RWE Great Yarmouth - Air Quality Modelling Technical Note

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Introduction

AECOM have been commissioned by RWE to prepare a technical note which quantifies the impact of the Great Yarmouth power station (the Facility) Combined Cycle Gas Turbine (CCGT) operating with a maximum output of 430 MW_e depending on ambient temperature, pressure and other ambient factors.

The operator currently does not take into account the impacts of ambient factors on the CCGT power generation capability and restricts the facility to a maximum gross generation output of 420 MW_e. Unrestricted, the facility could generate up to 430 MW_e when ambient conditions are favourable (i.e. external temperatures are 5°C or less) and assuming there is a demand from the National Grid for the Facility to generate the additional electrical output.

This assessment has, therefore, been prepared to assess the impact on local air quality as a result of any change in emissions from the Facility that would result due to a maximum output of 430 MWe. This has been assessed in comparison to the predicted impacts on local air quality from the Facilities existing emissions, i.e. when operating at 420 MW_e.

Scope of Works

This assessment assesses three scenarios during the operation of the CCGT, which are detailed as follows:

- Scenario 1 – Current baseline; operating all year per RWE's strict application of the term 'about', i.e. 420 MW_e (gross);
- Scenario 2 – Worst Case; impacts if the power station were to operate at 430 MW_e (gross) all year; and
- Scenario 3 – Realistic Case: The power station operates at 420 MW_e (gross) for the majority of the year except when the ambient temperature is favourable, i.e. 5°C or less, at which time the Facility would operate at 430 MW_e (gross).

This assessment considers the change in Process Contributions (PCs) from the Facility at modelled receptors as a result of the change in operations, i.e. the difference between Scenario 1 vs 2 and Scenarios 1 vs 3, and not the total concentration. This is principally because the Facility is already fully operational and generating 420 MW_e which is its current permitted maximum gross output. As such, emissions from the Facility operating at 420 MW_e, are included within current ambient air quality monitoring which has been used to establish existing air quality in the local area. The focus of this assessment is, therefore, the change that would result if the facility were to operate at a new maximum capacity of 430 MW_e rather than the total PC or impact of the Facility on local air quality though both have been considered to ensure that the proposed change does not have a significant impact at modelled receptor locations.

Modelling Methodology

The assessment will be undertaken against the UK Air Quality Strategy[1] (AQS) objective concentrations set for the protection of human health and ecological receptors as appropriate. In addition, the Environment Agency (EA) has defined Environmental Assessment Levels (EALs)[2] for the protection of human health from pollutant species without Air Quality Strategy (AQS) objectives. However, the only EAL, applicable to this assessment, not covered by the AQS objectives is for maximum 1-hour carbon monoxide (CO) concentrations.

For clarity, both the UK AQS objectives and EA EALs will be referred to as EALs throughout this assessment when discussing the appropriate air quality assessment criteria. Table 1 presents the EALs applicable to this assessment.

Table 1 - Environmental Assessment Level

Pollutant	Source	Concentration (µg/m^3)	Measured as
Nitrogen dioxide (NO_2)	AQS Objective	40	Annual mean
		200	1-hour mean, not to be exceeded more than 18 times a year, equivalent to 99.79th percentile of hourly results
Carbon monoxide (CO)	AQS Objective	10,000	Running 8-hour average
	EAL	30,000	Maximum 1-hour mean

The impact of emissions from the Facility on sensitive ecological receptors is quantified within this assessment in two ways:

- as direct impacts arising due to increases in atmospheric pollutant concentrations; assessed against Critical Levels, and
- indirect impacts arising through the deposition of acids and nutrient nitrogen to the ground surface, assessed against Critical Loads.

The Critical Levels for the protection of vegetation and ecosystems are presented in Table 2 and apply regardless of habitat type.

