to already be accounted for in background air quality data.

4.54 The developments that ECL were aware of (at the time of writing), but which have been excluded from the assessment for the reasons given are as follows:

- Potential new Energy from Waste ("EfW") site opening in 2026 at the former SSI steelworks site, which is situated approximately 1.6 km east-north-east from the proposed FCC Installation. This information was obtained from pre-release statements only and no further data are available: consequently this development has not been considered.
- Dockside Road (1) and Dockside Road (2) Teeside Renewable Energy Centre, operated by PD Ports, is expected to be operational within the next few years. Situated approximately 1.7 km to the west of the proposed development, this information was obtained from pre-release statements only and no further data are available: consequently this development has not been considered.
- Wilton 11 EfW, operated by Suez / Sembcorp is situated approximately 2.1 km east from the proposed development. Despite being operational since around 2018, no data are publicly available in relation to the input data required to model the site. An information request has been sent by ECL to the EA; however, at time of writing no suitable data were available.
- Haverton Hill household waste recycling centre and North East Energy Recovery Centre, both operated by Suez, are located approximately 6.5 km to the west from the proposed development. It is considered by ECL, given their distance from the proposed development, that it will not be necessary to include them in the cumulative assessment.
- Tees Eco Energy, which is currently proposed (planning and permitting granted). This site is situated approximately 6.7 km to the west from the proposed development. It is considered, given the distance of Tees Eco Energy from the proposed development, that it will not be necessary to be include it in the cumulative assessment.

4.55 The development that has been included in the cumulative assessment is the Redcar Energy Centre ("REC"). The REC will be situated at land formerly occupied by Redcar Bulk Terminal (approximately 4.8 km to the north of the proposed development) and is due to be commissioned circa 2024 to 2025. Consequently, the emissions arising from the two stacks associated with its two process lines have been incorporated into the cumulative impact assessment undertaken as part of this study. This has been carried out making use of the emissions data disclosed in the air quality chapter submitted as part of the planning application documentation for REC[6].

[6] Planning Application Reference Number: R/2020/0411/FFM. Available online via: https://planning.redcar-cleveland.gov.uk/Planning/Display?applicationNumber=R%2F2020%2F0411%2FFFM

Table 13: *Comparison of Maximum Predicted Oxides of Nitrogen PCs with Critical Levels at receptor locations TCC10-13 – In-combination*

ECL Receptor Ref.	Long Term PC (µg/m^3)	Long Term Critical Level (CL) (µg/m^3)	Long Term PC as a % of the CL (µg/m^3)	Background (µg/m^3)	PEC (µg/m^3)	PEC as %age of CL	Short Term PC (µg/m^3)	Short Term Critical Level (CL) (µg/m^3)	Short Term PC as a % of the CL (µg/m^3)
TCC10	0.159	30	0.53%	n/a	n/a	n/a	1.69	75	2.26%
TCC11	0.253		0.84%	n/a	n/a	n/a	4.29		5.72%
TCC12	0.145		0.48%	n/a	n/a	n/a	2.01		2.68%
TCC13	**0.861**		**2.87%**	21.52	22.38	75%	5.18		6.91%

4.56 A summary of maximum predicted GLCs of oxides of nitrogen at the modelling points is presented in Table 13. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively. Any significant impacts are highlighted in bold.

4.57 It can be seen from the data in Table 13 that the daily mean oxides of nitrogen PCs are all less than 10% of the respective critical level and therefore, are not significant at the four receptor locations identified in relation to the SSSI.

4.58 For the annual mean oxides of nitrogen PCs, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC13. Consequently, the PECs have been calculated for these receptors. Using the background NO_X concentrations the PEC assessment for TCC13 is shown in Table 13.

4.59 It can be seen from the results in Table 13, that for TCC13 there will be no adverse effect (i.e., the PECs are less than 100% of the critical level).

4.60 The results of revised modelling carried out by ECL in 2022 (Table 43 in ECL, 2022) show similar results, i.e., that no adverse effect can be assumed for the modelling points (i.e., the PECs are less than 100% of the critical level).

Table 14: *Comparison of Maximum Predicted SO_2 PCs with Critical Levels at receptor locations TCC10-13 – In-combination*

ECL Receptor Ref.	Long Term PC (µg/m^3)	Long Term Critical Level (CL) (µg/m^3)	Long Term PC as a % of the CL (µg/m^3)	Background (µg/m^3)	PEC (µg/m^3)	PEC as %age of CL
TCC10	0.0399	20	0.20%	n/a	n/a	n/a
TCC11	0.0634		0.32%	n/a	n/a	n/a
TCC12	0.0362		0.18%	n/a	n/a	n/a
TCC13	**0.215**		**1.08%**	2.38	2.60	13%

4.61 A summary of maximum predicted GLCs of sulphur dioxide at the modelling points are presented in Table 14. The significance of the impacts has been determined using the 1% criteria for long-term predictions, for four receptor locations identified in relation to the SSSI. Any significant impacts are highlighted in bold.

4.62 It can be seen from the data in Table 14 that, with the exception of TCC13, the annual mean sulphur dioxide PCs are all less than 1% of the critical levels and therefore are not significant at modelling points TCC10, TCC11 and TCC12.

4.63 For the annual mean sulphur dioxide PC, the impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC13. It should be noted that the latest background SO_2 concentration at TCC13, as reported by APIS, is 0 µg/m^3. However, it is suspected this value is erroneous and in the interest of being conservative the SO_2 value from TCC11 (i.e., the receptor closest in distance to TCC13) of 2.38 µg/m^3 has been used for calculating the SO_2 PEC for TCC13.

4.64 Consequently, with a PEC of 2.60 µg/m^3 (or 13% of the critical level) at TCC13, it can be assumed there will be no adverse effect (i.e., the PEC is less than 100% of the critical level).

4.65 The revised modelling data from 2022 show a similar result (ECL, 2022).

***Table 15**: Comparison of Maximum Predicted NH_3 PCs with Critical Levels at receptor locations TCC10-13 – In-combination*

ECL Receptor Ref.	NH_3 (annual mean) - When Lichens and Bryophytes are NOT present					
	Long Term PC (µg/m^3)	Long Term Critical Level (CL) (µg/m^3)	Long Term PC as a % of the CL (µg/m^3)	Background (µg/m^3)	PEC (µg/m^3)	PEC as %age of CL
TCC10	0.0133	3	0.44%	n/a	n/a	n/a
TCC11	0.0211		0.70%	n/a	n/a	n/a
TCC12	0.0121		0.40%	n/a	n/a	n/a
TCC13	**0.0717**		**2.39%**	0.89	0.962	32%

4.66 A summary of maximum predicted GLCs of ammonia at the four receptor locations identified in relation to the SSSI are presented in Table 15. The significance of the impacts has been determined using the 1% criteria for long-term predictions. Any significant impacts are highlighted in bold.

4.67 It can be seen from the data in Table 15 that, with the exception of TCC13) the annual mean ammonia PCs are all less than 1% of the critical level at the majority of the modelling points assessed. The impact is potentially significant (i.e., greater than 1% of the long-term critical level) at TCC13. Consequently, PECs will need to be calculated for this receptor.

4.68 Using the relevant background NH_3 concentrations, the PEC assessment for TCC13 is shown in Table 15. As displayed by the results in Table 15 it can be assumed that there will be no adverse effect on the SSSI (i.e., the PEC is less than 100% of the critical level).

4.69 The revised modelling data from 2022 show a similar result (ECL, 2022 – Tables 45 and 46). For all modelling points it can be assumed that there will be no adverse effect on the ecological sites assessed (i.e., the PECs are all less than 100% of the critical level).

***Table 16**: Comparison of Maximum Predicted HF PCs with Critical Levels at receptor locations TCC10-13 – In-combination*

ECL Receptor Ref.	Weekly PC (µg/m³)	Weekly Critical Level (CL) (µg/m³)	Weekly PC as a % of the CL (µg/m³)	Background (µg/m³)	PEC (µg/m³)	PEC as %age of CL	Daily PC (µg/m³)
TCC10	**0.00656**	0.5	**1.31%**	0.003*	0.00956	1.91%	0.0141
TCC11	**0.0135**		**2.70%**		0.0165	3.30%	0.0355
TCC12	**0.00769**		**1.54%**		0.0107	2.14%	0.0166
TCC13	**0.0177**		**3.55%**		0.0207	4.15%	0.0428

Notes to Table 16

*Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005µg/m³ with an elevated background of 0.003µg/m³ where there are local anthropogenic emission sources (7).

4.70 A summary of maximum predicted GLCs of hydrogen fluoride at the four receptor locations identified in relation to the SSSI are presented in Table 16. The significance of the impacts has been determined using the 1% and 10% criteria for long and short-term predictions, respectively, for the SSSI. Any significant impacts are highlighted in bold.

4.71 It can be seen from the data in Table 16 that the daily mean HF PCs are all less than 10% of the critical levels and therefore are not significant at all modelling points.

4.72 For the weekly mean HF PCs, a conservative approach has been taken and the significance of impacts have been assessed against the 1% criterion for long-term predictions. Consequently, the weekly average HF PCs are greater than 1% of the critical level for TCC10 - TCC13, inclusive, and are therefore potentially significant.

4.73 For the ecological receptors with PCs that are potentially significant PECs will need to be calculated. Monitoring of ambient levels of HF is not currently carried out in the UK. A modelling study has suggested a natural background concentration of 0.0005 µg/m³ with an elevated background of 0.003 µg/m³ where there are local anthropogenic emission sources (8). In the interest of being conservative, the higher background concentration (i.e., 0.003 µg/m³) will be used for the purposes of calculating the PECs.

4.74 The maximum weekly HF PC for the four modelling points listed in Table 16 occurs at TCC13 and therefore the worst-case PEC would be 0.0177 µg/m³ (or 3.55% of the weekly critical level). It can therefore be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

4.75 The revised modelling data from 2022 show a similar result (ECL, 2022). As above, it can be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

(7) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects
(8) EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects

Table 17: *Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at receptor locations TCC10-13 – In-combination*

ECL Receptor Ref.	Nitrogen Deposition Rate (kgN/Ha/yr)	Lower Critical Load (kgN/Ha/yr)	Upper Critical Load (kgN/Ha/yr)	PC as a Percentage of Lower Critical Load	PC as a Percentage of Upper Critical Load	Background (kgNha/yr)	PEC (kgN/ha/yr)	PEC as %age of Lower Critical Load	PEC as %age of Upper Critical Load
TCC10	0.0688	8	10	0.86%	0.69%	n/a	n/a	n/a	n/a
TCC11	**0.118**			**1.48%**	**1.18%**	10.78	10.90	**136%**	**109%**
TCC12	0.0630			0.79%	0.63%	n/a	n/a	n/a	n/a
TCC13	**0.421**			**5.26%**	**4.21%**	9.1	9.52	**119%**	95%

4.76 A summary of maximum predicted nutrient nitrogen deposition rates at the receptor locations TCC10-13 are presented in Table 17. It should be noted that the habitat with the lowest lower and upper critical load has been selected. As noted in section 3.12, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

4.77 In Table 17, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on the SSSI) of the critical load are highlighted in bold.

