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Tees CCPP Project

The Tees Combined Cycle Power Plant Project
Land at the Wilton International Site, Teesside

Volume 1 - Chapter 7

Regulations – 6(1)(b) and 8(1)

Applicant: Sembcorp Utilities UK
Date: May 2018

7 AIR QUALITY

7.1 INTRODUCTION

7.1.1 Terms of Reference for this Chapter

7.1 This chapter presents the assessment of the likely significant effects due to emissions to air from construction, operation and decommissioning of Project. Relevant aspects of the design and emissions to atmosphere are set out, along with the assumptions made by ERM pertinent to the assessment of impacts on air quality.

7.2 The legal framework is described, including relevant air quality standards for the protection of human health and sensitive ecology. The baseline air quality environment around the Project site is described, and specific constraints due to the baseline conditions are identified. In addition, the criteria for assessing the significance of effects are set out.

7.3 The main potential effects of the Project due to impacts on air quality include:

- effects on sensitive human and ecological receptors due to emissions from the combustion processes within the Project;
- effects on sensitive human receptors due to additional traffic generated during the construction and operational phase; and
- effects on sensitive human receptors due to dust emissions from construction activities.

7.4 In regard to effects on ecological receptors this chapter presents a screening assessment that identifies which receptors require further more detailed assessment. The significance of the effects of air quality impacts on ecological receptors is assessed in *Chapter 9*.

7.5 The Project is for an up to 1,700 MWe power generation plant comprising two gas turbines, operating in line with two HRSG Heat Recovery Steam Generators (HRSGs). This configuration is referred to as Combined Cycle Gas Turbine (CCGT) mode. The Project is also equipped with small auxiliary boilers for use during plant start up.

7.1.2 Basis of Assessment including Realistic Worst Case Scenario

7.6 The air quality impact assessment considers the following:

- road traffic during the construction phase;
- dust during the construction phase; and
- impacts of operations of the CCGTs.

7.7 The CCGT component of the Project will be fuelled by natural gas. The pollutants of interest are:

- oxides of nitrogen (NO_x) and by association nitrogen dioxide (NO_2), acid deposition and nutrient nitrogen deposition from the operation of the CCGTs on natural gas, and traffic exhausts;
- particulate matter (as PM_{10} and $PM_{2.5}$) arising from traffic exhausts and construction activity; and
- dust arising from construction activity.

7.8 The operation of the CCGT will dominate the impacts from the Project, where the long terms impacts are the most important. The emissions from the short term use of the auxiliary boilers are negligible and have not been considered, as their use will contribute only a 3% increase in the total NO_x emissions from the plant during use.

7.9 It is possible that the Project may be phased in development as described in *Chapter 5*. For the purposes of assessing operational emissions it is assumed that the Project will be of 1,700 MWe capacity. For the purposes of considering traffic emissions the assessment basis is that there will be a single phase of construction as this would generate the largest number of traffic movements at peak (*see Section 7.4.2*).

7.10 Following from the above assumption on operational capacity, it is understood that once completed the Project will operate one train in base load mode, where the plant operates continuously, and one train in peak load mode, where the plant operates intermittently to 'top up' the grid when electricity demand is highest. As the Project may eventually have two generation lines (trains), it is feasible to operate one line in base load and one line in peak load mode. However, in order to capture the worst case, the assessment is based upon both lines operating in base load to reflect the worst case impact.

7.11 The assumption is therefore made that the Project will be operating at maximum capacity for 8,760 hours per annum on both lines (24 hours a day for every day). This approach is the most conservative approach, as in practice the Project will not operate at full capacity or continuously.

7.12 At the present time the vendor for supply of the gas turbine technology has not been confirmed, with three potential vendors currently under consideration. The vendors have supplied the emissions and design information required to undertake an air quality impact assessment. This information was reviewed by Sembcorp and ERM to identify the preferred case for assessment. In terms of potential impact, there was little difference between the three competing designs; the decision was taken between Sembcorp and ERM to use the data provided by a potential gas turbine original equipment manufacturer (OEM), as this was the most comprehensive

data set provided. The design and emissions data for the project are set out in *Section 7.2.3*.

7.13 The Study Area for the air quality impact assessment is a 15 km radius from the Project site. This is based upon guidance from the Environment Agency (EA), which sets this as the boundary for screening of impacts on sensitive ecological receptors. Impacts on sensitive human receptors are based upon a study area within this, but the principal focus is on the maximum off-site impacts, impacts at the nearest sensitive receptor locations, and impacts at locations with elevated baseline.

7.14 Detailed dispersion modelling is used to predict concentrations of pollutants at ground level locations outside the Project boundary, at sensitive human receptors and sensitive ecological receptors. Five years of hourly meteorological data are used, so that inter-annual variability is incorporated in the model. The results of the assessment are based upon the worst case result for any of the five meteorological years used.

7.15 For the purposes of this assessment the screening/ worst-case scenario conversion ratios for NO_X and NO_2 recommended by the EA [(1)] have been used. Actual oxidation rates are dependent on the availability of O_3, distance from the source and wind speed. Hence, these conversion factors are considered conservative and are likely to result in higher estimations of the process contribution for NO_2 than would occur in reality.

7.16 The impacts at sensitive ecological receptors are defined on the basis of the largest impacts arising at any point on the designated habitat within the 15 km Study Area radius. Therefore, the predicted impacts may not actually be coincidental with the sensitive feature described given that some ecological sites are substantial in size. This approach is worst case. The air quality impact assessment for ecological sites is used to screen for those sites at risk of incurring significant effects; a more comprehensive assessment of potential effects is undertaken in *Chapter 9*.

7.17 The following issues have been screened out and are not considered further.

- Emissions from mobile and non-mobile on-site construction plant during the construction phase of the Project are considered to be negligible. During construction there will be a requirement for mobile and non-mobile plant, which are sources of emissions; for example, excavators, dump trucks and generators. Whilst it is acknowledged that these will have some impact on air quality, considering the size of the site, the distance of receptors from the fence line and the schedule of operations, the emissions arising from these are anticipated to be negligible and have not been considered further.

[(1)] Environment Agency (2016) Conversion Ratios for NO_x to NO_2

- The operational traffic (Heavy Goods Vehicles (HGV) + Light Duty Vehicles (LDV)) is expected to be considerably lower than the screening thresholds of 100 AADT HGVs and 500 AADT LDVs. As discussed in *Table 7.1*, the Secretary of State agreed that operational traffic can be screened out. On this basis the emissions arising from operational traffic are anticipated to be negligible and have not been considered further (see also *Table 7.1* below).

7.1.3 Consultation

7.18 Consultation responses relevant to air quality are set out in *Table 7.1*.

Table 7.1 Consultation Responses

Source	Consultee Comment	Response
Secretary of State (Scoping Opinion)	Two reservoirs are located approximately 900m to the south of the Proposed Development site, beyond which lie the Wilton Woods –a designated Local Wildlife Site (LWS) containing ancient woodland (see Figures 6.2 and 6.5 of the Scoping Report).	Wilton Woods and Eston Nab LWS sites are included in the assessment.
	Section 6.2.2 of the Scoping Report states that Lovell Hill Pools Site of Special Scientific Interest (SSSI) is located approximately 3km to the south-east. At its closest point, the North York Moors National Park is located approximately 5.5km to the south of the Proposed Development site (Section 6.10.2 of the Scoping Report). Parts of the National Park are designated as the North York Moors Special Protection Area (SPA) and Special Area of Conservation (SAC), located approximately 7.7km to the south of the Proposed Development site.	A full list of sensitive ecological receptors has been compiled including SACs, SPAs, Ramsar sites and SSSIs. The assessment includes consideration of impacts across the spatial extent of all receptors. Note that in scoping, distances were set from the approximate centre of each receptor.
	The SoS recommends that the ES should include a clear description of all aspects of the Proposed Development, at the construction, operation and decommissioning phases, and include:……emissions - … air …	Emissions to atmosphere have been assessed.
	The Applicant has identified in some topic sections and in Table 8.1 (pages 119 to 122) of the Scoping Report a number of matters that it does not propose to consider, although it is not always explicit if they are proposed to be formally scoped out. The SoS assumes that the following matters are proposed to be scoped out:… … traffic emissions during operation; It is proposed that traffic emissions during the operational phase are scoped out on the basis that they are not considered to have any likely significant effects on people or ecological receptors. The SoS agrees that this matter can be scoped out on the basis that the number of traffic movements during the operational phase of the Proposed Development is unlikely to be sufficient to generate significant effects	Traffic emissions during operation have been scoped out.
	It is proposed that a 15km study area will be used to identify internationally and nationally designated sites, and a 2km study area to identify areas of ancient woodland and LWSs. These study areas should be discussed and agreed with NE/the Council, as appropriate. It is noted from North Yorkshire County Council's consultation response that it considers the use of a 15km study area to identify international sites to be appropriate. It is noted that Table 6.2 of the Scoping Report identifies nationally designated ecological sites within a 15km radius of the Proposed Development site. In addition to this, Figure 6.2 of the Scoping Report usefully illustrates the 15km buffer and the locations of these ecological sites. A plan akin to Figure 6.2 should be provided with the ES, although this should additionally clearly identify all components of the same SSSI. For	In line with Environment Agency's guidelines, designated sites within a 15 km radius have been considered. The specific receptors listed here are included in the assessment (*Sections 7.3.2* and *7.4.3*) and also addressed in *Chapter 9* Ecology and Nature Conservation.

Source	Consultee Comment	Response
	example, whilst part of the Tees and Hartlepool Foreshore and Wetlands SSSI is identified by a label to the north of the 15km buffer, Section 6.4.2 of the Scoping Report indicates that other components of this SSSI are located closer to the Proposed Development site, although this is not clear from Figure 6.2. However, it is noted from Figure 6.2 that the following nationally designated sites are located within a 15km radius of the site, but have not been identified in Table 6.2: • Lovell Hill Pools SSSI • Cliff Ridge SSSI • Saltburn Gill SSSI • Langbaurgh Ridge SSSI It is also noted that Table 6.2 and Section 6.4.2 of the Scoping Report identifies Tees and Hartlepool Foreshore and Wetlands SSSI as the closest nationally designated site to the Proposed Development site, located approximately 4.3km to the west. However, Section 6.2.2 of the Scoping Report states that Lovell Hill Pools Site of SSSI is located approximately 3km to the south-east of the Proposed Development site. The Applicant should ensure that the information provided is consistently reflected throughout the ES.	These four SSSIs have been included in the assessment (*Sections 7.3.2* and *7.4.3*) The Tees and Hartlepool Foreshore and Wetlands SSSI has been included in this assessment.
	The SoS notes from Section 6.4.4 of the Scoping Report that the Applicant intends to undertake a Habitats Regulations Assessment (HRA) screening exercise to assess the potential impacts on four European sites identified within a 15km radius of the site: Teesmouth and Cleveland Coast SPA Teesmouth and Cleveland Coast Ramsar site • North York Moors SAC • North York Moors SPA However Table 6.3 of the Scoping Report identifies only three internationally designated sites (and their interest features) within a 15km radius of the site, and omits the Teesmouth and Cleveland Coast Ramsar site. The Applicant should ensure that information is consistently reflected in the ES and information provided to support consideration under the Habitats Regulations.	The Teesmouth and Cleveland Coast Ramsar site has been included.
	The SoS notes that the study area for the air quality assessment is defined as a 15km radius from the site, and a 2km radius for national and local nature reserves and ancient woodlands. The extent of the study area should be agreed with relevant bodies, such as the EA, NE and local authorities, and the rationale for selecting it should be explained in the ES topic chapter. It should be stated whether there are any Air Quality Management Areas in the vicinity of the site that could be affected.	In line with the Environment Agency's guidelines, a 15 km radius study area was used. This is recognised by the EA and NE as a worst case screening study area and is therefore considered to be appropriate.