Table 2: Critical Levels (CL) for Air (for the Protection of Designated Habitat Sites)

Pollutant	Source	Concentration (µg/m^3)	Measured as
Oxides of Nitrogen (as NO_2)	AQS objective & EA Guidance	30	Annual Mean
	EA Guidance	75	Daily Mean

The Critical Loads are set out on the Air Pollution Information System website[3]. Critical Load criteria for the deposition of acids and nutrient nitrogen are specific to the ecological area and are dependent on the soil type, habitat type and species present so are specific to the ecological receptor location being considered.

The Critical Load criteria adopted for the sensitive ecological receptors considered by the assessment are site dependent. As such they are presented in Table 5 along with each site's applicable designation.

Model Setup and Emission Sources

Dispersion modelling calculates the predicted concentrations arising from emissions to the atmosphere, based on Gaussian approximation techniques. This method is widely accredited and routinely used in the UK for assessing emissions from point sources such as CCGT stacks. The previous modelling of the Facility[4] was undertaken using ADMS and AERMOD which are both advanced steady-state gaussian dispersion models. The results from these models were compared against wind-tunnel testing, and it was determined that predicted results from AERMOD were closer to those obtained from the wind tunnel testing. On this basis, the

[1] Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum
[2] Environment Agency, 2022, Guidance: Air emissions risk assessment for your environmental permit, url: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[3] Centre for Ecology and Hydrology (CEH), 2017, Air Pollution Information System, url: https://www.apis.ac.uk/
[4] Great Yarmouth Power Station PPC Application 1999 Appendix A Air Quality Modelling Study.

latest version of AERMOD (22112, AERMOD Lakes v 11.2.0) has been used in this assessment to predict the PC's at modelled receptors.

The emission data to be used in the modelling is presented in Table 3 below. NO_x emissions have been assessed at the permitted Emission Limit Values (ELVs), as set out in the Environmental Permit for the facility. During normal operation, it is expected that the Facility will operate at levels below the permitted ELVs, and this assessment represents a conservative assessment of potential emissions from the Facility. Both hourly and annual mean ELVs as set out in the Facility's permit have been used to capture the short-term and long-term PCs.

Table 3. Emissions Parameters

Parameter	Existing Operations (420 MW_e)	Proposed Operations (430 MW_e)
X, Y Coordinate of Exhaust Stack	653082, 305018	
Stack Exit Diameter (m)	7.0	
Stack Height (m)	70	
Stack Discharge Velocity (m/s)	18.1	18.5
Stack Discharge Temperature (ºC)	93	93
Volumetric Flow (m^3/s)	695.2*	711.8**
% H_2O in stack exhaust	8.6	8.6
% O_2 in dry stack exhaust	13.5	12.4
Normalised Volumetric Flow (Nm^3/h)***	2,148,732	2,199,892
NO_x Hourly Emission Limit (mg/Nm^3)***	50	50
NO_x Emission (@ hourly emission limit) (g/s)	29.8	30.6
NO_x Annual Emission Limit (mg/Nm^3)***	42	42
NO_x Emission (@ annual emission limit) (g/s)	25.1	25.7
CO Emissions (mg/Nm^3)***	150	150
CO Emissions (g/s)	89.5	91.7

* estimated from stack diameter and emission velocity.
** factored from existing operational volumetric flow at 420 MW_e to 430 MW_e.
*** Normalised to 15% O_2 v/v, dry, 1 ATM, 273 K.