4.78 It can be seen from the data in Table 17 that there are predicted exceedances for nitrogen deposition at modelling point TCC11 and TCC13, with the remaining sites screening out as insignificant. This is based on the more cautious assessment for Coastal stable dune grasslands (acid type). When the appropriate Critical Load range is considered for Coastal stable dune grasslands (calcareous type), there is only exceedance of the lower Critical Load (1.18% at TCC11 and 4.21% at TCC13).

4.79 If the Critical Load range is considered for Coastal stable dune grasslands (calcareous type), the PEC is only greater than 100% for the lower Critical Load (10 kgN/Ha/yr) at TCC11. It is worth noting that the background levels are already elevated and exceed the lower critical load in the absence of the development.

4.80 The revised modelling completed in 2022 shows similar results (Table 48 in ECL, 2022). There are predicted exceedances for lower critical load for Nitrogen deposition at modelling points TCC11, TCC13 and TCC14, with the remaining sites screening out as insignificant (a Critical Load range of 10-15 kgN/ha/yr has been considered). There are only predicted exceedances for the upper critical load for Nitrogen deposition at modelling points TCC13 and TCC14.

4.81 The PEC as a percentage of the lower Critical Load is only exceeded at TCC11 and TCC14 (109%). No PECs as a percentage of the upper Critical Load are exceeded. At these modelling points the baseline already exceeds the lower Critical Load.

***Table 18**: Comparison of Maximum Predicted Acid Deposition Rates with the Maximum Critical Load at receptor locations TCC10-13 – In-combination*

ADMS Ref.	PC N (keq/Ha/yr)	BG N (keq/ha/yr)	PC S (keq/Ha/yr)	BG S (keq/ha/yr)	CL MinN (keq/ha/yr)	CL MaxN (keq/ha/yr)	CL MaxS (keq/ha/yr)	PEC N (keq/ha/yr)	PEC S (keq/ha/yr)	PC as % of CL	Total PEC (keq/ha/yr)	PEC as % of CL
TCC 10	0.00490	1.03	0.00520	0.20	0.223	1.998	1.56	1.03	0.205	0.51%	n/a	n/a
TCC 11	0.00842	1.07	0.00894	0.28	0.223	1.998	1.56	1.08	0.289	0.87%	n/a	n/a
TCC 12	0.00448	1.07	0.00475	0.28	0.223	1.998	1.56	1.07	0.285	0.46%	n/a	n/a
TCC 13	0.0299	0.75	0.0318	0.25	0.223	1.998	1.56	0.78	0.282	**3.09%**	1.06	53%

Notes to Table 18

PC N = Process contribution from nitrogen and ammonia (dry deposition only)

PC S = Process contribution from sulphur (dry deposition) and hydrogen chloride (wet and dry deposition)

PEC = Predicted environmental concentration

BG = Background concentration

CL = Critical Load

4.82 A summary of maximum predicted acid deposition rates at the identified modelling points are presented in Table 18, with the deposition velocities for grassland utilised for all four receptor locations identified in relation to the SSSI assessed.

4.83 In Table 18, any PCs greater than 1% of the critical load, and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on the SSSI) of the critical load are highlighted in bold.

4.84 It can be seen from the data in Table 18 that the maximum acid deposition rates due to process contributions are less than 1% of the critical load at all the modelled points, with the exception of TCC13.

4.85 Following the calculation of the PECs, for the modelled points with potentially significant PCs on acid deposition rates, it can be seen from the data in Table 18 that the PECs are all less than 100% of the critical load. It can therefore be assumed that there will be no adverse effects on receptors at these locations.

4.86 The revised modelling data from 2022 show a similar result (ECL, 2022). As above, it can be assumed that there will be no adverse effect (i.e., the PECs are all well below 100% of the critical level).

Revised air quality modelling data

4.87 A meeting was held with Natural England on 24 November 2021 during which ECL advised that NH_3 was the main contributor to nitrogen deposition arising from the proposed development. ECL noted that the modelling approach that had been adopted, where emission rates for NOx and NH_3 had been calculated from Best Available Technique – Associated Emission Levels (BAT-AELs), was likely to have over-estimated actual NH_3 emissions. It was therefore agreed that further modelling would be carried out using actual emissions data from a similar operational facility at the Resource and Energy Recovery Centre at Millerhill, Edinburgh. Further details of the modelling approach are provided in a separate report (ECL, 2021).

4.88 The revised modelling has considered the habitats with the lowest lower and upper critical loads, i.e., a precautionary approach has been adopted. The results of the revised modelling using data from the Millerhill facility show that the revised NH_3 emission rates at all modelling points are less than 1% of the critical load (Table 19). In accordance with published guidance[9], the impacts can therefore be considered insignificant.

***Table 19**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC10 – TCC13 (Installation Only)*

ADMS Ref.	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)
TCC10	8	10	0.0239	0.298%	0.239%	n/a	n/a
TCC11			0.0216	0.270%	0.216%	n/a	n/a
TCC12			0.0164	0.205%	0.164%	n/a	n/a
TCC13			0.0492	0.615%	0.492%	n/a	n/a
TCC14			0.0204	0.254%	0.204%	n/a	n/a

Notes to Table 19

Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

4.89 ECL has created isopleths based on the revised modelling data (ECL, 2021). Figure 3 (reproduced from ECL, 2021) provides the nutrient nitrogen deposition rates in the area surrounding the modelled points.

[9] Environment Agency online guidance advises that if the short-term PC is less than 10% of the short-term environmental standard and the long-term PC is less than 1% of the long-term environmental standard it can be screened out as insignificant. See https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pcs.

4.90 In addition, Figure 4 has been included to allow for comparison to be made between the NH_3 emissions at the revised concentration and the NH_3 emissions at the BAT-AELs.

4.91 In Figures 3 and 4, the ecological receptors are represented by the pink annotated pins and the Installation as the red annotated circle. The results displayed are for the worst-case met year for the maximum GLC.

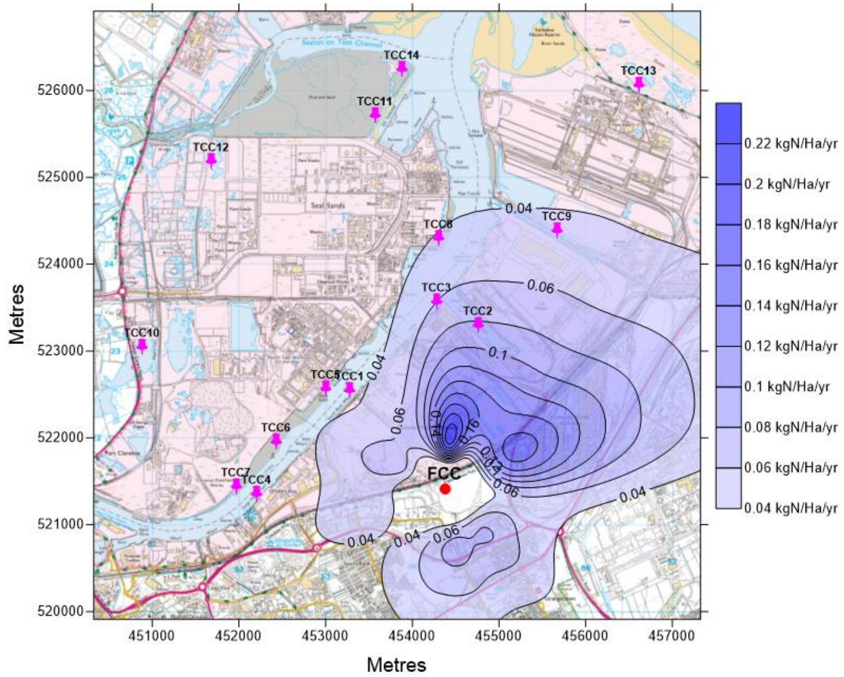


***Figure 3**: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (Revised NH_3 Emission Rate) – Met Year 2020 (Source: ECL, 2021)*

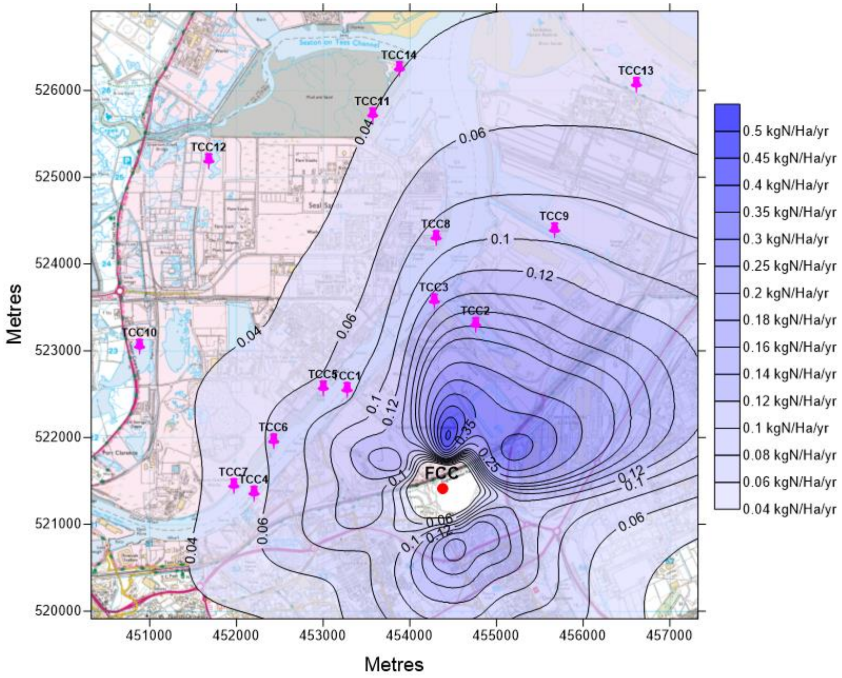


***Figure 4**: Nutrient Nitrogen Deposition (N + NH_3 (dry)) – Installation Only (NO_X & NH_3 at BAT-AELs) – Met Year 2020 (Source: ECL, 2021)*

4.92 Modelling of the proposed facility in-combination with the Redcar Energy Centre (REC) shows that there are exceedances predicted for nitrogen deposition at modelling points TCC11, TCC13 and TCC14 (Table 20). It should be noted that emission rates for NOx and NH_3 had been calculated from BAT-AELs for REC, and are also likely to have over-estimated actual NH_3 emissions.