Source	Consultee Comment	Response
		A review has been undertaken and there are no relevant AQMAs.
	The Applicant must be satisfied that the study area is sufficient to encompass all routes in the local transport network on which air quality could be significantly affected as a result of increased traffic generated by the Proposed Development, particularly during the construction phase	This has been undertaken.
	The SoS welcomes that potential impacts on ecological receptors as a result of NOx emissions, nutrient nitrogen deposition and acid deposition will be included in this topic assessment, and the inclusion of a plan (Figure 6.5) in the Scoping Report that shows the location of the receptors identified. The SoS recommends that the equivalent plan in the ES identifies each of the sites by name	Impacts at each relevant ecological receptor have been assessed.
	Sections 6.6.3 and 6.6.4 of the Scoping Report state, respectively, that dust and PM10 and PM2.5 produced during construction will be considered, and that dust impacts could result in potentially significant effects. The SoS considers therefore that the ES should include an assessment of the likely effects associated with increased emissions of PM10 and PM2.5 particularly associated with the construction phase of the Proposed Development. The Applicant should also agree with RCBC and EA the appropriate use of background mapping to inform the baseline	The construction dust assessment considers dust, PM_{10} and $PM_{2.5}$. No consultation has been made on the use of background mapping as the conclusion of the dust assessment is that it is appropriate to use mitigation for a High Risk site.
	The SoS welcomes that dispersion modelling is to be undertaken for the operational phase of the Proposed Development, and recommends that it considers a range of possibilities and seeks to ensure that the worst case scenario is assessed, such as, for example, in relation to the stack height	A stack height of 75 m was used as the optimum case, with a 90 m scenario also considered. As the 75 m stack is acceptable in terms of impact, results for the 90m stack are not presented, as these are lower.
	Air quality and dust levels should be considered not only on site but also off-site, including along access roads and local public rights of way (PRoW). Consideration should be given to monitoring dust complaints. The Applicant is referred to the consultation response from PHE, contained in Appendix 3 of this Opinion, in respect of the value of a CEMP in relation to mitigating potential impacts of emissions.	Mitigation measures are set out in *Section 7.4.8* and will be reflected in a draft CEMP.
	Section 6.6.5 of the Scoping Report refers to consideration of information and guidance on the 'UK Air Pollution Information Service' website. Documents used to inform and guide the assessment should be specifically identified and fully referenced in the ES	This has been undertaken.

Source	Consultee Comment	Response
	The Applicant's attention is drawn to the comments, contained in Appendix 3 of this Opinion, of the EA, particularly in respect of futureproofing this project in relation to reduced emission limits; and NE, particularly in respect of air pollution impacts on ecological features	The potential for lower emission limits in the future has been noted and considered in that the emission limit of 30 mg Nm^3 used in the assessment is the future lower emission limit.
	The assessment undertaken for this topic should inform the ecological assessment. Cross-reference should be made in the ES between this topic chapter and the ecology, noise and vibration, and traffic and transport chapters	This has been undertaken.
Environment Agency (Scoping Opinion)	Environmental Impact Assessment Requirements: advice to applicant. We request that the following information is included within the scope of the Environmental Impact Assessment: • a stack height (and diameter) sensitivity study to be prepared to enable early agreement on stack design.	Stack height sensitivity has been undertaken
	• Information relating to future-proofing this project, which considers the impact of the reduced emission limit values proposed in the European Union combustion BREF (Best Available Techniques Reference Document), due to be published in 2017, which would require this plant to be compliant within 4 years, thereafter.	The plant emissions used as the basis for the assessment reflect the draft Bref note and use an emission limit of 30mg/Nm^3 for NO_x.
	Teesmouth Special Protection Area. We wish to inform the operator/applicant that there is a proposed expansion of the Teesmouth Special Protection Area (SPA). Details of this proposed expansion to the SPA are available on the Natural England website at the following link: http://publications.naturalengland.org.uk/publication/5987326182293504 Consideration will need to be had within the Environmental Impact Assessment and Habitats Directive Assessment to the proposed SPA expansion, as it will greatly increase the size of the existing protected area and move the SPA boundary closer to the proposed power plant site.	The extension to the SPA has been considered.
	Environmental Permitting Regulations: advice to applicant. The development will require an Environmental Permit under the Environmental Permitting Regulations 2010, from the Environment Agency, unless an exemption applies.	The EA has communicated with the Applicant to the effect EA does not feel there are any indications to suggest that they are unlikely to agree to issue an Environmental permit.
Environment Agency (PEIR response)	In Annex L – Air Quality in PEIR Volume 2, the PCLT at the Teesmouth & Cleveland Coast SPA is detailed as 0.272ug/m3. However, in Annex H the same determinand is 0.301µg/m3. We consider that this discrepancy should be investigated as this affects the Process Contribution/Critical Load (PC/CL) data in Annex L. Annex L shows the nitrogen (NOx) annual mean data at protected habitat sites. At Teesmouth & Cleveland Coast the PC/CL (%) is 0.9% which is below the 1% threshold for significance. However, the Predicted	The data presented in PEIR *Annex H* was in error; PEIR *Annex L* (now *Annex E1* of the ES) was correct. This has now been corrected for *Annex H* of this ES.

Source	Consultee Comment	Response
	Environmental Concentration/Critical Load (PEC/CL) (%) is 107% and is 106% or 107% at a further 7 habitat locations, as the data is dominated by high background levels. We advise that you explain the location and measurement basis of background data and ensure that the same statistical basis is used to calculate process contributions and background concentrations. The national and non-statutory objectives are a benchmark for harm and any significant contribution to a breach is likely to be unacceptable but is assessed on a case by case basis taking account of the costs and benefits of the situation.	We note that the exceedance of the critical loads by the Predicted Environmental Concentrations at some sites is due to the high background and not due to the Project contributions. This is also discussed further in the HRA (*Annex H*). Background conditions (ambient concentration, acid deposition and nitrogen deposition) for the identified ecological receptors have been obtained from the APIS website (see *Section 7.3.2*). The process contributions are an output of the dispersion modelling for this assessment. There can be no common statistical basis as such for the two.
	The submitted information mentions heights of 75 metres and 90 metres as options for the main stack. However, the stack height of the black start(s) stack(s) has not been mentioned in the report or included in the photomontages.	Black start capability has been dropped from the Project so no assessment is required.
	A stack height and sensitivity study must be provided as part of the Development Consent Order (DCO) application. We note that it has not been provided in the submitted PEIR report.	As agreed via consultation subsequent to this response a stack height assessment has been prepared and is included within *Annex E2*.
	It might be useful for the applicant to provide a comparison between the old GDF Suez stack height and the proposed stack height, to help local residents assess the visual impact.	An assessment of the visual effects has been undertaken in *Chapter 11*.
Natural England (PEIR response)	In Annex H, table 3 (p 815), predicted NOx (Annual mean) for the Teesmouth and Cleveland Coast Special Protection Area (SPA), the PC is 0.301 µg/m^3, which is 1.003% PC/CL. This is incorrectly classed as <1% in the table. Instead, it should be 1%; however, this is still considered not to be above the 1% threshold of significance.	Noted (and also note that the value presented in PEIR *Annex H* was incorrect as explained above).

Source	Consultee Comment	Response
	In Annex L, table A7.1, the NOx (annual mean) for the Teesmouth and Cleveland Coast SPA, the PC is 0.272 µg/m^3. As the PC for the SPA differs between annexes, there needs to be clarification which number is accurate.	As explained above PEIR *Annex L* was correct. *Annex H* has been amended for this ES.
	In addition, we advise to add a map of emissions, which shows where the NOx emissions are predicted (and that also shows the designated sites). The reason for this is that in Annex H NOx emissions are lower for the Teesmouth and Cleveland Coast potential SPA (pSPA) than the SPA (0.283 ug/m3), yet the pSPA is closer to the application site. In Annex L the emissions for the pSPA are higher than the SPA, but again, clarification is needed about the discrepancies in data.	As explained above PEIR *Annex H* was in error. Contour plot also showing the Ecological Receptors is provided in *Figure 7.7* of this chapter.
	"Furthermore, the Habitats Regulations specify that the impacts of projects either alone or in combination need to be considered at the likely significant effect screening stage. In Annex H, it is stated that as the contributions from the project are insignificant, the effect will be insignificant alone and in combination (p.804). This is incorrect. As the contributions are insignificant alone, contributions from other relevant plans and projects need to be considered in combination. Table A1.3 (p 142) considers planning applications within a 15 km radius, which could form a basis for an in-combination assessment. Planning applications to include are those that have no likely significant effects alone, or have residual effects, and are pending or have been approved but are not (fully) in operation yet. In addition, the environmental permits application register could provide more information on projects in the area:	The HRA (*Annex H*, *Section H3.3*) sets out in detail how other relevant plans and projects have been identified in the context of their potential for having in-combination effects with the Project and provides a more detailed explanation of the conclusions on in-combination effects.
Redcar and Cleveland Borough Council by separate correspondence	RCBC indicated concerns relating to the assessment of cumulative effect of the proposed development. RCBC indicated that the Dormanstown air monitoring station has seen some 1 hour NO_x 'spike' concentrations up to and above 200µg/m^3. RCBC is keen to ensure that the Project would not adversely impacts on short term impacts.	From the perspective of human health, the pollutant of interest is nitrogen dioxide (NO_2) and the air quality standards relate only to NO_2. Oxides of nitrogen (NO_x) comprise NO_2 and nitric oxide (NO). As NO is inert in the human body, the NO component of NO_x is not a consideration. In the atmosphere NO and NO_2 exist in an equilibrium. NO will convert to NO_2, but this process is slow and will not occur completely. The rate of the reaction of NO to NO_2 is dependent on several factors

Source	Consultee Comment	Response
		including the availability of ozone, volatile organic compounds (VOCs) and ultraviolet light (sunlight). During short term 'spikes' in NO_x, the conversion of NO to NO_2 will use up available ozone and VOCs and most of the NO will not convert to NO_2. Consequently, as NO_x spikes occur, these are not associated with a proportionally large NO_2 spike. Looking at the NO_2 monitoring data for Dormanstown (1) the maximum 1 hour NO_2 monitored between 1st January 2013 and 23rd April 2017 is 93.7 µg/m^3 against the standard of 200 µg/m^3. On this basis, short term NO_x spikes are not a constraint for the project.
Redcar and Cleveland Borough Council (PEIR response)	Air Quality: The air quality assessment has screened out a number of emissions as dictated by the Secretary of State or factors which have been considered as negligible and has assumed the installation of a 75m stack. The design of the gas turbine will be such that it will be capable of meeting a 30mg/m^3 emission limit, which is BAT for the industry sector. Again is it acknowledged that mitigation during the construction phase will be required and will be incorporated into the CEMP including reference to the IAQM 2014 guidance document.	Construction phase mitigation is described in this chapter and the CEMP.

(1) Air Quality England (accessed 24/04/2017) Redcar and Cleveland Borough Council http://www.airqualityengland.co.uk/local-authority/data?la_id=279

7.1.4 Policy and Legislation

Overview

7.19 Air quality impact assessment is subject to a number of different regulations supported by several guidance documents. These are overlapping and interlocking, and holistically incorporate all the required aspects.

7.20 The Project requires a DCO (the purpose of the EIA) and an Environmental Permit. In terms of air quality, the requirements of these two regimes are closely related, but are not identical. The air quality impact assessment therefore draws primarily upon planning guidance, but also draws on permitting guidance to ensure that any potential issues are identified at an early stage and that design and mitigation decisions will satisfy both regimes.

Policy

7.21 *Table 7.2* identifies those policies that are relevant to air quality.

Table 7.2 Applicable Policy

Topic	Relevance
Overarching National Policy Statement for Energy(EN-1)	5.2 Air quality and emissions *Describe potentially significant emissions and undertaken an assessment of impacts on sensitive human and ecological receptors, taking into account existing baseline*
National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2)	2.5 Air quality and emissions *Meet requirements of IED, and obtaining of an Environmental Permit*
National Planning Policy Framework (NPPF)	11 Conserving and enhancing the natural environment *preventing development from contributing to unacceptable levels of air pollution at natural and local environment*
Planning Practice Guidance (PPG)	Air quality *Sets out requirements to achieve air quality standards and protection of natural habitats; sets out principals of cumulative assessments; sets out when air quality is a material consideration*
Redcar and Cleveland Borough Council Core Strategy Development Plan Document	Air quality *Sets out principle of ensuring good air quality and improving air quality*
Redcar and Cleveland Borough Council Local Plan	Air quality *Sets out principle of ensuring good air quality*

Air Quality Standards and Guidelines for Human Health

7.22 Within the UK the majority of the air quality standards relating to ambient air quality are based upon the European Union (EU) Air Quality Standards [(1)].

(1) European Union (accessed April 2011) Air Quality Standards http://ec.europa.eu/environment/air/quality/standards.htm

The EU air quality standards relating to short and long term average concentrations of NO_2 are pertinent to this assessment. As the plant operates on natural gas, there are no other pollutants of interest for the operational phase. For the construction phase, emissions of particulate matter (as PM_{10} and $PM_{2.5}$ (1)) are relevant as these arise from construction activities and road traffic exhausts, and NO_2 from traffic exhausts.

Air Quality Standards and Guidelines for Ecology

7.23 In addition to undertaking an assessment of the potential effects of emissions from the facility on human health, assessment of air quality impacts on protected ecological receptors has also been undertaken. These impacts are of interest only for the operational phase, as short term impacts during construction are negligible. Effects on sensitive ecological receptors primarily arise as a result of pollutant emissions by the following mechanisms:

- direct effects on flora due to increased concentrations of airborne pollutants;
- secondary effects on flora due to changes in soil chemistry brought about by deposition of pollutants to soil; and
- secondary effects on fauna due to changes in flora.

7.24 The European Habitats Directive (2) sets out the legal framework requiring EU member states to protect habitat sites supporting vulnerable and protected species, as listed within the Directive. This Directive was incorporated into UK domestic legislation by means of the Conservation of Habitats and Species Regulations 2010 (3). This Directive requires the protection of certain sites including Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. In addition, impacts on air quality are predicted at nationally important ecology sites in the form of Sites of Special Scientific Interest (SSSIs) and any relevant locally designated habitat sites.