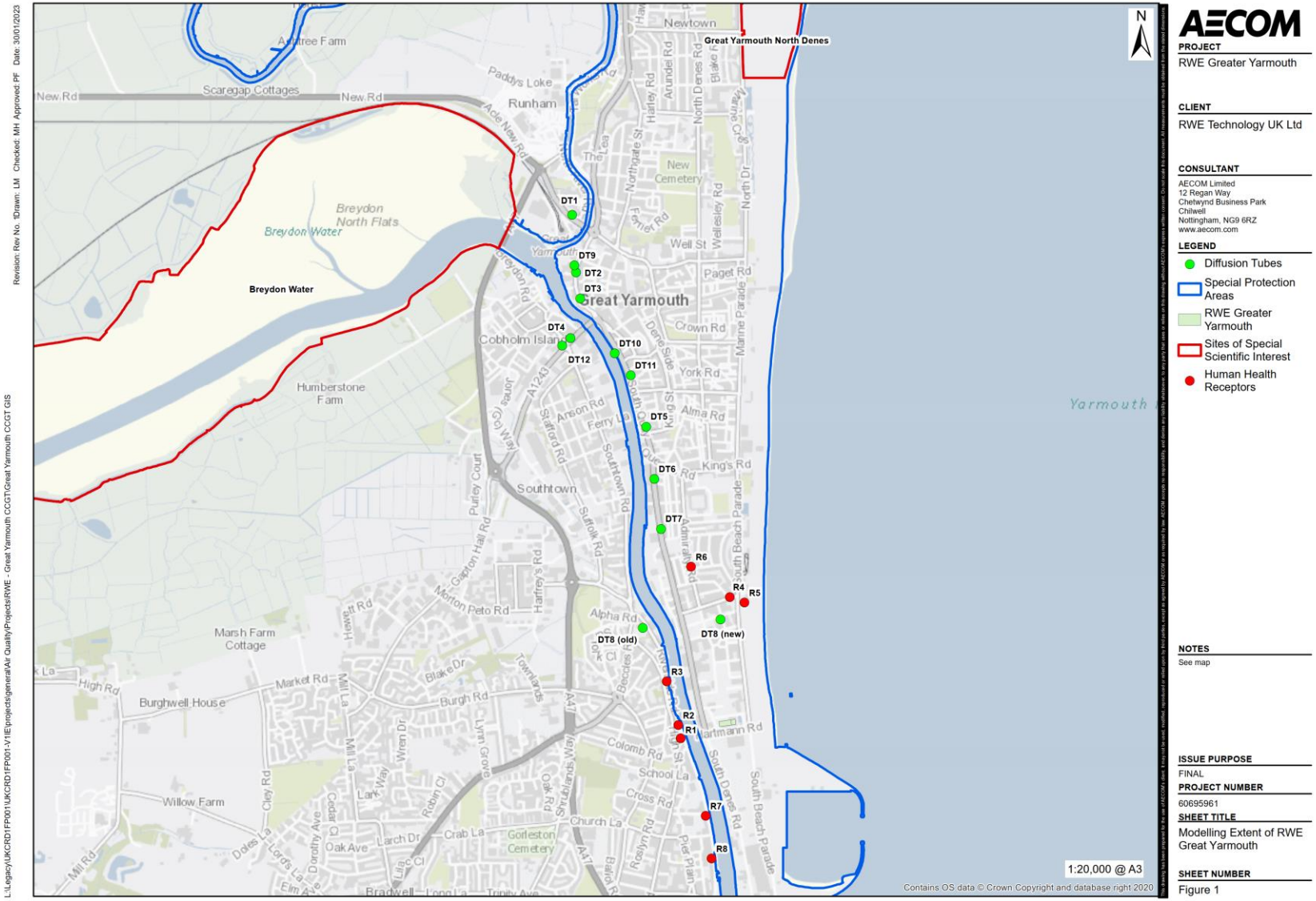
Modelled Receptors

Receptors potentially affected by operational emissions include local residential and amenity receptors which have been identified through desk study of local mapping and consultation. The assessment includes the receptors that are predicted to receive the highest impacts resulting from the point source contributions, identified through examination of isopleth figures of pollutant dispersion. All human health receptor points were modelled at a height of 1.5 m above ground level. Modelled receptors are detailed in Table 4 below and illustrated in Figure 1.