***Table 20**: Comparison of Maximum Predicted Nutrient Nitrogen Deposition Rates with Critical Loads at Sensitive Habitat Sites – TCC10 – TCC13 (Installation + REC)*

ADMS Ref.	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Nutrient Nitrogen Deposition Rate [(a)] (kgN/ha/yr)	PC as a % of Lower Critical Load	PC as a % of Upper Critical Load	Background Concentration (kgN/ha/yr)	PEC (kgN/ha/yr)	PEC as % of Lower Critical Load	PEC as a% of Upper Critical Load
TCC10	8	10	0.0397	0.496%	0.397%	n/a	n/a	n/a	n/a
TCC11			0.0919	**1.15%**	0.919%	10.78	10.87	**136%**	**109%**
TCC12			0.0475	0.593%	0.475%	n/a	n/a	n/a	n/a
TCC13			0.382	**4.77%**	**3.82%**	9.1	9.48	**119%**	95%
TCC14			0.125	**1.56%**	**1.25%**	10.78	10.91	**136%**	**109%**

Notes to Table 27

Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).

4.93 In Table 20, any PCs greater than 1% of the critical load and PECs greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on the SSSI) of the critical load are highlighted in bold.

4.94 The data presented in Table 20 show that there are predicted exceedances for Nitrogen deposition at modelling points TCC11, TCC13 and TCC14, with the remaining sites screening out as insignificant. Where there are predicted exceedances of the critical load, these are 1.15%, 4.77% and 1.56% of the lower critical load and 3.82% (TCC13) and 1.56% (TCC14) of the upper critical load.

4.95 As noted in section 3.12, this is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has also been considered (instead of 8-10 kgN/ha/yr for acid type dunes). If the more conservative Critical Load range is applied, there is only exceedance of the lower Critical Load at TCC13 (3.82%) and TCC14 (1.25%). The upper Critical Load is only exceeded at TCC13. When the PEC is considered the only PECS that exceed 100% are for the lower Critical Load at TCC11 and TCC14.

4.96 It is important to note that the background levels are already elevated and exceed the lower critical load in the absence of the development (at TCC11 and TCC14).

4.97 The proposed development operating in isolation does not lead to a breach of the relevant nutrient nitrogen critical loads for any of the modelled points assessed. It is only the cumulative impact of both installations operating simultaneously that result in the exceedances shown in Table 20.

4.98 Table 21 demonstrates the predicted nutrient nitrogen deposition rates associated with the three scenarios that have been modelled by ECL, i.e., the Installation in isolation, REC in isolation and the cumulative scenario of the Installation's and REC's emissions.

***Table 21**: Predicted Nutrient Nitrogen Deposition Rates at Sensitive Habitat Sites (TCC10 – TCC13) For Three Scenarios*

ADMS Ref.	**Nutrient Nitrogen Deposition Rate [(a)] [(b)] (kgN/ha/yr)**		
	Installation Only	**REC Only**	**Installation + REC**
TCC10	0.0239	0.0310	0.0397
TCC11	0.0216	0.0714	0.0919
TCC12	0.0164	0.0356	0.0475
TCC13	0.0492	0.356	0.382
TCC14	0.0204	0.105	0.125

Notes to Table 21
(a) Total PC to nutrient nitrogen deposition is derived from the sum of the contribution from Nitrogen and Ammonia (dry deposition only).
(b) The NO_X and NH_3 emission rates for both the Installation and REC are as discussed in Section 10.4.1 of ECL (2021).

4.99 The results presented in Table 21 show that, overall, the predicted nutrient nitrogen deposition rates for the REC are greater than those for the Installation.

4.100 ECL (2021) note that the '*greater predicted deposition rate associated with the REC scenario is largely due to REC's closer proximity to a number of the specified ecological points (TCC11 and TCC13, in particular)*'. In addition, they also note that '*the emission rates for REC are based on the BAT-AELs*' and therefore it follows that '*When accounting for normal day to day operation, it is anticipated that the actual emission rates for REC, particularly in regard to NH_3, are likely to be lower, as is the case with the FCC Installation*'.

4.101 ECL has produced isopleths (Figure 5) for nutrient nitrogen deposition rates for the installation in combination with REC. In addition, Figure 6 has been included to allow for comparisons to be made between the cumulative emissions with the Installation's actual NH_3 concentration, compared to the BAT-AELs.

4.102 In Figures 5 and 6, the ecological receptors are represented by the pink annotated pins and the Installation and REC as the red annotated circles. The results displayed are for the worst-case met year for the maximum GLC.

Figure 5*: Nutrient Nitrogen Deposition (N + NH3 (dry)) – Installation (with revised NH3) + REC – NWP 2020 (Source: ECL, 2021)*

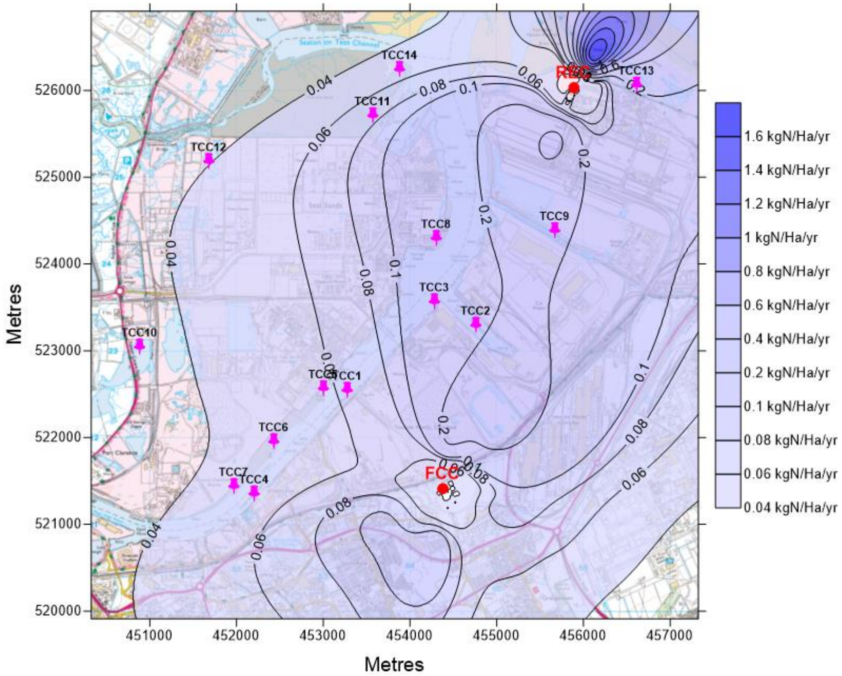
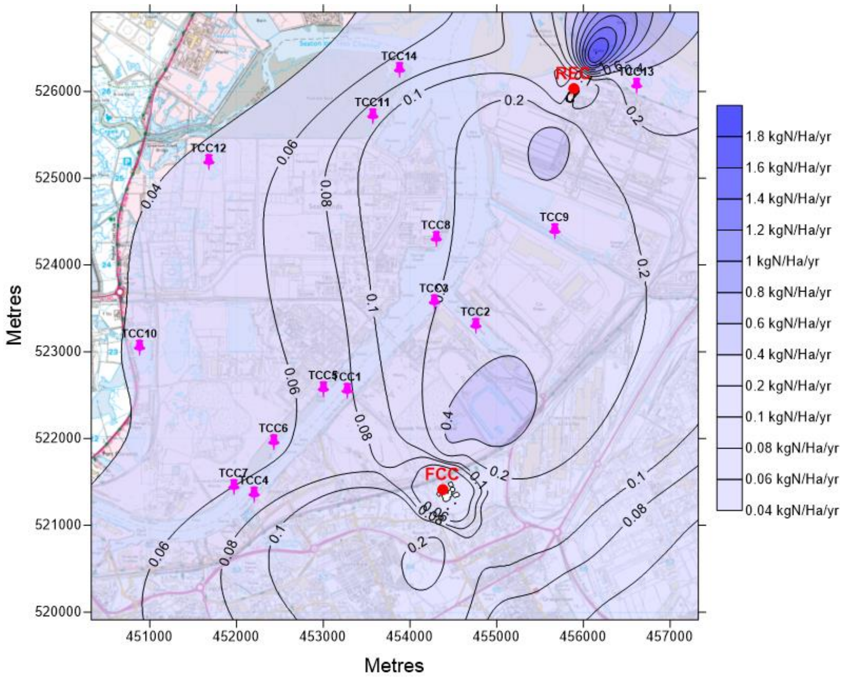


***Figure 6**: Nutrient Nitrogen Deposition (N + NH3 (dry)) – Installation + REC (BAT-AELs) – NWP 2020 (Source: ECL, 2021)*



Habitat sensitivity at modelling point

4.103 Table 22 provides an evaluation of the points where modelling has identified a potential exceedance of a critical load or level. In each case the habitats present are identified and related to the qualifying features (birds) of the SSSI. The locations of all air quality modelling points are shown on Figure 2.

4.104 Mapping presented on the MAGIC website shows the locations of coastal priority habitats in relation to the site. It should be noted that the only coastal priority habitat that occurs within the inner and central estuary is intertidal mudflats – all other coastal priority habitats are located at the coast or the extreme outer part of the estuary.

4.105 As previously noted, TCC10 is a saline lagoon located at Saltholme; TCC11 is saltmarsh and sand dune; TCC12 is saltmarsh; and TCC13 is sand dune. TCC10 to TCC13 are all located within the boundary of the Teesmouth and Cleveland Coast SSSI. TCC14, which is located close to TCC11, is saltmarsh and sand dune.