7.25 The relevant standards and guidelines that provide a framework for assessing impacts on sensitive ecological receptors are derived from a number of sources:

- air quality standards (AQS) for NO_x (annual mean) for the protection of habitats are derived from European Union Air Quality Directives;

(1) 'PM_{10}' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM_{10}, EN 12341, with a 50 % efficiency cut-off at 10 µm aerodynamic diameter; '$PM_{2.5}$' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of $PM_{2.5}$, EN 12341, with a 50 % efficiency cut-off at 2.5 µm aerodynamic diameter;
(2) Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora
(3) Statutory Instrument 2010 No. 490 The Conservation of Habitats and Species Regulations 2010

- air quality guidelines for NO_x (24 hour mean) have been derived by the Centre for Ecology and Hydrology (CEH) and are set out in Environment Agency Guidance (1); and

- guidelines for the assessment of acid and nutrient nitrogen deposition have been derived according to habitat type, and are set out on the UK Air Pollution Information Service (APIS) website (2).

7.26 On the basis of the above legislative framework and guidance, relevant critical levels (that relate to airborne pollutants) and site specific critical loads (that relate to deposition of materials to soils) have been established. These values represent the environmental criteria used in this assessment.

Industrial Emissions Directive (IED)

7.27 The IED is the successor of seven existing Directives, including the IPPC Directive and in essence is concerned with minimising pollution from industrial sources throughout the European Union through the implementation of established Best Available Techniques (BAT) for pollution control. The IED entered into force on 6 January 2011 and was transposed into national legislation by Member States by 7 January 2013. In the UK, IED is implemented through the existing Environmental Permitting Regulations, but requires a somewhat different approach to previous regimes, insomuch as the achievement of BAT is the explicit priority.

7.28 The permit conditions including emission limit values (ELVs) must be based on the Achievable Emission Levels published in BAT Reference (BREF) notes. BAT conclusions (documents containing information on the emission levels associated with the best available techniques, which act as a summary of BREF notes) are the reference for setting permit conditions. To determine BAT, the European Commission organises an exchange of information between experts from the EU Member States, industry and environmental organisations. This work is coordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville, Spain. This results in the adoption and publication by the Commission of the BAT conclusions and BAT Reference Documents.

7.29 The IED contains certain elements of flexibility by allowing the licensing authorities to set less strict emission limit values in specific cases. Such measures are only applicable where an assessment shows that the achievement of emission levels associated with BAT as described in the BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:

a) geographical location or the local environmental conditions; or

(1) Environment Agency (2016) Air emissions risk assessment for your environmental permit https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#page-navigation
(2) Centre for Ecology and Hydrology (2010) UK Air Pollution Information Service http://www.apis.ac.uk/

b) the technical characteristics of the installation.

7.30 The competent authority must always document the reasons for the application of the flexibility measures in the permit including the result of the cost-benefit assessment. Chapter III of the IED on large combustion plants includes certain flexibility instruments (Transitional National Plan, limited lifetime derogation, etc.). At the Permitting stage, consideration will need to be given to whether the Project will need to comply with the BAT AELs. The presumption is that it will be expected to, as a derogation for new plant would be highly unlikely.

7.31 The plant design considered in this study reflects the Best Available Techniques (BAT) Reference Document for Large Combustion Plants Final Draft (June 2016), as cited by Industrial Emissions Directive 2010/75EU. At this point the NO_x emission limit will be set at 30 mg/Nm^3. Given the EA scoping response the emission limit of 30 mg/Nm^3 has been used as the basis for assessment.

7.32 The EA has produced a guidance document for assessing and quantifying the impacts of emissions to air for processes regulated under the PPC regime. This guidance document is referenced throughout the air quality impact assessment undertaken for the Project. The guidance sets out specific points of method and is also the basis for setting the screening criteria used for assessing impacts on habitats.

Local Air Quality Management

7.33 The Environment Act 1995 requires local authorities to periodically review and assess air quality. Initially, a screening process was undertaken by local authorities to identify which pollutants, of the eight in the AQS at the time of the screening process, may be in excess of the air quality standards. Where pollutant concentrations were identified to be in excess of the standards, local authorities undertook a further investigation to identify exactly where standards were exceeded. On the basis of the results of this investigation, Air Quality Management Areas (AQMAs) were declared for the relevant locations and local authorities have developed Air Quality Management Plans setting out measures that will be taken to improve air quality in these AQMAs.

7.34 Following this initial staged process, there is an on-going review and assessment process, which periodically reviews local air quality, with regard to changes that may cause impacts on the local air quality. These might include: new roads; changes in road layouts; other new development; new industry, closure or changes in existing industry, etc. On the basis of this on-going process, local authorities may declare or revoke AQMAs and update action plans accordingly. Relevant Local Air Quality Management reviews have been considered, in terms of identification of any relevant AQMAs. This review identified that there are no AQMAs for NO_2 declared within the Study Area.

7.35 The principal LAQM guidance document is TG(16) [1]. Where relevant this document, and the associated web-based guidance from Defra have been considered. In addition, the Institute of Air Quality Management (IAQM) has produced two guidance documents relevant to this assessment, relating to air quality impact assessments for planning [2], and impact assessment for construction activities [3]. Again, where relevant these have been used.

Environmental Protection Act 1990

7.36 Section 79(1) of the Environmental Protection Act 1990 (EPA 1990) states:

"Subject to subsections (1A) to (6A) below, the following matters constitute 'statutory nuisances' for the purposes of this Part, that is to say:

(a) any premises in such a state as to be prejudicial to health or a nuisance;

(b) smoke emitted from premises so as to be prejudicial to health or a nuisance;

(c) fumes or gases emitted from premises so as to be prejudicial to health or a nuisance;

(d) any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance;

(e) any accumulation or deposit which is prejudicial to health or a nuisance;

(f) any animal kept in such a place or manner as to be prejudicial to health or a nuisance;

(fa) any insects emanating from relevant industrial, trade or business premises and being prejudicial to health or a nuisance;

(fb) artificial light emitted from premises so as to be prejudicial to health or a nuisance;

(g) noise emitted from premises so as to be prejudicial to health or a nuisance;

(ga) noise that is prejudicial to health or a nuisance and is emitted from or caused by a vehicle, machinery or equipment in a street or in Scotland, road; and

(h) any other matter declared by any enactment to be a statutory nuisance."

(1) Defra (2016) Local Air Quality Management Technical Guidance (TG16) April 2016
(2) Institute of Air quality Management (2017) Land-Use Planning & Development Control: Planning For Air Quality
(3) Institute of Air quality Management (2014) Guidance on the assessment of dust from demolition and construction

7.37 Pertinent to this assessment, EPA 1990 requires the control of emissions of dust that may arise from the construction or operation of the Project, such that these emissions do not result in nuisance issues. This is relevant to the Project during construction and decommissioning phases.

7.1.5 Supporting Information for this Chapter

7.38 Information on the emissions from the CCGTs has been provided by a potential gas turbine OEM, and site layout and buildings from Sembcorp.

7.39 Information on baseline conditions has been obtained from public sources:

- Redcar and Cleveland Borough Council;
- UK Automatic Urban and Rural Network (AURN); and
- Defra baseline mapping.

7.40 Detailed results for sensitive ecological receptors are set out in *Annex E1*.

7.2 ASSESSMENT METHODOLOGY

7.2.1 Introduction

7.41 The potential for impacts on air quality due to emissions arising from the Project are assessed by comparing the predicted impacts against standards and guidelines for the protection of human health, and when considering operational emissions, critical loads and levels for the protection of sensitive ecology.

7.42 The effects from the Project are assessed in terms of:

- Process Contribution (PC), which is the impact associated with emissions from the Project only; and

- Predicted Environmental Concentration (PEC), which is the impact associated with emissions from the Project added to the existing background conditions.

7.43 In terms of construction phase traffic and dust, PM_{10} and $PM_{2.5}$ emissions, a semi-quantitative approach has been used, and quantification of the PC and PEC is not required.

7.2.2 Assessment Criteria

Overview

7.44 The potential effects of the emissions from the Project on human health are assessed by comparison to air quality standards and guidelines. The assessment criteria used to establish the potential for likely significant effects on human health are set out in this section. The potential for likely significant

effects on sensitive habitats and need for further ecological assessment are identified through a screening comparison with relevant critical loads and critical levels.

Assessment Criteria for Sensitive Human Receptors

7.45 The statutory criteria used in this EIA for assessment of impacts at sensitive human receptors are derived from the UK Air Quality Standards (AQS), which are derived from and consistent with EU Air Quality Directives and are set out in *Table 7.3*.

Table 7.3 Air Quality Criteria for the Protection of Human Health

Pollutant	Averaging period and statistic	Assessment criterion (µg/m³)	Sources
NO_2	Annual	40	UK/EU AQS
NO_2	1 hour mean, not to be exceeded more than 18 times per year	200	UK/EU AQS
PM_{10}	Annual	40	UK/EU AQS
PM_{10}	24 hour mean, not to be exceeded more than 35 times per year	50	UK/EU AQS
$PM_{2.5}$	Annual	25	UK/EU AQS

Assessment Criteria for the Protection of Sensitive Ecological Receptors

7.46 Impacts on sensitive ecological receptors are quantified by comparison to Critical Levels (ambient air) and Critical Loads (deposition). Effects relating directly to air quality (i.e. NO_x) are assessed against standards which apply for all sensitive ecological receptors. These are set out in *Table 7.4*.

Table 7.4 Critical Levels for Sensitive Ecological Receptors

Pollutant	Averaging period and statistic	Assessment criterion (µg/m³)	Sources
NO_x	Annual mean	30	EA(1) and AQS(2)
NO_x	24 hour maximum	75	EA and APIS(3)

(1) EA: Derived from the Environment Agency guidance.
(2) UK/EU AQS: Air Quality Standard – these are currently legally binding in the UK and are derived from the Clean Air For Europe (CAFE) programme.
(3) APIS: Derived from guidelines presented on the APIS website.

7.47 Effects relating to acid and nutrient nitrogen deposition are specific to each sensitive receptor and each qualifying feature within it. Therefore each sensitive ecological receptor is subject to multiple Critical Loads. The site-specific critical loads (CL) are set out in *Annex E1* for the sensitive ecological receptors of interest.

7.2.3 *Dispersion Modelling Approach*

Introduction

7.48 The assessment of emissions from the project when operational uses dispersion modelling to predict the ground level increases in pollution concentrations attributable to the Project emissions, and combines this with the baseline pollution concentration to establish whether there is the potential for significant effects on human health to occur (see *Section 7.2.2*) or for thresholds to be exceeded beyond which there is the potential for significant effects on ecology to occur.

7.49 The detailed dispersion modelling is used to predict concentrations of pollutants at ground level locations outside the Project boundary, at sensitive human receptors and sensitive ecological receptors. Five years of hourly meteorological data are used, so that inter-annual variability is incorporated in the model. The results of the assessment are based upon the worst case result for any of the five meteorological years used.

General Considerations

7.50 The operational impacts from the combustion process were assessed using the USEPA Aermod model. Aermod is one of a 'new generation' of dispersion models which describe the atmospheric boundary layer properties. Aermod allows for the modelling of dispersion under convective meteorological conditions using a skewed Gaussian concentration distribution. It is able to simulate the effects of terrain and building downwash simultaneously. It can also calculate concentrations for direct comparison with air quality standards or guidelines.

Plant Assumptions

7.51 It is assumed that the Project will be operating at maximum capacity for 8,760 hours per annum. No consideration of different emissions during start-up and shutdown has been made; as discussed previously the short term emissions form the auxiliary boilers are negligible (~2% short term increase in NO_x), compared to the operation of the CCGTs.

7.52 At the time of this assessment, the final design has not been agreed, and data from a potential OEM's CCGTs has been used in the assessment as these are the most comprehensive data available from vendors at present.

7.53 *Table 7.5* shows the emission parameters as used in the model. The stack height used in this assessment is 75 m. This height is considered to represent an acceptable balance between reducing the impact on air quality and visual impacts. To support this premise a stack height assessment has been undertaken (*Annex E1*) which assessed six different stack heights: of 65 m, 70 m, 75 m, 80 m, 85 m and 90 m. The results show a close to linear decrease in concentrations as the stack height increases. It is clear that there is no point at which a small increase in stack height will result in a proportionately larger

decrease in impacts (the 'knee' of the curve). The stack height of 75 m assessed in the PEIR is a stack height at which effects on sensitive human receptors are deemed to be acceptable and not significant on ecological receptors. On the basis of the stack height assessment and the conclusions of the PEIR, the 75 m stack height is therefore considered to represent an acceptable balance between reducing the impact on air quality and visual impacts.