Table 4. Modelled Receptors

ID	Receptor Name	Receptor Type	X	Y	Distance (km) from the Site
R1	Riverside Road	Residential Property	652734	304914	0.25
R2	Riverside Road	Residential Property	652719	304997	0.25
R3	Riverside Road	Residential Property	652647	305270	0.40
R4	Main Cross Road	Residential Property	653041	305798	0.75
R5	South Beach Parade	Hotel	653133	305763	0.70
R6	Peggotty Road	Residential Property	652798	305988	1.00
R7	Riverside Road	Residential Property	652890	304431	0.60
R8	Riverside Road	Residential Property	652927	304164	0.85

Figure 1 Local Air Quality Monitoring, Ecological Sites and Modelled Receptor Locations



Guidance published by the Environment Agency[2] sets a screening distance criteria for the identification of ecological receptors which may be significantly effected by emissions from combustion facilities. For European sites (Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites (protected wetlands)), Sites of Special Scientific Interest (SSSIs) and local nature sites (ancient woods, local or county wildlife sites, national nature reserves (NNRs) and local nature reserves (LNRs)) an assessment is made as to whether the emissions are 'likely to have a significant effect', and whether this could lead to an 'adverse effect on site integrity'. The EA's assessment criteria for large emitters (greater than 50 MW) requires that European Sites within 15 km of a source be considered, while for SSSIs the assessment distance is 10 km. Several ecological sites have been identified within these distances:

- Great Yarmouth North Denes SSSI, SPA
- Broadland SPA, RAMSAR, incorporating:
  - Breydon Water SSSI, SPA, RAMSAR
  - Halvergate Marshes SSSI
  - The Broads SAC
- Kitchener Road Cemetery County Wildlife Site (CWS)

Two additional SPAs and SACs were identified, the Outer Thames Estuary and the Greater Wash. However, both of these have been designated due to marine components and are not considered to be directly affected by air pollution due to the dilution caused by tides and currents.

Areas of priority habitat have been identified, and those where it is considered likely to be sensitive to air pollution have been included in this assessment. Critical Loads relevant to each ecological area are summarised in Table 5.

Table 5. Ecological Receptors Critical Load Ranges

Ecological Site	Habitat	Critical Load Nitrogen (kgN/ha/yr)		Critical Load Acid (keq/ha/yr)					
		Min	Max	MaxCL MinN	MaxCL MaxN	MaxCL MaxS	MinCL MinN	MinCL MaxN	MinCL MaxS
Breydon Water	Coastal saltmarsh	20	30	N/A	N/A	N/A	N/A	N/A	N/A
Great Yarmouth North Denes	Coastal sand dunes	8	15	0.438	4.548	4.12	0.223	1.073	0.85
Broadland	Coastal and floodplain grazing marsh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: APIS
Note: APIS does not provide habitat or Critical Load data for County Wildlife Sites and, as such, Kitchener Road Cemetery CWS is excluded from the table.

Ecological receptors were modelled at a height of 0 m above ground level across a grid covering each ecological area. From this grid of receptors, the maximum predicted PCs within each designated site was determined. As this location is likely to be different for each averaging period, no single location has been considered. The point of maximum impact is, therefore, reported for each pollutant and averaging period within the results section of this report.

It should be noted that acid deposition at ecological receptors is not directly assessed as a percentage of the acid deposition Critical Load but rather against the Critical Load Function (CLF) which is calculated based on total nitrogen and sulphur acid PC (keq/ha/yr) in addition to background nitrogen and sulphur deposition and the sensitivity of the site to both. The APIS website provides a calculator that can be used to determine what percentage of the CLF a Facilities PC represents, however, it should be noted that the APIS CLF calculator only provides a value if the combined deposition PC of nitrogen and sulphur represents 0.6% of the minimum Critical Load or more, otherwise the CLF is reported as 0%.