***Table 22**: Evaluation of modelling points TCC10 to TCC13*

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC10		TCC10 is a saline lagoon located at Saltholme (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saline lagoon habitat to the development site. The modelling point is approximately 3.6 km to the west-north-west of the Site.	The only exceedance predicted at this location is hydrogen fluoride (1.30% of the CL). It can be seen from the data in Table 16 that the daily mean HF PC is less than 10% of the critical level and therefore is not significant at this modelling point.
TCC11 TCC14		TCC11 is saltmarsh located at Seal Sands (as mapped on the MAGIC website). Natural England has also advised that sand dune is present and Ian Bond (INCA – email dated 12 January 2022) has advised that there is a narrow fringe of dune present. TCC14 is located on the saltmarsh and sand dune habitat to the north of TCC11.	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saltmarsh habitat to the development site. The modelling point is approximately 4.3 km to the north-west of the Site.	The cumulative assessment predicts that nitrogen deposition will be 0.118 kgN/ha/yr, which is 1.48% of CL (lower) and 1.18% of CL (upper); the PEC is 136% of CL (lower) and 109% of CL (upper). However, the background concentration is 10.78 kgN/ha/yr, which exceeds the CL (lower and upper). These figures have been calculated for 'Coastal stable dune grasslands - acid type'. For pioneer low-mid mid-upper saltmarsh the nitrogen CL range is 10-20 kg N/ha/yr, i.e., the cumulative impact will be of lower significance.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC12		TCC12 is saltmarsh located close to Seal Sands (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saltmarsh habitat to the development site. The modelling point is approximately 4.7 km to the north of the Site.	The only exceedance predicted at this location is hydrogen fluoride (1.03% of the CL). It can be seen from the data in Table 16 that the daily mean HF PC is less than 10% of the critical level and therefore is not significant at this modelling point
TCC13		TCC13 is coastal sand dune located at Coatham Sands (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of coastal sand dune habitat to the development site. The modelling point is approximately 4.8 km to the north-east of the Site.	When the development is considered alone nitrogen deposition is predicted to be 0.107 kgN/ha/yr, which is 1.34% of CL (lower) and 1.07% of CL (upper); the PEC is 115% of CL (lower) and 92% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.421 kgN/ha/yr, which is 5.26% of CL (lower) and 4.21% of CL (upper); the PEC is 119% of CL (lower). However, the background concentration is 9.10 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type'[10], which is a habitat that is present at or near this modelling point. It is also noted the background concentration already exceeds the CL (lower) in the absence of the development. The PEC does not exceed the CL (upper). Exceedance is predicted at this location for hydrogen fluoride (1.07% of the CL). It can be seen from the data in Table 16 that the daily mean HF PC is less than 10% of the critical level and therefore is not significant at this modelling point.

[10] The APIS website advises the following for 'Coastal stable dune grasslands - acid type': 1. Potential negative impact on species due to impacts on the species' broad habitat. 2. Potential positive impact on species due to impacts on the species' food supply.

Nitrogen deposition to the River Tees and Tees Estuary

4.106 During the consultation meeting on 24 November 2021, Natural England advised that the assessment needs to consider nitrogen deposition to the River Tees and Tees Estuary. Their concern was that nitrogen deposition may contribute to nutrient enrichment of the water, which Natural England has advised is resulting in the formation of algal mats on mudflats (which makes it difficult for some birds to feed).

4.107 It is estimated that the area of the river and estuary downstream of the transporter bridge (OSGR NZ 49989 21308 – this is estimated to mark the extent of potentially significant effects) is approximately 880 ha. Extrapolating the data shown on Figure 36 in ECL (2021) a worst-case nitrogen deposition of 0.08 kg/Ha/yr has been assumed for the whole river and estuary area. This equates to total nitrogen deposition of 70.4 kg/yr for the whole river and estuary area. If it is assumed that the average depth of the estuary is 1 m (which is likely to be an under-estimate) this equates to 70.4 kg nitrogen deposition in 8.8 million m3 or 8 mg/m3, which is equivalent to 0.008mg/l.

4.108 Water quality monitoring of the Tees Estuary at Smiths Dock (https://environment.data.gov.uk/water-quality/view/sampling-point/NE-45400834) reported dissolved organic nitrogen levels that ranged from 0.76 mg/l (31 March 2021) to 3.49 mg/l (5 March 2021). The estimated total nitrogen deposition therefore equates to between 0.23% and 1.05% of the baseline dissolved organic nitrogen levels.

4.109 The above calculation is necessarily extremely crude and does not account for factors such as river flow, discharge, tidal mixing etc. Nevertheless it does demonstrate that deposition arising from the proposed development will make an insignificant contribution to nitrogen levels in the river and estuary based on current baseline levels.

5 Conclusion

5.1 Air quality modelling has been carried out by ECL for the proposed ERF using a total of fourteen modelling points. The choice of air quality modelling points includes sensitive habitats within the boundary of the Teesmouth and Cleveland Coast SSSI. TCC10 is a saline lagoon located at Saltholme; TCC11 is saltmarsh and sand dune; TCC12 is saltmarsh; TCC13 is sand dune; and TCC14 is saltmarsh and sand dune.

5.2 Air quality modelling has predicted small exceedances for nitrogen deposition at modelling points TCC11, TCC13 and TCC14. The exceedance has been predicted based on information available on the APIS website, i.e., effects have been considered for 'Coastal stable dune grasslands (acid type)' where the Critical Load of 8-10 kgN/Ha/yr is exceeded.

5.3 This is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 and TCC14 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has also been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

5.4 Based on this higher Critical Load range there would only be an exceedance of the Lower Critical Load for one receptor (TCC11) and only when it is considered in combination with the anticipated emissions from the Redcar Energy Centre.

5.5 Small exceedances are also predicted for NOx (modelling point TCC13), SO_2 (modelling point TCC13) and NH_3 (modelling point TCC13). In all cases the exceedances of the 1% threshold are small; however, the PEC is less than 100% of the critical level and so it can be assumed that there will be no adverse effect.

5.6 Whilst exceedances of the 1% threshold are predicted for hydrogen fluoride (at modelling points TCC10, TCC12 and TCC13), the predicted levels still fall well below the weekly critical level even when current baseline levels are factored in. No exceedance is predicted for SO_2 or acid deposition.

5.7 Overall, it is concluded that the small increase in nitrogen deposition are not likely to have an adverse effect on the conservation status of any qualifying habitat and hence the integrity of the Teesmouth and Cleveland Coast SSSI. This conclusion has been reached through consideration of changes against a baseline where there is exceedance of the lower Critical Load / Level for these pollutants.

6 References

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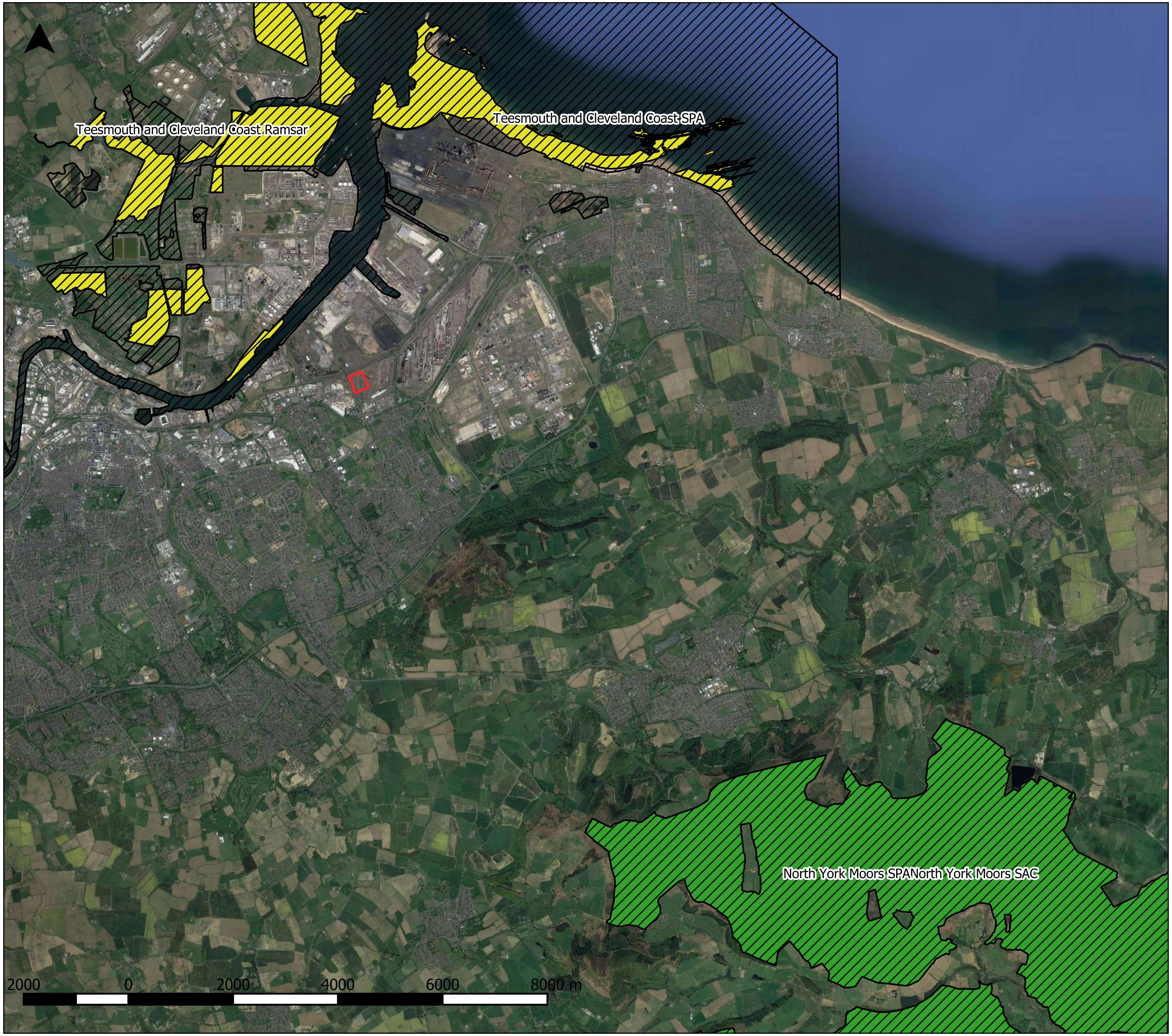
7 Figures

Figure 1: Location plan showing European designated sites (the Teesmouth and Cleveland Coast SSSI covers the same area as the SPA and Ramsar site combined)