7.54 Of note is that the use of a gas turbine capable of achieving 30mg/Nm^3 represents BAT, as does the use of a stack height optimised to achieve sufficient dispersion of emissions.

Table 7.5 Emissions Parameters – Potential OEM's Design

Parameter	Unit	Value
Number of stacks		2
Stack height	m	65 m, 70 m, 75 m (as per PEIR), 80 m, 85 m and 90m subsequently
Flue diameter (per stack)	m	8 (note 1)
Volume flow rate	Am^3/s	928
Volume flow rate	Nm^3/s (note 2)	744
Emission temperature	Celsius	72.4
NO_x emissions	mg/Nm^3	30
NO_x emissions	g/s	22.3

Note 1: no sensitivity testing for stack diameter was undertaken, on the basis that the diameter is the optimised to avoid back pressure issues
Note 2: normalised to 273 K, 15% O_2 in dry gas, 0% H_2O

Meteorological Data Selection

7.55 The meteorological data used in the model must be reflective of the local conditions. There are only a limited number of meteorological stations in the UK which measure all of the parameters required by the model. A review of available meteorological sites was undertaken, which focussed on the surrounding land use, the surrounding terrain and relative proximity to the coast. On the basis of these criteria, the nearest meteorological station considered representative of conditions is at Durham Tees Airport. This is located approximately 20 km southwest of the Project. Although the Project is close to the coast, the more inland Durham Tees Airport site was considered to be appropriate.

7.56 Five years of meteorological data (2012 – 2016, inclusive) were used for this assessment. The wind roses for 2012 – 2016 are presented in *Figure 7.1* and show that the prevailing wind direction is mainly from the southwest.

Consideration of Terrain Effects

7.57 Changes in terrain elevations (i.e. hills or mountains) can have a significant impact on dispersion of emissions, in terms of funnelling of plumes and

changing local wind flows. Terrain effects are typically considered important where there are sustained gradients of 1:10 or greater.

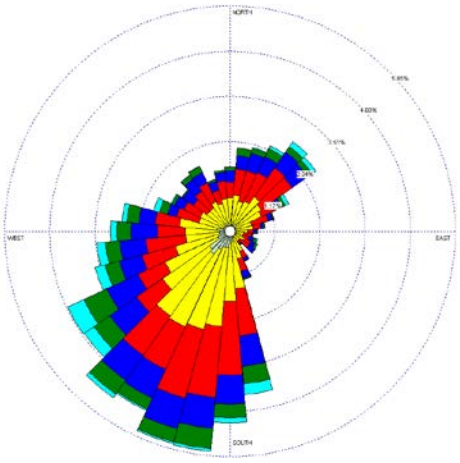
7.58 The study area is situated in the Tees Valley, in a relatively flat area. However, there is significant terrain elevation to the south of the site and further inland. On this basis, terrain was included in the model.

Consideration of Land Use

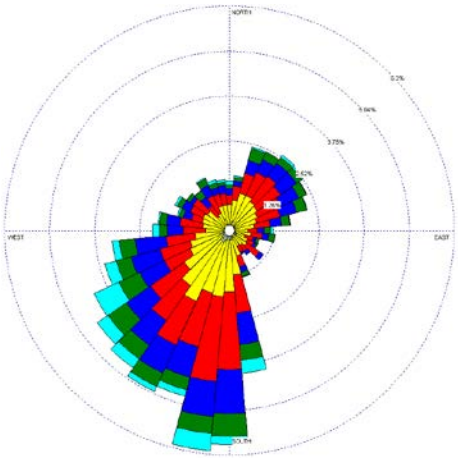
7.59 The surrounding land uses determine the disruption of airflow close to the ground due to obstructions and protuberances, such as buildings, trees and hedges. The industrial and suburban land use surrounding the Project has been reflected in this case.

Figure 7.1 Wind Roses for Durham Tees Airport (2012 – 2016) (UK Met Office)

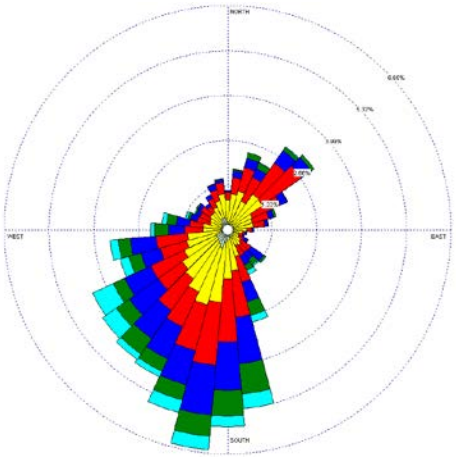
2012



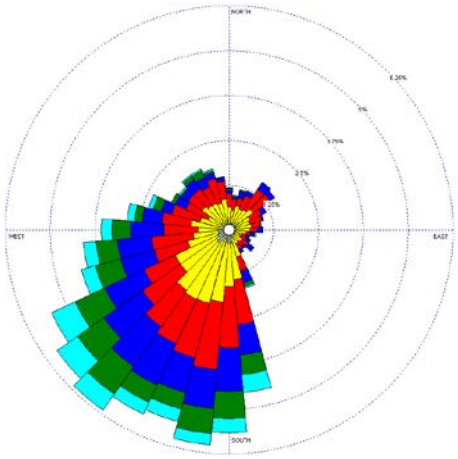
2013



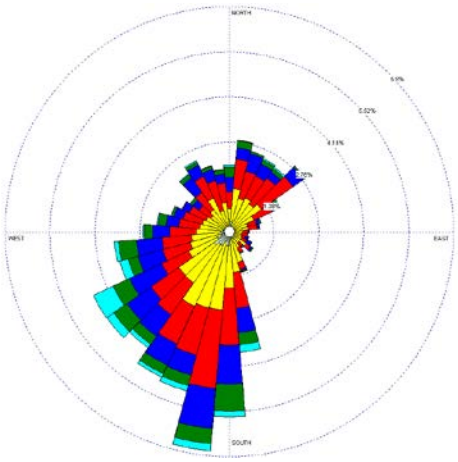
2014

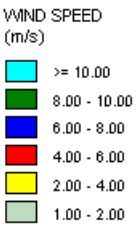


2015



2016





Consideration of Building Downwash

7.60 When air flow passes over buildings, a phenomenon known as building downwash occurs where the air is entrained in the lee of the building and drawn down to ground level. This phenomenon can bring the plume from the stack down to ground level more quickly than would otherwise be the case, and therefore increase the ground level concentration relative to a case where there are no buildings. All buildings that are greater than one third of the stack height, within five stack heights of the stack, need to be included.

7.61 The buildings included in the model are illustrated in *Figure 7.2*. The buildings as conceptualised into the model ~~with maximum dimensions~~ are set out in *Table 7.6*. The requested change to the DCO application includes an increase in the maximum potential height of the gas turbine buildings from 31 m to 32 m. The implications of this requested change in terms of potential air quality impacts are discussed in *Section 7.6*.

Figure 7.2 Indicative Building Layout

Table 7.6 Building Dimensions

Building	Height (m)	Length (m)	Width (m)
Gas Turbine east	31	63	30
Gas Turbine west	31	63	30
HRSG east (top of vents)	45	30	26
HRSG west (top of vents)	45	30	26
Cooling Bank east	25	177	20
Cooling Bank west	25	177	20

Conversion of NO_x to NO_2

7.62 Oxides of nitrogen (NO_X) emitted to atmosphere as a result of gas combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to NO_2, which is of

concern with respect to human health. The proportion of NO oxidised to NO_2 depends on a number of factors and is limited by the availability of oxidants, such as ozone (O_3).

7.63 For the purposes of this assessment the screening/ worst-case scenario conversion ratios for NO_X and NO_2 recommended by the EA [1] have been used. For long term average concentrations, the conversion of NO to NO_2 is 70%. For short term average concentrations, the conversion of NO to NO_2 is 35%.

7.64 Actual oxidation rates are dependent on the availability of O_3, distance from the source and wind speed. Hence, these conversion factors are considered conservative and are likely to result in higher estimations of the PC for NO_2 than would occur in reality.

Derivation of Acid and Nutrient Nitrogen Deposition

7.65 The deposition of acid and nutrient nitrogen is not directly modelled but is derived from the PC predicted at each sensitive ecological receptor for each pollutant of interest. The derivation is based upon Environment Agency guidance [2] and uses the conversion factors set out in *Table 7.7* and *Table 7.8*. The factors take into account the difference in deposition velocity and mechanisms experienced in forests, and grasslands and other non-arboreal areas.

Table 7.7 Factors for Conversion of PC to Acid Deposition

Pollutant	Deposition Velocity - Grasslands (m s^{-1})	Deposition Velocity - Forests (m s^{-1})	Conversion Factor (µg m^{-2} s^{-1} to kg ha^{-1} $year^{-1}$)	Conversion Factor (kg ha^{-1} $year^{-1}$ to keq ha^{-1} $year^{-1}$)
NO_2	0.0015	0.003	95.9	0.0714

Table 7.8 Factors for Conversion of PC to Nutrient Nitrogen Deposition

Pollutant	Deposition Velocity - Grasslands (m s^{-1})	Deposition Velocity - Forests (m s^{-1})	Conversion Factor (µg m^{-2} s^{-1} to kg ha^{-1} $year^{-1}$)
NO_x as NO_2	0.0015	0.003	95.9

7.2.4 Traffic Impacts

7.66 Guidance from the Institute of Air Quality Management [3] states that impacts on air quality are potentially significant when there are greater than 100 additional HGVs AADT (annual average daily traffic) or 500 LDV AADT

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290985/scho0907bnhi-e-e.pdf
(2) AQTAG06 – Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, Environment Agency, produced 06/02/04, Version 8
(3) IAQM (2017) Land-Use Planning & Development Control: Planning For Air Quality

generated by a scheme. Where vehicle numbers are below these thresholds impacts can be screened out from further consideration.

7.2.5 *Construction Dust, PM_{10} and $PM_{2.5}$*

7.67 The assessment of construction dust, PM_{10} and $PM_{2.5}$ is based on identifying the risk of significant effects at receptors, and recommending suitable mitigation based on the potential for effects. The assessment of the potential effects of construction dust, PM_{10} and $PM_{2.5\ is}$ based upon guidance from the IAQM [(1)].

7.2.6 *Impact Assessment Methodology and Significance Criteria*

Overview

7.68 The assessment methodology has two different aspects as follows.

- Criteria for assessing magnitude of air quality impacts and the likely significance of their effects on human health are based upon guidelines from the Institute of Air Quality Management (IAQM) [(2)].

- Screening criteria for determining whether more detailed assessment of effects on ecological receptors is required are derived from EA guidelines [(3)].

Significance Criteria for Effects on Human Health

7.69 The significance of an effect on human health is determined on the basis of the magnitude of the impact on air quality and the characteristics of the receptors. The criteria presented in *Table 7.9* have been used to quantify the magnitude of impacts at for sensitive human receptors.

Table 7.9 Magnitude Criteria – Human Health

PC as a percentage of AQS				
Long term average PEC at receptor as percentage of AQS	**PC 1%**	**PC 2-5%**	**PC 6-10%**	**PC >10%**
PEC 75% or less of AQS	Negligible	Negligible	Slight	Moderate
PEC 76% to 94% of AQS	Negligible	Slight	Moderate	Moderate
PEC 95% to 102% of AQS	Slight	Moderate	Moderate	Substantial
PEC 103% to 109% of AQS	Moderate	Moderate	Substantial	Substantial
PEC 110% or more of AQS	Moderate	Substantial	Substantial	Substantial
Short term PC	**< 10%**	**10 – 20%**	**20 - 50%**	**> 50%**
(not dependent on baseline conditions)	Negligible	Slight	Moderate	Substantial

7.70 The IAQM guidance notes the following.

(1) IAQM (2014) Assessment of dust from demolition and construction
(2) IAQM (2017) Land-Use Planning & Development Control: Planning For Air Quality, January 2017
(3) Environment Agency "Air emissions risk assessment for your environmental permit " accessed March 2017 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#page-navigation

(1) The criteria are intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within and to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.

(2) The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

(3) It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

7.71 The criteria are for individual receptors only. The IAQM guidance sets out factors to consider in determining the significance of effects on human health and particularly notes that in making judgements on significance the following matters are important:

- considering the specific characteristics of a project's setting;
- considering the potential for cumulative effects; and
- applying the professional judgement of a competent expert.

7.72 Taking these factors into consideration, *Table 7.10* sets out the general framework used in this assessment for determining the significance of effects on human health through a combination of the magnitude of the air quality impact and the characteristics of the human receptors affected by it.

Table 7.10 Determination of Significance of an Effect on Human Receptors for EIA

Characteristics of Receptor	Magnitude Slight	Moderate	Substantial
Low: areas of transient occupation, no permanent dwellings	Not significant	Minor	Moderate
Medium: general population, permanent dwellings, villages, towns	Minor	Moderate	Major
High: hospitals with intensive care or high dependency units, schools	Moderate	Major	Major

7.73 Within the air quality impact assessment the large number of sensitive receptor locations fall into the 'Medium' sensitivity category. Given the

nature of the emissions and impacts from the Project when operational, detailed differentiation between Medium and Low sensitivity areas is not considered due to the spatial resolution of the model. This approach is worst case, as it will, if anything, overstate impacts.