Building Downwash Effects

The dispersion of pollutants from modelled sources (particularly industrial point sources) may be affected by aerodynamic wakes generated by winds flowing around and over nearby buildings. Building wakes generally

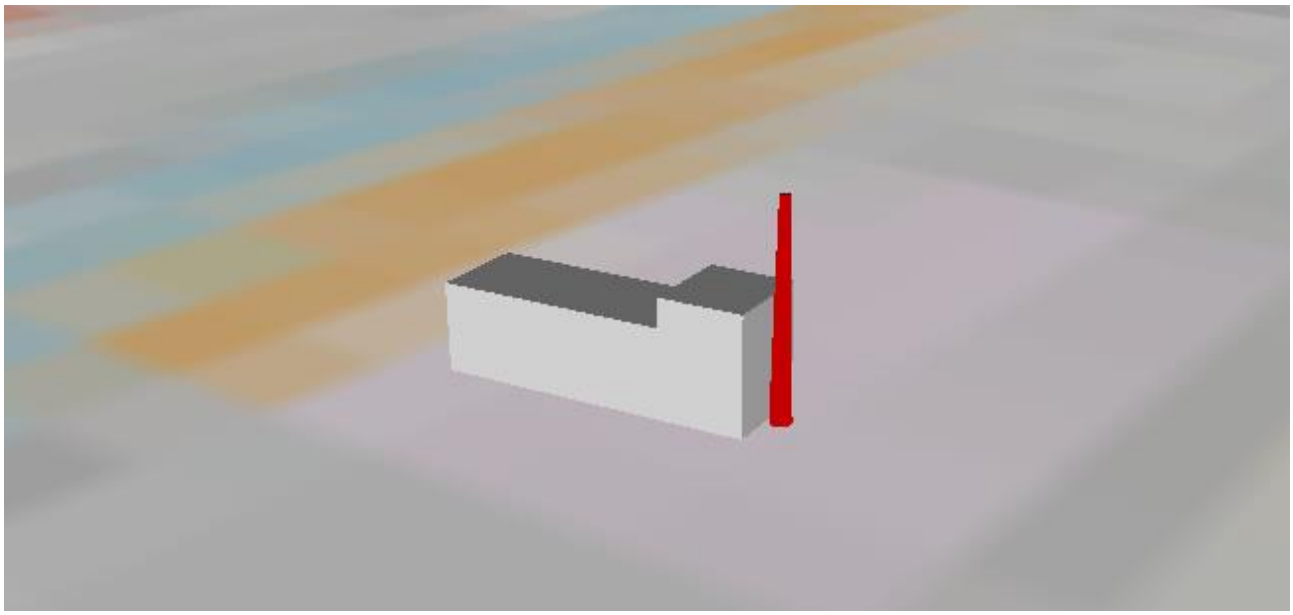
decrease the distance downwind at which pollutant plumes emitted from stacks come into contact with the ground. This may result in higher ground-level pollutant concentrations closer to the emission source.

The model has included the main boiler and the turbine hall, which are the tallest buildings in the vicinity of the site, to ensure that building downwash effects are appropriately assessed. The building parameters included within the model are shown in Table 6, with a 3D visual representation shown in Figure 2. Building downwash effects are subsequently calculated using the AERMOD BPIP tool, using the building parameters set out in Table 6.

Table 6. Modelled Building Parameters

Building Description	Coordinates of southwest corner		Height (m)	Length (m)	Width (m)	Angle (from east-west) (°)
	X	Y				
Turbine Hall	652978	304988	29	75	32	8
Boiler House	653052	304998	38.5	28	32	8

Figure 2: Modelled Buildings



Meteorological Data

A key consideration when undertaking dispersion modelling is the selection of appropriate meteorological data which represents conditions experienced in the vicinity of the modelled source. Therefore actual measured hourly-sequential meteorological data from a monitoring station close to the site is typically used. Though, other monitoring data from further away may be used if the closest monitoring location is considered not representative, e.g. due to large differences in elevation or local terrain or if insufficient data is available. For locations where actual monitoring data is not available then modelled Numerical Weather Prediction (NWP) data can be purchased.