Legend

- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- Ramsar
- Site boundary

Document path

BSG ecology

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JOB REF: P20-1004

PROJECT TITLE
Grangetown Prairie Energy Recovery Facility

DRAWING TITLE
Figure 1: Site Location

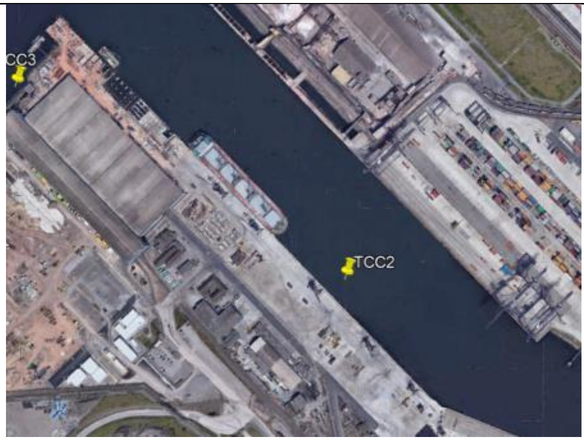
DATE: 19.8.2021
SCALE: 1:7,000
DRAWN: HB
STATUS: Final

Sources: BSG Ecology survey data

Figure 2: Air quality modelling locations

(Source: ECL, 2022)

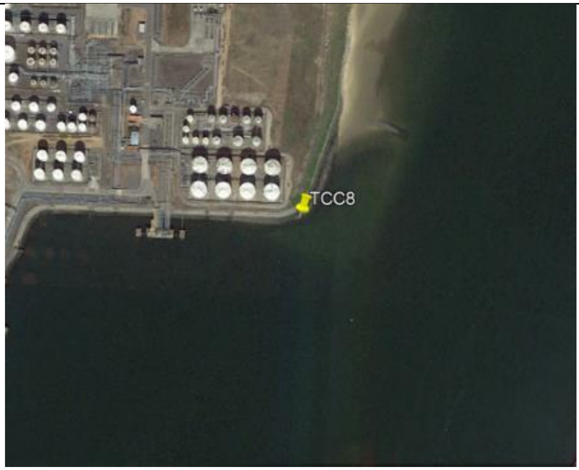
***Table 29**: Evaluation of modelling points*

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC1		TCC1 is located on a section of the estuary where there is a quay consisting of a raised deck supported on pillars. There appears to be minimal if any intertidal habitat – images on Google Earth Pro show water alongside the quay whilst other areas are exposed at low tide (for example TCC5 on the screen capture to the left).	Examination of the Government's MAGIC mapping website shows that the only coastal priority habitat in the area is intertidal mudflat with small areas present between the quay platform and the shore and on the north side of the estuary (at TCC5). Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.110 kgN/ha/yr, which is 1.37% of CL (lower) and 1.10% of CL (upper); the PEC is 113% of CL (lower) and 91% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.139 kgN/ha/yr, which is 1.73% of CL (lower) and 1.39% of CL (upper); the PEC is 114% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.
TCC2		TCC2 is located within the Tees Dock which is a facility characterized by reinforced dock walls. There appears to be no intertidal habitat (which is expected for a key dock facility) – images on Google Earth Pro show water alongside the quay whilst elsewhere in the estuary intertidal habitats are shown as being exposed. The same images also indicate that the dock has been a busy facility.	Examination of the Government's MAGIC mapping website shows that there are no coastal priority habitats within or near the dock: the nearest coastal priority habitats are small localised areas of intertidal mudflat in the main estuary. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.210 kgN/ha/yr, which is 2.62% of CL (lower) and 2.10% of CL (upper); the PEC is 115% of CL (lower) and 92% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.287 kgN/ha/yr, which is 3.59% of CL (lower) and 2.87% of CL (upper); the PEC is 116% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
				For NOx the PC is predicted to be 0.477 ug/m^3: this is 1.59% of CL and PEC is 121% of CL. The cumulative assessment shows that for NOx the PC is predicted to be 0.662 ug/m^3: this is 2.21% of CL and PEC is 121% of CL. However, the background concentration is 35.78 ug/m^3, which exceeds the CL. The CL[18] for open water and its associated vegetation has been used for this assessment; however, the only intertidal habitat present in this part of the estuary is mudflat.
TCC3		TCC3 is located on the southern bank of the main estuary close to the Tees Dock. The quayside appears to be characterized by a boulder reinforced slope with adjacent sections with retaining walls. There appears to be no or very limited intertidal habitat (which is expected for the adjacent dock facilities) – images on Google Earth Pro show water alongside the quay whilst elsewhere in the estuary intertidal habitats are shown as being exposed.	Examination of the Government's MAGIC mapping website shows that there are no coastal priority habitats near the modelling point: the nearest coastal priority habitats are small localized areas of intertidal mudflat in the main estuary. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.143 kgN/ha/yr, which is 1.79% of CL (lower) and 1.43% of CL (upper); the PEC is 114% of CL (lower) and 91% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.201 kgN/ha/yr, which is 2.51% of CL (lower) and 2.01% of CL (upper); the PEC is 115% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website. For NOx the PC is predicted to be 0.301 ug/m^3: this is 1.003% of CL and PEC is 120% of CL. The cumulative assessment shows that for NOx the PC is predicted to be 0.433 ug/m^3: this is 1.44% of CL and PEC is 121% of CL. However, the background concentration is 35.78 ug/m^3, which exceeds the CL. The CL for open water and its associated vegetation has been used for this assessment;

[18] The APIS website advises the following for littoral and supralittoral sediments 1. No expected negative impact on species due to impacts on the species' broad habitat. 2. Potential positive impact on species due to impacts on the species' food supply.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
				however, the only intertidal habitat present in this part of the estuary is mudflat.
TCC4		TCC4 is located on a section of the estuary where there is a reinforced bank with adjacent sections with reinforced quay walls. There appears to be minimal if any intertidal habitat at the modelling location – images on Google Earth Pro show water alongside the bank whilst other areas are exposed at low tide (for example TCC7 on the screen capture to the left).	Examination of the Government's MAGIC mapping website shows that no coastal priority habitat is present near the modelling location but intertidal mudflat is present along the northern side of the estuary with small areas of this habitat to the west and east along the southern side of the estuary. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	The cumulative assessment predicts that nitrogen deposition will be 0.0857 kgN/ha/yr, which is 1.07% of CL (lower) and 0.86% of CL (upper); the PEC is 113% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.
TCC5		TCC5 is located on a section of the estuary where intertidal mudflats are exposed at low tide. No other coastal priority habitats are thought to be present.	Examination of the Government's MAGIC mapping website shows that the only coastal priority habitat in the area is intertidal mudflat. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.103 kgN/ha/yr, which is 1.29% of CL (lower) and 1.03% of CL (upper); the PEC is 113% of CL (lower) and 91% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.129 kgN/ha/yr, which is 1.61% of CL (lower) and 1.29% of CL (upper); the PEC is 114% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC6 & TCC7		TCC6 and TCC7 are located on a section of the estuary where an area of intertidal mudflats is exposed at low tide. No other coastal priority habitats are thought to be present.	Examination of the Government's MAGIC mapping website shows that the only coastal priority habitat in the area is intertidal mudflat. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone for TCC6 nitrogen deposition is predicted to be 0.110 kgN/ha/yr, which is 1.38% of CL (lower) and 1.10% of CL (upper); the PEC is 113% of CL (lower) and 91% of CL (upper). The cumulative assessment for TCC6 predicts that nitrogen deposition will be 0.132 kgN/ha/yr, which is 1.65% of CL (lower) and 1.32% of CL (upper); the PEC is 114% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.
TCC8		TCC8 is located on the northern bank of the main estuary close to the Tees Dock. The bank appears to be a mixture of boulder reinforced slope with adjacent sections with concrete revetment. The location is on the edge of an area of intertidal mudflats (as mapped on the MAGIC website).	Examination of the Government's MAGIC mapping website shows that intertidal mudflat is the only coastal priority habitat in the main estuary. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.098 kgN/ha/yr, which is 1.23% of CL (lower) and 0.98% of CL (upper); the PEC is 113% of CL (lower) and N/A for CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.183 kgN/ha/yr, which is 2.29% of CL (lower) and 1.83% of CL (upper); the PEC is 114% of CL (lower). However, the background concentration is 8.96 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website. The cumulative assessment shows that for NOx the PC is predicted to be 0.396 ug/m^3: this is 1.32% of CL and PEC is 165% of CL.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
				However, the background concentration is 49.10 ug/m^3, which exceeds the CL. The CL for open water and its associated vegetation has been used for this assessment; however, the only intertidal habitat present in this part of the estuary is mudflat.
TCC9		TCC9 is located in the Dabholm Cut, which is a narrow channel with an outflow structure at the eastern end. The Cut appears to receive effluent from the adjacent sewage treatment works to the north-east. The Cut is characterized by sloping banks on both sides, which are either grass or reinforced.	Examination of the Government's MAGIC mapping website shows that the coastal priority habitat intertidal mudflat is present along the whole of the Cut. Mudflat is not identified as a habitat requiring further assessment on the APIS website (in an estuarine environment mudflats will derive nutrient inputs from both marine and riverine sources).	When the development is considered alone nitrogen deposition is predicted to be 0.174 kgN/ha/yr, which is 2.18% of CL (lower) and 1.74% of CL (upper); the PEC is 107% of CL (lower) and 86% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.314 kgN/ha/yr, which is 3.43% of CL (lower) and 3.14% of CL (upper); the PEC is 109% of CL (lower). However, the background concentration is 8.40 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat is the only coastal priority habitat that is present in this part of the estuary and this habitat is not identified as a habitat requiring further assessment on the APIS website.
TCC10		TCC10 is a saline lagoon located at Saltholme (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saline lagoon habitat to the development site. The only exceedance predicted at this location is hydrogen fluoride (1.30% of the CL).	Modelling does not predict that the long-term PC is greater than 1% for European sites, and/or the PEC is greater than 70% for European sites.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC11 TCC14		TCC11 is saltmarsh located at Seal Sands (as mapped on the MAGIC website) TCC14 is located on the saltmarsh and sand dune habitat to the north of TCC11	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saltmarsh habitat to the development site. No exceedance is predicted at this location.	The cumulative assessment predicts that nitrogen deposition will be 0.118 kgN/ha/yr, which is 1.48% of CL (lower) and 1.18% of CL (upper); the PEC is 136% of CL (lower) and 109% of CL (upper). However, the background concentration is 10.78 kgN/ha/yr, which exceeds the CL (lower and upper). These figures have been calculated for 'Coastal stable dune grasslands - acid type', which is a habitat that is not present at or near this modelling point. Mudflat and saltmarsh are the only coastal priority habitats that are present in this part of the estuary. Mudflat is not identified as a habitat requiring further assessment on the APIS website. For pioneer low-mid mid-upper saltmarsh the nitrogen CL range is 10-20 kg N/ha/yr, i.e., the cumulative impact will be of lower significance.
TCC12		TCC12 is saltmarsh located close to Seal Sands (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of saltmarsh habitat to the development site. The only exceedance predicted at this location is hydrogen fluoride (1.03% of the CL).	Modelling does not predict that the long-term PC is greater than 1% for European sites, and/or the PEC is greater than 70% for European sites.