Screening Criteria for Potential Ecological Effects

7.74 In relation to potential impacts on sensitive ecological receptors, there are specific criteria that are used in this assessment derived from the EA Guidance. These relate to the contribution from an emission source and the 'environmental standards' for protected conservation areas and 'Critical Loads' (CLs) set for the protection of sites designated under the Habitats Regulations.

7.75 The criteria presented in *Table 7.11* have been used in a screening capacity to determine whether more detailed assessment of the effects on sensitive ecological receptors is required (and where it is required this is presented in *Chapter 9*).

Table 7.11 Screening Criteria used in Assessing Impacts at Protected Conservation Areas (SPAs, SACs, Ramsar Sites and SSSIs)

Criterion	Assessment Actions (1)
Long Term	
PC < 1% of Environmental Standard/CL	Insignificant contribution and no further assessment required
PC > 1% of Environmental Standard/CL and PEC < 70% of Environmental Standard/CL	Unlikely to make a significant contribution
PC > 1% of Environmental Standard/CL and PEC > 70% of Environmental Standard/CL	Significant contribution and therefore detailed assessment required
Short Term	
PC < 10% of Environmental Standard/CL	Insignificant contribution and no further assessment required
PC > 10% of Environmental Standard/CL and PEC < 70% of Environmental Standard/CL	Insignificant contribution and no further assessment required
PC > 10% of Environmental Standard/CL and PEC > 70% of Environmental Standard/CL	Significant contribution and therefore detailed assessment required

(1) The term 'significant' is used here in the context of its meaning within the EA guidance and not within the context of the EIA Regulations

7.76 EA guidance states that process contributions can be considered insignificant if: the long term process contribution is <1% of the long term environmental standard; and the short term process contribution is <10% of the short term environmental standard. Process contributions below these criteria are not taken forward for assessment and are considered in the ecological assessment to have no significant effects.

7.77 Where a process contribution exceeds the long term 'insignificant contribution' criterion but is below 70% of the environmental standard this is deemed unlikely to make a 'significant contribution' but may be subject to

further ecological assessment where factors such as cumulative/in combination effects may require consideration and the PEC is close to the assessment criterion of 70%.

7.78 In regard to local nature sites within the specified distance the process contributions are considered insignificant if:

- the short-term PC is less than 100% of the short-term environmental standard; and
- the long-term PC is less than 100% of the long-term environmental standard.

7.79 There is no requirement under the EA Guidance to calculate the PEC for local nature sites.

7.80 In line with the EA Guidance, where a 'significant contribution' is identified detailed modelling is required and further consideration is necessary as part of the ecological assessment to establish whether the predicted air quality impact could lead to a significant effect.

7.3 BASELINE CONDITIONS

7.3.1 Overview

7.81 This section sets out the existing baseline conditions in the vicinity of the Project. The description includes details of sensitive human and ecological receptors and their locations with respect to the Project.

7.3.2 Sensitive Receptors

Sensitive Human Receptors

7.82 The air quality standards and guidelines for the protection of sensitive human receptors apply at all off-site locations. On this basis, the assessment considers the maximum impacts predicted anywhere outside the Project site boundary. Additional receptors have been identified in locations close to the Project and in areas with potentially elevated baseline. The baseline at the sensitive human receptors considered in the impact assessment is set out in *Table 7.12* and shown in *Figure 7.3*.

Table 7.12 Summary of Specific Sensitive Human Receptors

Location	Site description
Redcar	Suburban residential locations approximately 4.5 km to the east of the Project, close to other industrial sources
Lazenby	Residential area and primary school located approximately 600 m to the south and southeast of the Project
Grangetown, West Lane Eston	Residential area located approximately 1 km to the west and southwest of the Project site
Dormanstown	Suburban residential locations approximately 4.5 km to the northeast of the Project, close to other industrial sources
Grangetown, Ullswater Close Eston	Residential area located approximately 1 km to the west and southwest of the Project site

7.83 Existing industrial areas are to the north of the Project and these are not considered to be relevant as specific sensitive receptors.

Sensitive Ecological Receptors

7.84 In accordance with the requirements of EA Guidance, consideration is given to sensitive ecological sites.

- European designated sites: Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 15 km of the Project.
- Nationally designated sites: Sites of Special Scientific Interest (SSSIs) within 15 km of the Project.
- National Nature Reserves (NNRs), Local Nature Reserves (LNRs), local wildlife sites (LWS), Sites of Nature Conservation Importance (SNCIs) and ancient woodland within 2 km of the location of the installation.

7.85 The issue for ecosystems is the possibility that the deposition rate of acid (keq/ha/yr) or nutrient nitrogen (kg N/ha/yr) may be in excess of the amount that the ecosystem can tolerate. The point at which this occurs is termed the 'critical load'.

7.86 For acidic deposition, the critical load of a habitat site is determined mostly by the underlying geology and the soils. Alkaline soils have an innate capacity for neutralising acidic deposition, whereas acidic soils do not. The other factor is the type of vegetation present at the habitat. Defining critical loads for habitats is difficult, therefore, since it requires knowledge of both factors and represents a considerable mapping exercise for all habitats in the UK.

7.87 Nutrient nitrogen is also assessed relative to a critical load, but in this case, the critical load can be determined largely on the basis of the species or habitat type affected. Critical loads have been determined for a number of habitat types at the European level and have been the subject of a series of workshops

held under the auspices of the United Nations Economic Council for Europe (UNECE). Essentially, the critical loads reflect the way different plants have adapted to differing availabilities of nutrient. Those in nutrient deficient environments, for example coastal sand dunes, will be intolerant of excess nitrogen from aerial deposition.

7.88 The critical loads used in this assessment are obtained from the Air Pollution Information System (APIS) (1) website, based on the simple site-based assessment tool. The Simple Site-based Assessment is a tool based on a search by location which can be used to provide background NO_x concentrations, background nitrogen/ acid deposition, critical loads and critical levels at a particular location throughout the UK. These are based on national maps of air pollutant exposure and critical loads/ critical levels. The maps are those documented in the 2001 National Expert Group on Transboundary Pollution (NEGTAP) report (2).

7.89 The critical loads/ critical levels are linked to a specific habitat type, and are only available for a limited number of habitat types. In this case, the value for the most similar habitat is assigned to the habitat being considered. In addition, the retrieved data from a location search is drawn from a base map with much larger grid resolutions of 1 to 5 km. Uncertainties related to sub-grid variability are not captured within the 1 km or 5 km average and so, the simple site-based method is used only as a broad indication of the likely pollutant impact at a specific location, as local factors may modify feature sensitivity/ response to a particular pollutant. There are, therefore, uncertainties in both the best estimates of the critical loads/ critical levels and in the assignment of habitats. In order to best determine the most appropriate habitat type, the process has been cross referenced with the ecological assessment (*Chapter 9*).

7.90 A review of the sensitive habitats has been undertaken using the MAGIC website (3) and in conjunction with the ecology assessment.

7.91 The relevant receptors are listed in *Table 7.13*; the locations are presented in *Figure 7.4* showing the distances of the receptors from the Project site. In terms of the dispersion modelling, impacts on the receptors are captured using a grid of receptors defined throughout each habitat.

(1) www.apis.ac.uk
(2) www.edinburgh.ceh.ac.uk/negtap
(3) Multi Agency Geographic Information for the Countryside (MAGIC) (2009) www.magic.gov.uk

Table 7.13 Sensitive Ecological Receptors

Habitat Name	Type
Teesmouth & Cleveland Coast	Ramsar
North York Moors	SAC
North York Moors	SPA
Teesmouth and Cleveland Coast	SPA
Cliff Ridge	SSSI
Cowpen Marsh	SSSI
Hartlepool Submerged Forest	SSSI
Kildale Hall	SSSI
Langbaurgh Ridge	SSSI
Lovell Hill Pools	SSSI
North York Moors	SSSI
Pinkney and Gerrick Woods	SSSI
Redcar Rocks	SSSI
Roseberry Topping	SSSI
Saltburn Gill	SSSI
Seal Sands	SSSI
Seaton Dunes and Common	SSSI
South Gare & Coatham Sands	SSSI
Tees and Hartlepool Foreshore and Wetlands	SSSI
Eston Moor (LWS)	LWS
Wilton Woods Complex (LWS)	LWS
Teesside pSPA	SPA

7.92 Baseline conditions (ambient concentration, acid deposition and nitrogen deposition) for the identified ecological receptors have been obtained from the APIS website and presented in *Annex E1*, together with the critical loads.

7.93 In many areas of the UK, the baseline conditions are already in excess of critical loads and critical levels at many sensitive ecological receptors. It can be seen from *Annex E1* that this is also the case for certain ecological sites identified in *Table 7.13*; the background acid and nitrogen deposition rates have already exceeded the critical loads for acid and nitrogen. Transboundary sources are a key input, and in addition sulphur and nitrogen oxides from existing industrial sources and transport are contributors.

Indicative Site Boundary

Sensitive Human Receptor

0 500 1,000 1,500 2,000

Metres

N

SCALE: 1:125,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: CHM
DATE: 04/05/2017	APPROVED: RE

Figure 7.3
Sensitive Human Receptors

ERM

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PROJECTION: British National Grid

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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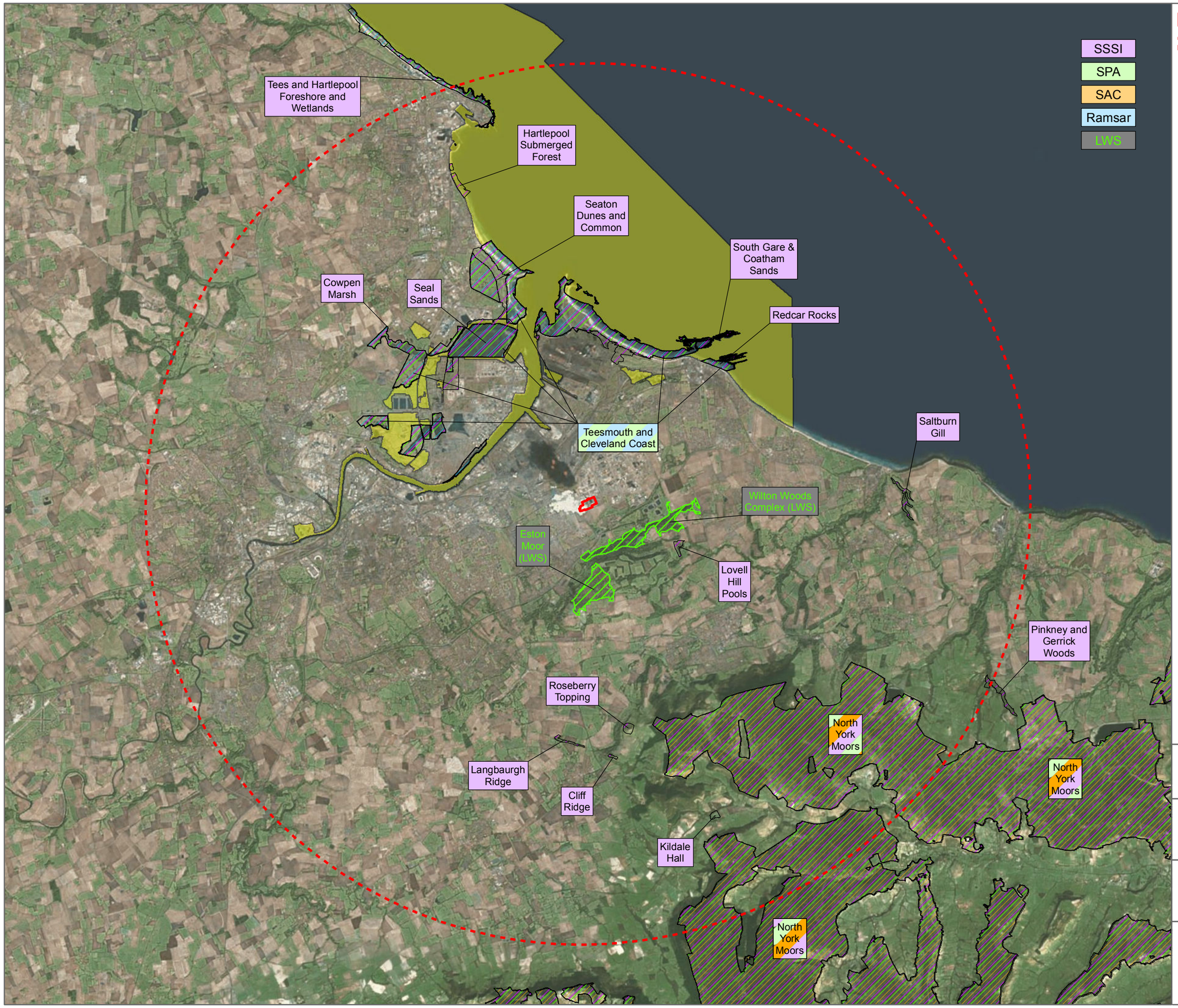

SCALE: 1:125,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: CHM
DATE: 10/05/2017	APPROVED: RE

Figure 7.4
Sensitive Ecological Receptors

ERM

sembcorp

PROJECTION: British National Grid

Path: \\ukbrsdc02\Data\Bristol\Confidential Projects\0375193 TLP2 DCO Support.RE\2. Working Folders\2. GIS\MAPS\PEIR\Fig07.04_0375193_AQ_SensitiveEcoReceptors_A01.mxd

7.3.3 *Baseline Air Quality*

Overview

7.94 The baseline conditions for the Project depend upon local and regional sources of emissions to air, both natural and anthropogenic. This section describes the baseline conditions in the study area with regard to existing:

- concentrations of airborne NO_2 and NO_x at sensitive human and ecological receptors; and
- rates of deposition of acid and nutrient nitrogen at sensitive ecological receptors.