A review of the available meteorological monitoring stations in the vicinity of the Facility was therefore undertaken. The previous assessment of the Facility[5] used data from Hemsby, located approximately 12.5 km north of the Facility, however, this site was subsequently closed and applicable data is no longer available. Other locations within Norfolk and Suffolk were considered, however, most are located inland and are not considered representative of the coastal locations. The nearest coastal sites are located at Weybourne and Cromer, both on the northern coast of Norfolk and so are also not considered representative of the east coast. It was decided that NWP modelled centred on the facility would, therefore, be the most representative of meteorological conditions and therefore be the most appropriate data source for dispersion modelling. Five

[5] Great Yarmouth Power Station PPC Application 1999 Appendix A Air Quality Modelling Study.

years of hourly sequential data (2017 to 2021) was, therefore, obtained and used within this assessment. NMP meteorological data was provided by ADM Limited, a supplier of processed meteorological data used in dispersion modelling across the industry.

The purchased meteorological data was processed within the AERMOD AERMET meteorological pre-processor, to convert into an appropriate format for use within the AERMOD model. AERMET allows the specification of different surface roughness values to be accounted for according to land use around the Facility. As such, the surface roughness from 0° (north) round to 180° (south), representative of the area to the east of the site, was assumed to be open sea with a surface roughness of 0.0001 m, while from 180° to 360° (reported as 0° within the model), the area to the west of the site, was assumed to be urban with a surface roughness of 1 m. Upper air data was predicted using the AERMET Upper Air Estimator tool to represent mixing heights from 500 m to 4000 m+.

Terrain

The site and surrounding area are relatively flat with little significant change in terrain height. As such, the effects of terrain on the dispersion of emissions have not been considered in the modelling.

Specialised Model Treatments

Emissions will be modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is standard practice and likely to result in an overestimation of impacts at receptors (i.e. environmentally conservative).

Oxides of Nitrogen to NO_2 Conversion

Emissions of NO_x from the project sources will mainly consist of nitric oxide (NO) at the point of release. NO is subsequently oxidised to form NO_2 following release from the flue stacks, with the proportion of NO_2 in the exhaust plume increasing with distance from the point of release. NO is a relatively innocuous substance, but it is of interest as a precursor to NO_2 through chemical reactions in the atmosphere.

Conversion of NO to NO_2 can be significant at downwind distances of up to 10 km from the emission sources. However, the chemistry of this conversion is complex and subject to many influences (such as the primary NO_x-NO_2 ratio of the emission at the source, locations of receptors in relation to the source, and the background concentrations of NO, NO_2 and ozone (O_3), and to a lesser extent background hydrocarbons); it is consequently difficult to accurately predict the rate of conversion of NO to NO_2.

The EA, therefore, recommends applying the following conversion ratios to provide what it describes as a realistic "worst-case scenario"[6]:

- Long-term of NO_x to NO_2 conversion: 70%
- Short-term of NO_x to NO_2 conversion: 35%

These "worst-case" conversion rates have, therefore, been used within this air quality assessment.

Calculation of Impacts at Ecological Receptors

Nitrogen and acid deposition rates have been derived from the factored annual NO_x concentrations for comparison against the appropriate Critical Loads for each ecological habitat site. Nitrogen and acid deposition have been calculated following the methodology set out in AQTAG06[7]. AQTAG06 recommends the deposition rates and conversion factors, presented in Table 7, to convert from µg/m^3 i.e. concentration in air, to kgN/ha/year, required to assess nitrogen deposition against the relevant Critical Load, and keq/ha/year for assessing acid deposition, which is comprised of both nitrogen and sulphur, against the Critical Load. It should be noted that as the Facility is operated on natural gas it will not have any emissions of sulphur.