Rec. Ref.	Location	Habitat Description	Evaluation	Assessment
TCC13		TCC13 is coastal sand dune located at Coatham Sands (as mapped on the MAGIC website)	Examination of the Government's MAGIC mapping website shows that this is one of the nearest occurrences of coastal sand dune habitat to the development site. The only exceedance predicted at this location is hydrogen fluoride (1.07% of the CL).	When the development is considered alone nitrogen deposition is predicted to be 0.107 kgN/ha/yr, which is 1.34% of CL (lower) and 1.07% of CL (upper); the PEC is 115% of CL (lower) and 92% of CL (upper). The cumulative assessment predicts that nitrogen deposition will be 0.421 kgN/ha/yr, which is 5.26% of CL (lower) and 4.21% of CL (upper); the PEC is 119% of CL (lower). However, the background concentration is 9.10 kgN/ha/yr, which exceeds the CL (lower). These figures have been calculated for 'Coastal stable dune grasslands - acid type'[19], which is a habitat that is present at or near this modelling point. However, this habitat is of importance for supporting nesting terns but none have been recorded near this location (see Section 4.2.4). It is also noted the background concentration is 9.1 kgN/ha/yr, i.e., there is already exceedance of the CL (lower) in the absence of the development. The PEC does not exceed the CL (upper).

[19] The APIS website advises the following for 'Coastal stable dune grasslands - acid type': 1. Potential negative impact on species due to impacts on the species' broad habitat. 2. Potential positive impact on species due to impacts on the species' food supply.

Nitrogen deposition to the River Tees and Tees Estuary

6.112 During the consultation meeting on 24 November 2021, Natural England advised that the HRA needs to consider nitrogen deposition to the River Tees and Tees Estuary. Their concern was that nitrogen deposition may contribute to nutrient enrichment of the water, which Natural England has advised is resulting in the formation of algal mats on mudflats (which makes it difficult for some birds to feed).

6.113 It is estimated that the area of the river and estuary downstream of the transporter bridge (OSGR NZ 49989 21308 – this is estimated to mark the extent of potentially significant effects) is approximately 880 ha. Extrapolating the data shown on Figure 36 in ECL (2022) a worst-case nitrogen deposition of 0.08 kg/Ha/yr has been assumed for the whole river and estuary area. This equates to total nitrogen deposition of 70.4 kg/yr for the whole river and estuary area. If it is assumed that the average depth of the estuary is 1 m (which is likely to be an under-estimate) this equates to 70.4 kg nitrogen deposition in 8.8 million m3 or 8 mg/m3, which is equivalent to 0.008mg/l.

6.114 Water quality monitoring of the Tees Estuary at Smiths Dock (https://environment.data.gov.uk/water-quality/view/sampling-point/NE-45400834) reported dissolved organic nitrogen levels that ranged from 0.76 mg/l (31 March 2021) to 3.49 mg/l (5 March 2021). The estimated total nitrogen deposition therefore equates to between 0.23% and 1.05% of the baseline dissolved organic nitrogen levels.

6.115 The above calculation is necessarily extremely crude and does not account for factors such as river flow, discharge, tidal mixing etc. Nevertheless it does demonstrate that deposition arising from the proposed development will make an insignificant contribution to nitrogen levels in the river and estuary based on current baseline levels.

7 Conclusion

7.1 Air quality modelling has predicted small exceedances for nitrogen deposition at eight modelling points for Sandwich tern and little tern. The birds themselves are not vulnerable to elevated levels of nitrogen deposition; however, some of the habitats upon which they depend may be sensitive to increased nitrogen deposition. The exceedance has been predicted based on information available on the APIS website, which indicates that effects need to be considered for 'Coastal stable dune grasslands (acid type)' where the Critical Load of 8-10 kgN/Ha/yr is exceeded.

7.2 This is a highly precautionary approach as the most sensitive habitat type, Coastal stable dune grasslands (acid type), is not present at any of the ecological receptors. As there are areas of Coastal stable dune grasslands (calcareous type) at receptors TCC11 and TCC14 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), a Critical Load range of 10-15 kgN/ha/yr has also been considered (instead of 8-10 kgN/ha/yr for acid type dunes).

7.3 Based on this higher Critical Load range for nitrogen deposition there would only be an exceedance of the Lower Critical Load for one receptor (TCC11) and only when it is considered in combination with the anticipated emissions from the Redcar Energy Centre. It is noted that the lower CL is already exceeded in the absence of development.

7.4 Saltmarsh is present at modelling point TCC11. There is currently no evidence that terns are nesting in any of the dune habitat that has been considered in the air quality modelling for this assessment. It is therefore concluded that no adverse effects are likely in relation to the conservation status of any tern species that is a qualifying feature of the SPA and Ramsar site.

7.5 Small exceedances are also predicted for NOx (two modelling points) and NH_3 (two modelling points). In all cases the exceedances of the 1% threshold are small: none of the PECs are greater than 100% (i.e., the level beyond which it cannot be assumed that there will be no adverse effect on European Sites and SSSI's).

7.6 Whilst exceedances of the 1% threshold are predicted for hydrogen fluoride (twelve modelling points), the predicted levels still fall well below the weekly critical level even when current baseline levels are factored in. No exceedance is predicted for SO_2 or acid deposition.

7.7 Evaluation of the modelling locations in the estuary (TCC1 to TCC9) has concluded that they are typically characterised by hard-engineered banks or quay walls with minimal or no intertidal habitat present (many areas remain flooded at low tide). Where intertidal habitat is present this is limited to mudflats, which is not considered to be vulnerable to the effects of elevated nitrogen deposition. There are no saltmarsh or sand dune or other sensitive coastal priority habitats in the vicinity of the proposed development site: the nearest sand dunes are at Coatham Sands, approximately 4.8 km to the north-east, and the nearest saltmarsh is at Seal Sands, approximately 4.2 km to the north of the proposed development (modelling points TCC10 to TCC13 have been included specifically to assess air quality impacts on coastal priority habitats).

7.8 Air quality modelling has also predicted exceedances for NOx at modelling points TCC2, TCC3 and TCC9 for Sandwich tern and little tern (for supralittoral sediment). There are predicted exceedances of the long-term (30 ug/m^2) and short-term (75 ug/m^2) Critical Level for supralittoral sediment. At modelling points TCC2 and TCC3 the long-term CL is exceeded in the absence of development.

7.9 As noted above, the habitats at many of the modelling points are either intertidal mudflat or are permanently inundated with sea water. Mudflat is not considered to be sensitive to elevated NOx levels of the magnitude predicted for the proposed development due to the effects of inundation, dilution, tidal mixing and dispersal.

7.10 It is also understood that parts of the estuary are subject to dredging in order to maintain a navigable channel. The removal of sediment will inevitably result in the removal of nutrients contained within those sediments.

7.11 Examination of the evidence base for the Teesmouth and Cleveland Coast SPA / Ramsar extension (Natural England, 2015; Natural England, 2018; Natural England, 2019) indicates that, whilst some tern species may feed within the estuary (and potentially in the vicinity of the areas where small-scale exceedance of nitrogen deposition and NOx are predicted), most of the qualifying species are associated with more distant areas. Terns are mainly piscivorous and it is concluded that the predicted air quality changes are not likely to affect prey availability and hence the conservation status of these species.

7.12 Overall, it is concluded that the small increases in nitrogen deposition, NOx and NH_3 at some modelling points are not likely to have an adverse effect on the conservation status of any qualifying species and hence the integrity of the Teesmouth and Cleveland Coast SPA / Ramsar site. This conclusion has been reached through consideration of changes against a baseline where there is exceedance of the lower Critical Load / Level for these pollutants.

7.13 The Habitats Regulations Assessment screening process has concluded that the proposed development is not directly connected with or necessary to the management of any European Site.

7.14 The HRA screening identified that a likely significant effect may arise as a result of changes in air quality during the operation of the ERF when considered alone. No other likely significant effects have been identified for the Teesmouth and Cleveland Coast SPA / Ramsar site or for any other European site.

7.15 The initial screening assessment of likely significant effects has been carried out in the absence of mitigation measures and is therefore compliant with the judgment People Over Wind - *Sweetman vs Coillte* (European Court, 12 April 2018).

7.16 An appropriate assessment has been completed, which includes further air quality studies, and this has concluded that the proposed development, based on the scientific evidence that is available, will not have an adverse effect on the integrity of the Teesmouth and Cleveland Coast SPA / Ramsar site alone and in combination with other plans and projects.