7.95 The Project site is located in an industrial area. There are local sources of emissions surrounding the Project, principally other industrial sources and road traffic. There are sensitive human receptors to the south, east and west of the Project site.

7.96 The baseline data are based upon recent monitoring and other currently available information. For NO_2, NO_x, acid and nutrient nitrogen deposition future baseline concentrations are likely to be similar to the present. There are national policies in place, the aim of which is to decrease concentrations of these pollutants, particularly in locations where they are elevated (i.e. adjacent to busy roads), theoretically improving baseline conditions overall. However, there is research (1) which indicates that, in urban environments at least, these policies do not appear to be reducing concentrations of these pollutants as expected. On the basis of the point outlined above, using current baseline pollution concentrations to represent future baseline concentrations represents a pragmatic, reasonable and worst case approach.

Summary of Data Sources - Human Receptors

7.97 Monitoring is undertaken by four local authorities in the vicinity of the Project. There are also Automatic Urban and Rural Network (AURN) monitoring sites within the study area, the results from which are relevant to this assessment.

7.98 In the UK, a national modelling exercise has been undertaken to identify baseline concentrations of several pollutants (2). These 'interpolated mapping' data are representative of general baseline concentrations, away from specific local sources of emissions (i.e. roads and industrial sources). To further support the data from the local authority monitoring, these data have been used to derive the baseline concentrations for NO_2. These baseline concentrations are substantially below the concentrations specified in the relevant air quality standards.

(1) Defra (2012) Local Air Quality Management: Note on Projecting NO_2 Concentrations
(2) Defra (2011) Interpolated mapping data: Local Air Quality Management Support
http://www.defra.gov.uk/environment/quality/air/air-quality/laqm/

7.99 These data are used to inform the baseline, which is determined on the basis of the most appropriate data for the sensitive human receptors in the study area.

Baseline at Sensitive Human Receptors

7.100 The baseline at the sensitive human receptors considered in the impact assessment is set out in *Table 7.14*.

Table 7.14 Summary of Baseline NO_2 at Sensitive Human Receptors within the Study Area

Location	Annual Mean NO_2 ($\mu g/m^3$)	Site description
Maximum off-site	13.7	There is no monitoring site that is exactly representative of the point of maximum off-site impacts. Therefore, data have been taken from the nearest monitoring station. This is the Dormanstown site operated by Redcar and Cleveland Borough Council for 2012-2015, noting that the maximum impact does not arise at the monitoring station.
Plantation Road	31.5	Average of monitoring from diffusion tube site Plantation Road (R09) Roadside diffusion tube monitoring station operated by Redcar and Cleveland Borough Council for 2012 and 2013
Wilton Primary School, Lazenby	11.6	Average of monitoring from diffusion tube site Wilton Primary School (R20) Urban Industrial diffusion tube monitoring station operated by Redcar and Cleveland Borough Council for 2012 and 2013
West Lane, Grangetown	30.3	Average of monitoring from diffusion tube site West Lane, Grangetown (R27) Roadside diffusion tube monitoring station operated by Redcar and Cleveland Borough Council for 2012 and 2013
Dormanstown monitoring station	13.7	Average of monitoring from Dormanstown suburban industrial automatic monitoring station operated by Redcar and Cleveland Borough Council for 2012-2015
Grangetown - residential	10.8	Based upon Defra mapping for Grangetown
Breckon Hill AURN station	18.5	Average of monitoring from Breckon Hill Urban Industrial AURN station for 2010-2015
BASF 3 diffusion tube - BASF Seal Sand	23.1	Average of monitoring from diffusion tube site BASF 3 Industrial diffusion tube monitoring station operated by Stockton-on-Tees Borough Council for 2011 and 2015

7.101 In order to assess short term impacts, the short term baseline concentrations have been derived by multiplying the long term derived baseline by a factor of 2 (1), as per standard practice. This approach takes into account the fact that the highest short term baseline will not arise under the same atmospheric conditions as the highest impacts from the plant.

(1) Defra (2009) Local Air Quality Management Technical Guidance Note TG(09)

7.102 Baseline rates for nutrient nitrogen and acid deposition for sensitive ecological receptors (habitats) were derived from the APIS website. Baseline deposition is set out on a site-by-site basis for the habitat sites of interest. The baseline concentrations and deposition rates at sensitive ecological receptors for acid, nutrient nitrogen and NO_x are set out in *Annex E1*, along with further details of the receptors.

7.3.4 Future Baseline

7.103 The only aspect of the future baseline that is material for the Project is ambient NOx concentrations, or more specifically NO_2 concentrations. According to the UK Government (1) NO_2 levels are in a downward trend in most parts of the country. In overall terms air quality has improved significantly in recent decades. Since 1970 emissions of nitrogen oxides have decreased by 69% and total UK emissions of nitrogen oxides fell by a further 19% between 2010 and 2015.

7.104 Looking ahead it is anticipated that further improvements will occur as older combustion plant is replaced with modern more efficient and cleaner equipment, emissions from motor vehicles are better controlled and increased electrification of the UK vehicle fleet take place. Additional benefits will also accrue in terms of reduce transboundary pollution from the near continent.

7.4 ASSESSMENT OF IMPACTS AND EFFECTS

7.4.1 Potential Effects

7.105 Emissions of dust, PM_{10} and $PM_{2.5\ can}$ lead to nuisance and soiling effects, and can adversely affect the performance of industrial facilities. Exposure to NO_2 leads to increases in mortality and morbidity in humans through a variety of effects principally associated with inflammation of the lungs. Exposure to airborne NO_x and associated nitrogen and acid deposition leads to detrimental impacts on ecosystems by increasing plant morbidity, changing the nutrient balance in and changing soil acidity.

7.4.2 Assessment of Effects during Construction

Traffic

7.106 As discussed in *Section 7.2.4*, traffic impacts can be screened out from further assessment where:

- there are less than 100 additional HGVs AADT; or
- less than 500 LDV AADT

(1) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

7.107 In this case there are predicted to be a peak of 84 HGVs AADT and 411 LDVs using the Westgate roundabout during Phase 1 of the construction. All other road links and phases will generate less traffic. On this basis impacts are considered negligible and have been screened out from further consideration.

Impacts from Dust Emissions during Construction

7.108 The assessment of the potential impacts of construction dust, PM_{10} and $PM_{2.5}$ is based on guidance from the IAQM [(1)]; however, this guidance has not been followed exactly, for the reasons explained below. Sensitive receptors include off-site sensitive human receptors and nearby industrial processes.

7.109 The Project is close to existing industrial areas, and in addition in the event of a phased development the second CCGT unit will be built immediately adjacent to the first. These facilities are sensitive to dust ingress and susceptible to damage due to ingress of dust. Given the surrounding environment, locations of existing sensitive receptors and the close proximity of the phase 2 works to the applicant's first operating CCGT in particular, the conclusion has been drawn that the construction works represent a high risk of significant dust, PM_{10} and $PM_{2.5}$ effects on industrial receptors, and as a consequence the mitigation measures for a high risk site will need to be implemented.

7.4.3 Assessment of Effects during Operation

Sensitive Human Receptors

7.110 *Table 7.15* presents a summary of NO_2 annual mean and 1 hour mean impacts at the maximum off-site location and at sensitive human receptors.

The tables set out:

- the air quality standard or guideline;
- the existing baseline;
- the Process Contribution (PC);
- the Predicted Environmental Concentration (PEC); and
- the significance of the effects.

7.111 The impacts are illustrated in *Figure 7.5* and *Figure 7.6* for annual mean NO_2 and 1 hour mean NO_2 respectively. *Figure 7.7* presents the annual mean NO_2 impacts overlaid with the location of the ecological receptors assessed.

(1) IAQM (2014) Assessment of dust from demolition and construction

Indicative Site Boundary

Air Quality Study Area

NO_2 Concentration ($\mu g/m^3$)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.8
- 0.8 - 2
- 2 - 4
- >4

0 1 2 3 4 5

Kilometres

N

SCALE: 1:125,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: CHM
DATE: 04/05/2017	APPROVED: RE

Figure 7.5
Annual Mean NO_2, PC only, $\mu g/m^3$

ERM

sembcorp

PROJECTION: British National Grid

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Indicative Site Boundary

Air Quality Study Area

NO_2 Concentration ($\mu g/m^3$)

- < 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 40
- 40 - 100
- > 100

0 1 2 3 4 5

Kilometres

N

SCALE: 1:125,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: CHM
DATE: 04/05/2017	APPROVED: RE

Figure 7.6
99.8th Percentile 1 Hour NO_2, PC only, $\mu g/m^3$

ERM

sembcorp

PROJECTION: British National Grid

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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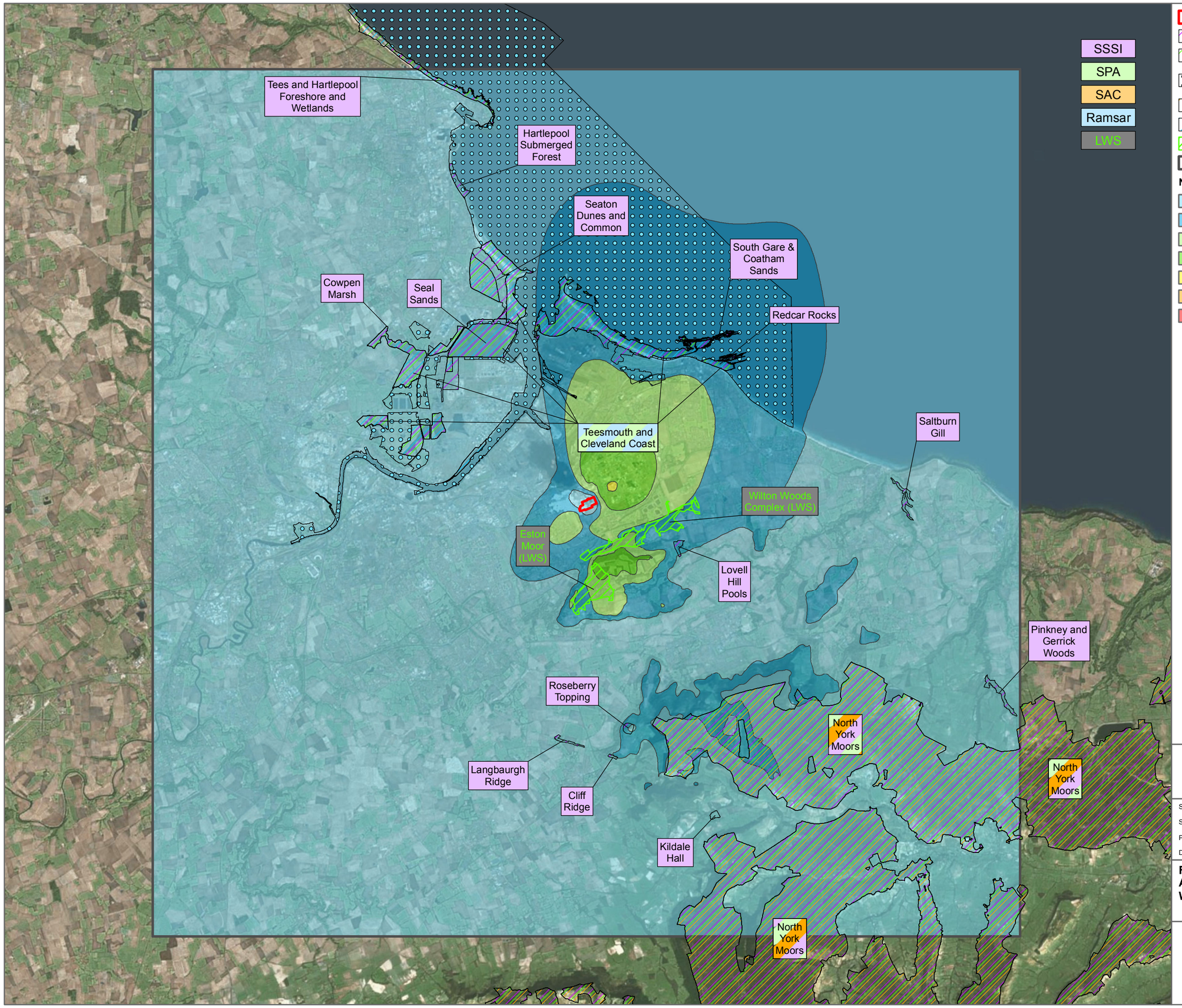