8 References

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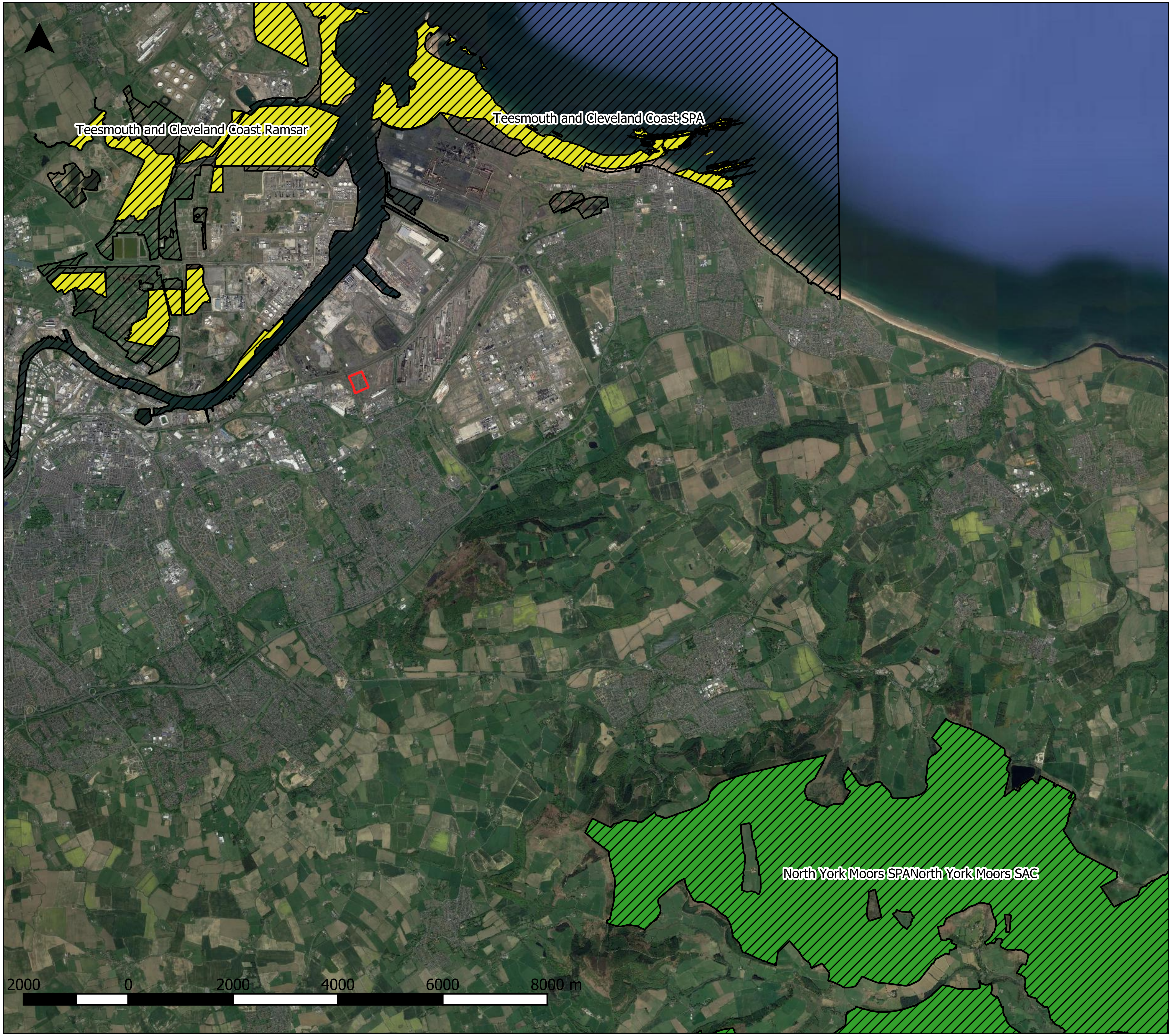
9 Figures

Figure 1: Location plan showing European designated sites



Legend
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- Ramsar
- Site boundary

BSG ecology

OFFICE: Newcastle
T: 0191 303 8964
JOB REF: P20-1004

PROJECT TITLE
Grangetown Prairie Energy Recovery Facility

DRAWING TITLE
Figure 1: Site Location

DATE: 19.8.2021 SCALE: 1:7,000
DRAWN: HB STATUS: Final

Sources: BSG Ecology survey data

Figure 2: Air quality modelling locations

(Source: ECL, 2022)

APPENDIX III
NE DAS – MEETING MINUTES

Natural England Call

Client: Natural England

Project: Grangetown ERF

Held At: Microsoft Teams

Time & Date: Wednesday 24th November 2021
09:00am

Present:	Nick Lightfoot	(NL)	Natural England	(NE)
	Lewis Pemberton	(LP)	Natural England	(NE)
	David Molland	(DM)	FCC	(FCC)
	Tim Heard	(TH)	ECL	(ECL)
	Sarah Burley	(SB)	ECL	(ECL)
	Sara Maile	(SM)	ECL	(ECL)
	Steve Betts	(SBT)	BSG Ecology	(BSG)
	Sam Thistlethwaite	(ST)	Identity Consult Planning	(ICP)

Originator	Approved	Version	Date Issued	Issued To	Version Comments
ST	ST	1	26/11/2021	As Listed Above	-

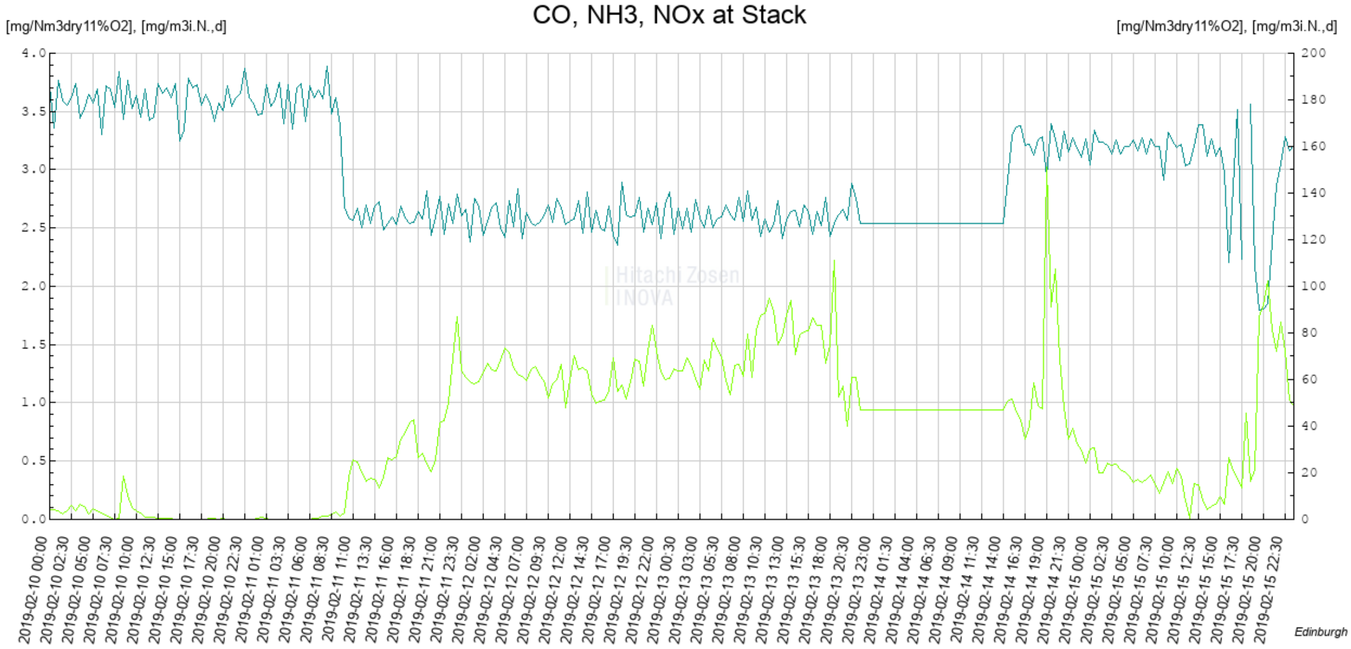
1	**Introduction to Project**	**Action**
1.1	The discussion started with general introductions from all parties followed by DM providing an overview of the planning and permitting process undertaken to date.	
2	**Planning and Permit Timescales**	
2.1.	DM confirmed that the deadline for final bid submission was likely to be in February 2022.	
3	**Air Dispersal Model**	
3.1	TH provided an overview of the dispersal model, explaining that it was based upon two 90m high stacks.	
3.2	TH shared the image of the sensitive receptors chosen for assessment and explained the distribution and justification for choosing them.	
3.3	SBT advised that the air quality modelling points included the most sensitive ecological habitat receptors (saltmarsh, dunes and lagoons), but that they also included intertidal mudflats, which are considered to be the least sensitive habitat.	
3.4	NL confirmed that the air dispersal model had selected the appropriate receptors.	
3.5	Of the air quality modelling locations chosen, NL thought that receptors TCC10-13 were the most sensitive in ecological terms, and in particular TCC11 – Seal Sands and TCC13 – South Gare and Coatham Dunes were the key ones and that the more detailed assessment of these locations was the correct approach. This was because of the presence of saltmarsh at TCC11 and dunes at TCC13 (the concern about these locations was in relation to impacts on the habitats and therefore this relates to the integrity of the SSSI and is not an issue for the HRA).	
3.6	NL stated that the fact that there were already pre-existing exceedances within the surrounding area made it difficult to assess the impact of the proposals.	
3.7	In relation to Seal Sands, NL stated that the high nutrient loading was becoming a problem allowing algal mats to become established thereby making it less favourable for feeding birds.	
3.8	SBT queried whether the algal growth had been positively linked to high nutrient levels or if this was just part of the natural development of a salt marsh habitat, and as such potentially a positive thing. NL didn't think it was but agreed to check with colleagues on this point.	
3.9	Similarly NL confirmed that the high nutrient loading was also a concern for the Coatham Dunes habitat.	
3.10	SB suggested sharing the existing data being generated by FCCs Millerhill site in Edinburgh as it would be helpful and would provide a more realistic reflection of what the likely emission levels would be.	**AP1 SB**
3.11	NL agreed that this would be helpful.	
3.12	SB asked if there was anything else that could be included in the assessment. NL confirmed that the model was pretty good especially in relation to the assessment of in combination effects.	

3.13	NL asked if there are any other mitigation measures (at source) that could be employed. DM responded stating that there may well be and that he and SB would look into this and provide an update.	**AP2** **SB** **DM**
3.14	SBT asked if NL was aware of any other pre-existing sources significant sources of pollution that may be specifically impacting on the habitats at Seal Sands or Coatham Dunes. NL was not aware of any but agreed to take it away and check.	
4	**<u>Biodiversity Net Gain Position</u>**	
4.1	SBT asked about the Biodiversity Net gain (BNG) proposed for the site and whether Natural England would be commenting on this, NL advised that they would be commenting and stated that it was one of his colleagues that would be dealing with that element of the proposals.	
4.2	DM explained the proposal for dealing with BNG within the bid and that the required up lift would be delivered offsite by the landowner for the wider regeneration area, South Tees Development Corporation.	
4.3	DM explained that despite it being addressed off site, opportunities were being explored on site to deliver biodiversity benefit where possible and NL agreed that there was some benefit in doing this.	
4.4	SBT explained the issues affecting the site in relation to Open Mosaic Habitats that had developed on the site following the closure of the steelworks. SBT raised the issue of needing to keep a balance between the landscaping requirements. SBT/DM agreed to share the landscape masterplan and BNG report produced for the site.	
4.5	ST shared the BNG report and the landscape masterplan after the meeting	
5	**<u>Any Other Business</u>**	
5.1	NL wanted to know more about the reference to water borne pollutants. The HRA report states that it was "unlikely that non-synthetic compounds would be issued by activities at the site". NL felt that this needed to be clarified especially in relation to the use of the term "unlikely" and what mitigation would be provided so that they become unlikely.	