Indicative Site Boundary
Site of Special Scientific Interest (SSSI)
Special Protection Area (SPA)
pSPA - Extension to Teesmouth and Cleveland Coast
Special Area of Conservation (SAC)
Ramsar
Local Wildlife Site (LWS)
Air Quality Study Area

NO_2 Concentration (µg/m^3)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.8
- 0.8 - 2
- 2 - 4
- >4

0 1 2 3 4 5
kilometres

N

SCALE: 1:125,000	VERSION: A01
SIZE: A3	DRAWN: WB
PROJECT: 0375193	CHECKED: CG
DATE: 26/09/2017	APPROVED:

Figure 7.7
Annual Mean NO_2 PC Only, µg/m^3, With Ecological Receptors

ERM

sembcorp

PROJECTION: British National Grid

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Table 7.15 NO_2 Annual Mean and 1 Hour Mean

Location	AQS	Baseline	PC	PC/AQS	PEC	PEC/AQS	Significance
	µg/m³	µg/m³	µg/m³	%	µg/m³	%	
NO_2 Annual Mean							
Maximum off-site impact (1)	40	13.7	0.852	2.13%	14.5	36.3%	Not significant
Redcar	40	31.5	0.252	0.630%	31.7	79.3%	Not significant
Lazenby	40	11.6	0.280	0.70%	11.9	29.7%	Not significant
Grangetown (1 - West Lane)	40	30.3	0.115	0.29%	30.4	76.0%	Not significant
Dormanstown	40	13.6	0.272	0.680%	13.9	34.8%	Not significant
Grangetown (2 – Ullswater Close)	40	10.8	0.377	0.94%	11.2	28.0%	Not significant
Short Term							
Maximum off-site impact (1)	200	27.3	44.4	22.2%	71.7	35.8%	Moderate
Redcar	200	62.9	2.58	1.29%	65.5	32.7%	Not significant
Lazenby	200	23.2	5.16	2.58%	28.4	14.2%	Not significant
Grangetown (1 - West Lane)	200	60.6	3.11	1.55%	63.7	31.9%	Not significant
Dormanstown	200	27.3	2.82	1.41%	30.1	15.1%	Not significant
Grangetown (2 – Ullswater Close)	200	21.6	5.06	2.53%	26.7	13.3%	Not significant

(1) The maximum off-site impact is to the south of the Project site on land with elevated terrain (see also *Figure 7.4* and *Figure 7.5*).

7.112 For the annual mean there are no significant effects on human health due to air quality impacts at any location. For the 1 hour mean, there is predicted to be a moderate impact at the maximum off-site location. However, due to the PEC being well below 50% of the AQS, due to the low baseline, this is not considered to be sufficient to warrant further mitigation.

Sensitive Ecological Receptors

7.113 A more detailed summary of the results is set out in *Annex E1*. *Table 7.16* sets out a summary of the impacts on sensitive ecological receptors due to annual mean NO_x, 24 hour mean NO_x, nutrient nitrogen deposition and acid deposition.

Table 7.16 Summary of Project Contributions to Impacts on Ecological Receptors

Site	Designation	Nutrient Nitrogen	Acid Deposition	NO_x annual mean	NO_x 24 hour mean
Teesmouth & Cleveland Coast	Ramsar	Insignificant	Insignificant	Insignificant	Insignificant
North York Moors	SAC	Insignificant	Insignificant	Insignificant	Insignificant
North York Moors	SPA	Insignificant	Insignificant	Insignificant	Insignificant
Teesmouth and Cleveland Coast	SPA	Insignificant	Insignificant	Insignificant	Insignificant
Cliff Ridge	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Cowpen Marsh	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Hartlepool Submerged Forest	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Kildale Hall	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Langbaurgh Ridge	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Lovell Hill Pools	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
North York Moors	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Pinkney and Gerrick Woods	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Redcar Rocks	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Roseberry Topping	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Saltburn Gill	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Seal Sands	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Seaton Dunes and Common	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
South Gare & Coatham Sands	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Tees and Hartlepool Foreshore and Wetlands	SSSI	Insignificant	Insignificant	Insignificant	Insignificant
Eston Moor (LWS)	LWS	Insignificant	Insignificant	Insignificant	Insignificant
Wilton Woods Complex (LWS)	LWS	Insignificant	Insignificant	Insignificant	Insignificant
Teesmouth and Cleveland Coast pSPA	pSPA	Insignificant	Insignificant	Insignificant	Insignificant

7.114 The emissions from the Project are not predicted to result in a significant contribution at any sensitive ecological receptors for any pollutant or impact of interest.

7.4.4 Assessment of Effects during Decommissioning

7.115 During decommissioning, impacts are expected to be similar to those during construction. Specific measures will need to be put in place for the control of dust, PM_{10} and $PM_{2.5}$ emissions and impacts, and mitigation will be similar to the construction phase. Similarly, traffic impacts are anticipated to be no worse than the construction phase.

7.4.5 Cumulative Effects

7.116 The project potentially has cumulative effects due to the combination of impacts with other proposed schemes in the study area, and the existing baseline. A review of proposed schemes with the potential to lead to cumulative effects has been undertaken. If a project was not required to undertake an EIA then it is assumed that following screening by the competent authority it was deemed that:

- there would be no likely significant effects as the result of the release of pollutants or any hazardous, toxic or noxious substances to air;
- there are no areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project; and
- there are no areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project.

7.117 These aforementioned criteria are three of the main questions asked in screening an application for EIA that are relevant to emissions to atmosphere and their effects on people and habitats. On the basis of the above approach, the schemes with potential for cumulative impacts are set out in *Table 7.17*.

Table 7.17 Proposed Schemes with the Potential for Cumulative Impacts

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened In at the EIA Scoping stage?	Further assessment	Conclusion
Town and Country Planning Act Applications							
R/2015/0149/OOM	Teesdock Teesdock Road Grangetown	Approved	MGT Teesside Ltd (MGT) proposes to construct a wood chip dryer in Teesport, on the banks of the Tees Estuary. The planning application is for an outline planning permission with all matters reserved. The wood chip dryer will be located within a larger site of 14 hectare which is being developed as a renewable energy plant with combined heat and power.	Operational emissions to air, 6.66 km from Project, within impact zone	**Y**	Not EIA development therefore no concerns over air quality effects on people or protected nature conservation sites	No potential for cumulative effects with the Project
R/2016/0484/FFM	Former Croda Site Wilton International Redcar	Approved	Proposed anaerobic biogas production facility and combined heat and power plant. The proposals include construction and operation of three 1.5MW and one 0.6MW CHP engines, together with digestion, fermentation and hydrolysis tanks, reception buildings, storage facilities and other associated infrastructure. Combustion products from the CHP engines will be released through a single, shared stack.	Operational emissions to air, 1.68 km from Project., within impact zone	**Y**	Not EIA development but air quality assessment undertaken. Concluded small localised air quality impacts well within standards. Impacts further afield at nature conservation sites did not require consideration.	No potential for cumulative effects with the Project
R/2016/0418/FFM	Wilton Waste Treatment Wilton Site Lazenby	Approved	Retention as built of the CSG Wilton facility as a hazardous waste transfer and treatment site for processing a range of hazardous and non-hazardous waste including recovery of waste oils and oil contaminated wastes as well as a biological treatment facility for hazardous liquids.	Operational emissions to air, 0.49 km from Project site, within impact zone	**Y**	No combustion sources are associated with this proposed development	No potential for cumulative effects with the Project

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened In at the EIA Scoping stage?	Further assessment	Conclusion
R/2015/0682/FFM	Wilton Waste Treatment ltd Wilton Site Lazenby	Approved	Provision of oil refinery at Wilton Waste Treatment Plant to enable the recovery of lubricating base oils, fuels and other hydrocarbon products from waste oils.	Operational emissions to air, 0.49 km from Project site, within impact zone	**Y**	Not EIA development but air quality assessment undertaken. Concluded that the process contribution for nitrogen dioxide was slightly above the threshold that would require detailed modelling to be undertaken for the Environmental Permit and that a small stack height increase could bring the level below the threshold to make the contribution insignificant	No potential for cumulative effects with the Project
R/2014/0627/FFM	The York Potash Project, Doves Nest Farm	Approved	The winning and working of polyhalite by underground methods including the construction of a minehead at Doves Nest Farm involving access, maintenance and ventilation shafts, the landforming of associated spoil, construction of buildings, access roads, car parking and helicopter landing site, attenuation ponds, landscaping, restoration and aftercare and associated works. In addition, the construction of an underground tunnel between Doves Nest Farm and land at	Operational emissions to air, 2.75 km from Project site at nearest, within impact zone	**Y**	The ES concluded that away from the mine site, (which is some distance from the Project) the proposed development would result in a small to imperceptible change in annual mean nitrogen	No potential for cumulative effects with the Project

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened In at the EIA Scoping stage?	Further assessment	Conclusion
			Wilton that links to the mine below, comprising 1 shaft at Doves Nest Farm, 3 intermediate access shaft sites, each with associated landforming of associated spoil, construction of buildings, access roads and car parking, landscaping, restoration and aftercare, the construction of a tunnel portal at Wilton comprising buildings, landforming of spoil and associated works.			dioxide, PM10 and PM2.5 concentrations at receptors exposed to during the construction phase.	
R/2013/0608/FFM	Teesport Waste Treatment Facility Grangetown TS6 6UG	Approved	Waste treatment facility.	Operational emissions to air, 2.83 km from Project site, within impact zone	**Y**	Not EIA development. No air quality issues raised in consultation response by EA	No potential for cumulative effects with the Project
R/2012/0314/FFM	Lotte Chemical UK ltd Queens Avenue Wilton International Site TS10 4XZ	Approved	Construction of a polyethylene terephthalate (PET) chemical plant.	Operational emissions to air, 1.65 km from Project site, within impact zone	**Y**	Not EIA development but air quality assessment undertaken which concluded: "*combustion emissions from the HTM unit stack are not predicted to have any significant impact on offsite air quality. There is therefore no benefit in undertaking further review of potential impacts at the nearest ecologically sensitive receptors which are more distant than the locations reviewed as*	No potential for cumulative effects with the Project

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened In at the EIA Scoping stage?	Further assessment	Conclusion
						part of this initial assessment."	
R/2012/0934/RSM	Land at Imperial Park Tilbury Road South Bank	Approved	Proposed anaerobic digestion plant (steel portal framed building), including external concrete hardstanding, car parking area and new sub-station (resubmission).	Operational emissions to air	**Y**	Not EIA development but air quality assessment undertaken, concluding the main source of combustion was the equivalent of a "*several lorries*".	No potential for cumulative effects with the Project
Electricity Act (1989) Section 36 and Section 37 Applications							
CHP CCGT - S36	Seal Sands, Teesside	Approved	Thor Cogeneration has applied to construct and operate a CHP CCGT generation station.	Operational emissions to air, 6.21 km from the Project site, within impact zone	**Y**	Determined subsequent to the PEIR that the licence has been revoked for this project and therefore not considered further.	No potential for cumulative effects with the Project
CHP CCGT - S36	Seal Sands, Teesside	Approved	Northsea Pipelines Ltd applying for CHP CCGT generating station.	Operational emissions to air, 5.68 km from the Project site, within impact zone	**Y**	Unlikely to have any cumulative human health air quality effects on the same receptors as the Project. Could potentially affect the same ecological receptors as the Project.	Scoped in for further consideration in the ecological impact assessment and HRA
Biomass - S36	Teesport, Teesside	Approved	MGT Teesside Limited applying to construct and operate a biomass fuelled renewable generating station.	Operational emissions to air, 3.53 km from the Project site,	**Y**	Considered as a single development of 299 MW capacity and having the	Scoped in for further consideration for cumulative

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened In at the EIA Scoping stage?	Further assessment	Conclusion
				within impact zone		potential to affects the same human and ecological receptors as the Project	human health effects in this chapter and also the ecological impact assessment for effects on protected areas and HRA
Biomass - S36	Teesport, Teesside	Approved	MGT Teesside Limited applying for extension to biomass fuelled renewable generating station.	Operational emissions to air, 3.53 km from the Project site, within impact zone	**Y**		
Biomass/S36C Electricity Act 1989	Teesport, Teesside		MGT Teesside Limited applying for revision to previous application to increase maximum output to 299MW.	Operational emissions to air, 3.53 km from the Project site, within impact zone	**Y**		
Transport and Works Act Applications							
Teesport (Land Acquisition) Order TWA/06/APP/03 SI No. 2008/1238	Teesport, Teesside	Approved	Expansion of container terminal facilities at Teesport. The proposed development will increase the port's capacity from around 250,000 TEU a year to around 1.5 million TEU a year.	Operational emissions to air, 2.58 km from Project site, within impact zone	**Y**	Port expansion with assumed incremental increase in associated traffic being the only material source of combustion emissions	Assumed to have no significant potential for cumulative effects with the Project

7.118 In terms of impacts on human health, the cumulative effects are not considered to be sufficient to lead to a risk of air quality standards being exceeded. The baseline conditions in the vicinity of the Project are generally well below air quality standards. The highest annual mean Predicted Environmental Concentration (PEC) (see *Table 7.15*) is 79.3% of the air quality standard at Redcar, with the Project contributing 0.63% of the standard. Even if the much smaller MGT project contributed a similar level to the Project the cumulative PEC would still be well within the standard and so there will be no significant cumulative effects. For short term concentrations the point of greatest impact for the 1 hour mean, will not be co-incidental with the greatest impacts from the other schemes identified.

7.119 In terms of cumulative impacts on sensitive ecological receptors, this is discussed in the ecology chapter and the HRA (*Chapter 9* and *Annex H*).

7.4.6 Visible Plumes

7.120 The project has the potential to result in the emission of visible plumes. Normally, water vapour in the plume which is generated as a combustion product will be in vapour phase as the plume temperature decreases. However, when ambient temperature is low or relative humidity is high water may condense into droplets forming visible plumes. The potential for visible plumes has been assessed using dispersion modelling, based upon the water content of the plume. The ADMS model has been used for this exercise, using the same set up as the Aermod model.

7.121 The results of the visible plume assessment are set out in *Table 7.18*.

Table 7.18 Predicted Occurrence of Visible Plumes

Parameter		2012	2013	2014	2015	2016	Average
Hours per year when plume visible	hours/year	64	58	12	34	36	41
Percentage of year when plume visible	%	0.7%	0.7%	0.1%	0.4%	0.4%	0.5%
Maximum length of plumes when visible	m	189	252	117	212	227	199
Average length of plume when visible	m	41	86	49	67	61	61

7.122 The results show that visible plumes will occur rarely, less than 1% of the year, and when they do will rarely exceed the confines of the site boundary.

7.4.7 Uncertainty

7.123 There are a number of points of uncertainty in the air quality impact assessment and to address these, the approach used is inherently conservative. Specific points are as follows.

- The effect on health and ecology of pollutants is uncertain and as such air quality standards and critical loads incorporate a safety margin between observable effect and the concentration.

- Dispersion modelling is inherently conservative. Five years of hourly sequential data have been used to capture year on year variations, with the worst case year results being reported.

- In terms of human health, impacts are associated with the NO_2 fraction of total NO_x. The conversion of NO_x to NO_2 is inherently conservative to allow for a margin of uncertainty in the actual conversion rate.

7.4.8 Summary of Mitigation Measures and Residual Significance of Effects

Construction Phase

7.124 No specific mitigation measures are required related to traffic and air quality.

7.125 Mitigation is required for mitigation of dust, PM_{10} and $PM_{2.5}$ emissions during the construction phase. There are nearby industrial processes which, taking a precautionary approach, are considered to be sensitive to dust. Whilst the exact nature of the processes undertaken is unknown, they are considered to be of high sensitivity to dust ingress. In the event of a phased development, the operating CCGT installed in the first phase will also be a sensitive receptor to dust impacts from construction of the second phase, as CCGTs are susceptible to damage from dust ingestion, and filters may become clogged. On this basis, best practice mitigation will need to be adopted. Dust, PM_{10} and $PM_{2.5}$ mitigation measures from the following guidance document for 'High Risk' sits will be adopted: *IAQM (2014) Guidance on the assessment of dust from demolition and construction*. With the use of best practice it should be feasible to minimise dust, PM_{10} and $PM_{2.5}$ emissions to the extent that impacts are negligible. However, it should be noted that due to the nature of dust emissions it is not possible to guarantee controls will always be implemented in sufficient time to avoid brief temporary effects.

Operational Phase

7.126 No further mitigation measures are required over and above the base Project design, these being the use of a turbine that meets future BAT NO_x emissions of 30 mg/Nm^3 and an appropriate stack height to ensure sufficient dispersion.

General Considerations

7.127 *Table 7.19* summarises the impacts where, either due to the significance of effects or requirements to comply with legislation, mitigation will be required. The mitigation is described and the significance of the residual effect after mitigation applied is assessed.

Table 7.19 Mitigation and Residual Effects

Phase	Receptor and Impacts	Mitigation Measures	Residual Significance
Construction	Impacts associated with road traffic emissions	None	Not significant
Construction	Impacts associated with dust emissions from construction activities	Mitigation as per IAQM (2014) guidance	At worst Minor, or Not significant
Operation	Impacts due to CCGT operation	None	Human Health – Moderate at maximum off site location, but due to low PEC no mitigation required Ecology – No Potentially Significant Contribution were identified. Therefore no mitigation required.
Decommissioning	Impacts associated with road traffic	None	Not significant
Decommissioning	Impacts associated with dust emissions from construction activities	Mitigation as per IAQM (2014) guidance (or any subsequent guidance prevailing at the time)	At worst Minor, or Not significant

7.5 CONCLUSIONS

7.128 The air quality impact assessment considered impacts during the construction phase for traffic and dust; operational phase for emissions from the Project CCGTs; and decommissioning phase for traffic and dust. Consideration was given to impacts at nearby sensitive human receptors where the highest impacts are likely to arise, or the baseline is likely to be elevated. In addition, impacts at statutory and non-statutory sensitive ecological receptors within 15 km were assessed considering site-specific baseline and critical loads and critical levels. The plant design assessed has a 75 m stack, and meets the future BAT emission limit for NO_x of 30 mg/Nm^3.

7.129 There are no significant effects from emissions associated with construction traffic, on any road during any phase of the construction works.

7.130 If unmitigated, there are potentially significant effects associated with dust emissions at nearby existing industrial facilities and, if the development is phased, on the phase 1 CCGT itself during construction of the phase 2 CCGT. As such mitigation measures are recommended to control these emissions; residual effects are considered to be, at worst, minor and likely not significant.

7.131 During the operational phase, in terms of human health there are no significant effects at the large majority of receptors. There is predicted to be an effect of moderate significance at the maximum off-site location for 1-hour NO_2. However, it is noted that the air quality standard is not exceeded or approached and effects are not significant for the large majority of locations.

7.132 The maximum off-site impact for 1-hour mean NO_2 is predicted to have an effect of moderate significance. However, the air quality standard is not predicted to be exceeded. This impact occurs to the south of the Project site, coincident with the rising terrain to the south of the Tees Valley, as shown in *Figure 7.4*. This location is characterised by agricultural areas where the baseline will be lower than in urban areas near the Project site.

7.133 There are no significant effects on sensitive ecological receptors. In terms of European and nationally designated sensitive ecological receptors, the contributions by the Project to impacts at all receptor locations are insignificant for all pollutants and impacts of interest. The contributions from the Project at the two Local Wildlife Sites are also insignificant. Overall, no specific mitigation is required above and beyond that inherent in good design according to BAT.

7.134 During the decommissioning phase, if unmitigated, there are potentially significant effects associated with dust, PM_{10} and $PM_{2.5}$ emissions and deposition at any nearby industry that might be close to the Project boundary at that time, noting that existing human receptors are too distant to be impacted. As such mitigation measures are recommended to control these emissions; residual effects are considered to be, at worst, minor and likely not

significant. There are no significant effects associated with emissions from construction traffic, on any road during any phase of the construction works.

7.6 IMPLICATIONS OF THE REQUESTED CHANGE TO AIR QUALITY IMPACTS

The air quality assessment for the Project has taken into account the height of all the proposed structures for the Project as the dispersion of stack emissions can be influenced by tall buildings greater than 1/3rd stack height due to downwash effects. A gas turbine buildings height of 31 m and HRSG buildings height of 45 m were considered in the air quality dispersion model (see *Table 7.6*). The requested change for the gas turbine buildings height to be increased up to a maximum of 32 m is therefore considered in this section.

The amended gas turbine buildings potential maximum height (i.e. an increase of 1 m from that modelled for this chapter) will not materially alter the air quality model output as presented in *Section 7.4.3*. This is demonstrated through a comparison of the modelling results presented in the PEIR with those presented in *Section 7.4.3* (relevant information has been reproduced below for ease of comparison purposes). At the PEIR stage, the heights for the gas turbine buildings and HRSG buildings were modelled at 21.3 m and 33.6 m respectively. For this chapter the gas turbine buildings and HRSG buildings have been modelled at 31 m and 45 m, increases of circa 10 m and 11 m respectively. These relatively large increases do not lead to any differences in the modelling results (see for example PEIR Table 7.15 and Table 7.15 of this chapter reproduced below). Given the requested change is only a minor change (1 m increase) from the air quality basis of assessment modelled inputs for the EIA it can be concluded with a high level of certainty that this will not materially alter the outcome of the modelling and demonstrates the assessment still represents the worst case scenario for air quality impacts. Another reason for this high level of confidence is that all but one of the identified effects are 'not significant' in terms of the effects on human health and are below the thresholds for an insignificant contribution at sensitive ecological receptors. The one exception is an effect of moderate significance for short-term NO_2 concentrations at a receptor location characterised by agricultural land use and which is still within the standards designed to protect human health.

The conclusions on the significance of effects within the air quality assessment (*Section 7.5*) are therefore unaffected by the requested change.

PEIR Table 7.6 Building Dimensions

Building	Height (m)	Length (m)	Width (m)
Gas Turbine east	21.3	63	30
Gas Turbine west	21.3	63	30
HRSG east	33.6	30	26
HRSG west	33.6	30	26
Cooling Bank east	35.0	177	20

Building	Height (m)	Length (m)	Width (m)
Cooling Bank west	35.0	177	20

PEIR Table 7.15 NO_2 Annual Mean and 1 Hour Mean

Location	AQS	Baseline	PC	PC/AQS	PEC	PEC/AQS	Significance
	µg/m³	µg/m³	µg/m³	%	µg/m³	%	
NO_2 Annual Mean							
Maximum off-site impact	40	13.7	0.852	2.13%	14.5	36.3%	Not significant
Redcar	40	31.5	0.252	0.630%	31.7	79.3%	Not significant
Lazenby	40	11.6	0.280	0.70%	11.9	29.7%	Not significant
Grangetown (1 - West Lane)	40	30.3	0.115	0.29%	30.4	76.0%	Not significant
Dormanstown	40	13.6	0.272	0.680%	13.9	34.8%	Not significant
Grangetown (2 – Ullswater Close)	40	10.8	0.377	0.94%	11.2	28.0%	Not significant
Short Term							
Maximum off-site impact	200	27.3	44.4	22.2%	71.7	35.8%	Moderate
Redcar	200	62.9	2.58	1.29%	65.5	32.7%	Not significant
Lazenby	200	23.2	5.16	2.58%	28.4	14.2%	Not significant
Grangetown (1 - West Lane)	200	60.6	3.11	1.55%	63.7	31.9%	Not significant
Dormanstown	200	27.3	2.82	1.41%	30.1	15.1%	Not significant
Grangetown (2 – Ullswater Close)	200	21.6	5.06	2.53%	26.7	13.3%	Not significant

Reproduced for ease of comparison from this chapter Table 7.6 Building Dimensions

Building	Height (m)	Length (m)	Width (m)
Gas Turbine east	31	63	30
Gas Turbine west	31	63	30
HRSG east (top of vents)	45	30	26
HRSG west (top of vents)	45	30	26
Cooling Bank east	25	177	20
Cooling Bank west	25	177	20

Reproduced for ease of comparison from this chapter Table 7.15 NO_2 Annual Mean and 1 Hour Mean

Location	AQS	Baseline	PC	PC/AQS	PEC	PEC/AQS	Significance
	µg/m³	µg/m³	µg/m³	%	µg/m³	%	
NO_2 Annual Mean							

Location	AQS	Baseline	PC	PC/AQS	PEC	PEC/AQS	Significance
Maximum off-site impact	40	13.7	0.852	2.13%	14.5	36.3%	Not significant
Redcar	40	31.5	0.252	0.630%	31.7	79.3%	Not significant
Lazenby	40	11.6	0.280	0.70%	11.9	29.7%	Not significant
Grangetown (1 - West Lane)	40	30.3	0.115	0.29%	30.4	76.0%	Not significant
Dormanstown	40	13.6	0.272	0.680%	13.9	34.8%	Not significant
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Maximum off-site impact	200	27.3	44.4	22.2%	71.7	35.8%	Moderate
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Dormanstown	200	27.3	2.82	1.41%	30.1	15.1%	Not significant
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