APPENDIX IV
HZI CEMS DATA – MILLERHILL, EDINBURGH

Plant	**Edinburgh**
Timeframe	10.02.2019 00:00 - 15.02.2019 23:59
Averaging	30'

CO, NH3, NOx at Stack



Signal		#values	mean	stdev	Min	Max
NOx 30 min Average, 1CFB40CQ902-ZJ51	[mg/Nm3dry11%O2]	288	147.43	24.18	89.89	258.56
NOx 24 h Rolling Average, 1CFB40CQ903-ZJ50	[mg/Nm3dry11%O2]	0	0.00	0.00	0.00	0.00
NH3 24 h Rolling Average, 1CFB43CQ903-ZJ50	[mg/Nm3dry11%O2]	0	0.00	0.00	0.00	0.00
Conc NO Comp EmiMeas, 1CFB41CQ901-XE01	[mg/m3i.N.,d]	255	96.06	15.88	57.26	166.93
Conc NO2 Comp EmiMeas, 1CFB42CQ901-XE01	[mg/m3i.N.,d]	255	2.55	0.20	1.84	3.31
Conc NH3 Comp EmiMeas, 1CFB43CQ901-XE01	[mg/m3i.N.,d]	255	0.75	0.62	0.00	3.03
Conc N2O Cmn, 1CFB44CQ901-XE01	[mg/m3i.N.,d]	255	0.26	0.60	0.00	5.67
Conc CO Comp EmiMeas, 1CFB50CQ901-XE01	[mg/m3i.N.,d]	255	4.91	4.55	1.10	48.33
Conc NOx EmiMeas, 1CFB40CQ901-XE01	[mg/m3i.N.,d]	255	149.80	24.42	89.98	259.17
NO 30 min Average, 1CFB41CQ902-ZJ51	[mg/Nm3dry11%O2]	288	94.53	15.73	57.07	166.54
NO2 30 min Average, 1CFB42CQ902-ZJ51	[mg/Nm3dry11%O2]	288	2.54	0.19	1.85	3.30
NH3 30 min Average, 1CFB43CQ902-ZJ51	[mg/Nm3dry11%O2]	288	0.77	0.59	0.00	3.03
CO 30 min Average, 1CFB50CQ902-ZJ51	[mg/Nm3dry11%O2]	288	5.45	10.38	1.10	132.01
NO 24 h Rolling Average, 1CFB41CQ903-ZJ50	[mg/Nm3dry11%O2]	0	0.00	0.00	0.00	0.00
NO2 24 h Rolling Average, 1CFB42CQ903-ZJ50	[mg/Nm3dry11%O2]	0	0.00	0.00	0.00	0.00
CO 24 h Rolling Average, 1CFB50CQ903-ZJ50	[mg/Nm3dry11%O2]	0	0.00	0.00	0.00	0.00

APPENDIX V
NE DAS LETTER

Date: 13 January 2022
Our ref: DAS A002818 / 371306
Your ref: 4710149699

Steven Betts
BSG Ecology
4 Riverside Studios
Amethyst Road
Newcastle Business Park
Newcastle Upon Tyne
NE4 7YL

BY EMAIL ONLY

Customer Services
Hornbeam House
Crewe Business Park
Electra Way
Crewe
Cheshire
CW1 6GJ

0300 060 3900

Dear Mr Betts,

Discretionary Advice Service (Charged Advice)
DAS A002818
Development proposal and location: Energy Recovery Facility at Grangetown Prairie

Thank you for your consultation on the above dated 14 October 2021, which was received on the same date.

This advice is being provided as part of Natural England's Discretionary Advice Service. BSG Ecology (on behalf of FCC Environment (UK) Ltd) has asked Natural England to provide advice upon:

A review of the shadow Habitat Regulations Assessment, with a focus on the initial findings and interpretation of air quality modelling data, to provide the following:

- Advice on potential impacts on designated or proposed designated sites
- Advice on non-biological survey / modelling work
- Advice on the information for a draft Habitats Regulations Assessment.

This advice is provided in accordance with the Quotation and Agreement dated 19 October 2021.

The following advice is based upon the information within:

1. Grangetown Energy Recovery Facility Report to Inform a Habitats Regulations Assessment; *BSG Ecology (*August 2021) [referred to as **Review Document 1**]
2. Grangetown Energy Recovery Facility Biodiversity Improvement Plan; *BSG Ecology* (August 2021) [referred to as **Review Document 2**]
3. Air Dispersion Modelling Assessment of Releases from the Proposed Energy Recovery Facility at Tees Valley; *ECL. and FCC Environmental* (December 2021) [referred to as **Review Document 3**]

Protected sites

Natural England is satisfied that, on the basis of the objective information provided, it can be excluded that the proposed plan or project will have a significant effect on the Teesmouth and Cleveland Coast Special Protection Area (SPA) and Ramsar site, either individually or in combination with other plans or projects.

However, it would be beneficial to provide additional details in Review Document 1 regarding the conclusion of no Likely Significant Effects from the “Introduction of non-synthetic compounds – Abnormal or emergency operating conditions” (pg. 18).

Natural England is not yet satisfied that the proposed operations are not likely to damage any of the interest features of the Teesmouth and Cleveland Coast SSSI. It is noted in Review Documents 1 and 3 that the Predicted Environmental Concentration (PEC) for Nutrient Nitrogen would:

- for the installation *alone*, exceed the Lower Critical Load at two sensitive ecological receptors (TCC11 and TCC13) and would exceed the Upper Critical Load at one of these receptors (TCC11).
- *in combination* with other relevant developments, exceed the Lower Critical Load at 11 receptors (TCC1 – TCC9, TCC11 and TCC13) and would exceed the Upper Critical Load at one receptor (TCC11).

However, the aerial deposition modelling is based on the most sensitive habitat type, *Coastal stable dune grasslands (acid type)*, which is not present at any of the ecological receptors. When the appropriate Critical Load range is considered for habitat types at all of the receptors there would not be an exceedance, except for at one receptor.

There are areas of *Coastal stable dune grasslands (calcareous type)* at receptors TCC11 (Seal Sands Peninsula) and TCC13 (Coatham Dunes), which has a Critical Load range of 10-15 kgN/ha/yr (instead of 8-10 kgN/ha/yr for acid type dunes). **Based on this higher Critical Load range there would only be an exceedance of the Lower Critical Load for one receptor (TCC11) and only when it is considered in combination with the anticipated emissions from the Redcar Energy Centre.**

Given that the predicted exceedance is small and should be taken in the context with the elevated background concentrations, Natural England does not require further information at this stage. However, Natural England requests that an assessment of the potential impacts of Nutrient Nitrogen deposition on the dune system at the Seal Sands Peninsula (SSSI unit 9 and TCC11 in the assessment provided) is provided when the planning application is submitted in order to address these uncertainties.

Other advice
There are also other possible impacts resulting from this proposal that you should consider when developing your planning application. These issues, together with where you may find further guidance, are summarised below.

Biodiversity Net Gain

Natural England welcomes the commitment to include environmental enhancements in the development site to offset the impacts on existing habitat.

Natural England have discussed the approach taken by BSG Ecology, in liaison with INCA and in the absence of the original baseline survey, to re-estimate the baseline Biodiversity Unit score as 49.7 and agree that the approach taken to do so is reasonable.

To further improve the provision of on-site net gains for biodiversity, Natural England recommends minimizing the extent of ‘modified (or amenity) grassland’ and to instead create additional ‘other neutral grassland’ or ‘Open Mosaic Habitat’.

Furthermore, Natural England encourages the applicant to liaise with South Tees Development Corporation to ensure that the baseline assessment matches theirs and that they are made aware of the Biodiversity Units created by this development.

Green Infrastructure
The proposed development is within an area that Natural England considers could benefit from enhanced green infrastructure (GI) provision. Multi-functional green infrastructure can perform a range of functions including improved flood risk management, provision of accessible green space,

climate change adaptation and biodiversity enhancement. Evidence and advice on green infrastructure, including the economic benefits of GI can be found on the Natural England Green Infrastructure web pages.

For clarification of any points in this letter, please contact Nick Lightfoot on 02080 261194.

This letter concludes Natural England's Advice within the Quotation and Agreement dated 19 October 2021.

☒ The advice provided in this letter has been through Natural England's Quality Assurance process

The advice provided within the Discretionary Advice Service is the professional advice of the Natural England adviser named below. It is the best advice that can be given based on the information provided so far. Its quality and detail is dependent upon the quality and depth of the information which has been provided. It does not constitute a statutory response or decision, which will be made by Natural England acting corporately in its role as statutory consultee to the competent authority after an application has been submitted. The advice given is therefore not binding in any way and is provided without prejudice to the consideration of any statutory consultation response or decision which may be made by Natural England in due course. The final judgement on any proposals by Natural England is reserved until an application is made and will be made on the information then available, including any modifications to the proposal made after receipt of discretionary advice. All pre-application advice is subject to review and revision in the light of changes in relevant considerations, including changes in relation to the facts, scientific knowledge/evidence, policy, guidance or law. Natural England will not accept any liability for the accuracy, adequacy or completeness of, nor will any express or implied warranty be given for, the advice. This exclusion does not extend to any fraudulent misrepresentation made by or on behalf of Natural England.

Yours
Nick Lightfoot
Northumbria Area Team

Cc commercialservices@naturalengland.org.uk

Annex 1
European Protected Species

A licence is required in order to carry out any works that involve certain activities such as capturing the animals, disturbance, or damaging or destroying their resting or breeding places. Note that damage or destruction of a breeding site or resting place is an absolute offence and unless the offences can be avoided (e.g. by timing the works appropriately), it should be licensed. In the first instance it is for the developer to decide whether a species licence will be needed. The developer may need to engage specialist advice in making this decision. A licence may be needed to carry out mitigation work as well as for impacts directly connected with a development. Further information can be found in Natural England's 'How to get a licence' publication.

If the application requires planning permission, it is for the local planning authority to consider whether the permission would offend against Article 12(1) of the Habitats Directive, and if so, whether the application would be likely to receive a licence. This should be based on the advice Natural England provides at formal consultation on the likely impacts on favourable conservation status and Natural England's guidance on how the three tests (no alternative solutions, imperative reasons of overriding public interest and maintenance of favourable conservation status) are applied when considering licence applications.

Natural England's pre-submission Screening Service can screen application drafts prior to formal submission, whether or not the relevant planning permission is already in place. Screening will help applicants by making an assessment of whether the draft application is likely to meet licensing requirements, and, if necessary, provide specific guidance on how to address any shortfalls. The advice should help developers and ecological consultants to better manage the risks or costs they may face in having to wait until the formal submission stage after planning permission is secured, or in responding to requests for further information following an initial formal application.

The service will be available for new applications, resubmissions or modifications – depending on customer requirements. More information can be found on Natural England's website.