Deposition rates vary between grassland and woodland habitats and will depend on the ecological interest feature for each site. The relevant interest feature has been identified for each site and the appropriate deposition rate (grassland or woodland). As the main interest feature of the modelled ecological sites are all

[6] Environment Agency (n.d.), "Conversion Ratios for NO_x and NO_2," EA - Air Quality Modelling and Assessment Unit. https://webarchive.nationalarchives.gov.uk/ukgwa/20140328232919/http:/www.environment-agency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf
[7] Environment Agency AQTAG06 Technical guidance of detailed modelling approach for an appropriate assessment of emissions to air.

comprised of grassland type habitats (i.e. coastal saltmarsh, coastal sand dunes and coastal / floodplain grazing marshes) only the grassland deposition rates have been used when assessing annual nitrogen and acid deposition.

Table 7: AQTAG06 Deposition Rates and Conversion Factors

Parameter	Grassland	Woodland
Deposition Velocity NO_x (m/s)	0.0015	0.003
Conversion of annual NO_x concentrations (µg/m^2/s) to nitrogen deposition (kgN/ha/yr)	96	96
Conversion of annual nitrogen deposition (kg N/ha/year) to acid deposition (keq/ha/yr)	0.071428	0.071428

It should be noted that the maximum modelled NO_x PC for each ecological site has been used in the calculation of nitrogen and acid deposition values. Therefore, if the NO_x concentration or nitrogen / acid deposition rate presented in the results is below the relevant Critical Level or Load then the impact on the whole site will also be below the relevant criteria.

Human Health Significance Criteria

The EA's Risk Assessment for Specific Activities[2] guidance identifies stage one screening criteria for the comparison of PC against EALs and states that an emission may be considered to have an insignificant impact where:

- Short term PC <=10% of the EAL; and
- Long term PC <=1% of the EAL.

The second stage of the EA screening process considers the PCs in the context of the existing background pollutant concentrations. For long-term PCs the Predicted Environmental Concentration (PEC) is calculated, with the PEC representing the PC plus annual background concentration, and is subsequently compared to the EAL. In comparison, for short-term impacts, the PC is compared to the EAL minus double the background concentration. The EA considered the effects of an emission source to be negligible where the:

- Short term PC represents <20% of the short term EAL (minus twice the long-term background); and
- Long term PEC represents <70% of the EAL.

The EA's Risk Assessment guidance indicates that where EALs are likely to be breached as a result of contributions from an installation, or where installation releases constitute a major proportion of the standard or objective, such releases are likely to be considered unacceptable.

Where the PEC is not predicted to exceed the EAL and the proposed emissions comply with the best available techniques associated emission levels (BAT-AEL), or equivalent requirements, the emissions may be considered acceptable by the EA.

Ecological Significance Criteria

The EA's Risk Assessment guidance states that, for European Sites and SSSIs, PCs may be considered to have an insignificant impact at the first stage of screening if the:

- Short term PC <=10% of the Critical Level / Critical Load; and
- Long term PC <=1% of the Critical Level / Critical Load.

If these requirements are not met further assessment is required. For long term impacts, the PEC must be calculated and if it is less than 70% of the Critical Level / Critical Load, the impacts are considered insignificant. If the short-term PC is greater than 10% of the Critical Level / Critical Load then once more the PC is compared to the Critical Level / Critical Load mins double the background concentration to determine if it exceeds 20% of the Critical Level / Critical Load. If these values are exceeded then further assessment may be required by an appropriately qualified ecologist to determine if the predicted PCs are significant in the context of the ecological habitat as part of a Habitat Risk Assessment (HRA).

For local nature sites, the EA's Risk Assessment guidance states that PCs may be considered to have an insignificant impact where the:

- Short term PC <100% of the Critical Level or Critical Load; and
- Long term PC <100% of the Critical Level or Critical Load.

The EA's Risk Assessment guidance screening criteria for significance of the PC have been applied to the outcome of the dispersion modelling for all identified ecological sites.

Assessment of Cumulative Effects

The use of recent monitoring data is intended to ensure that baseline air quality reported in this assessment is representative of actual conditions and that potential effects are assessed appropriately. The inclusion of other developments in the assessment is to ensure that changes since the monitoring data was gathered are included within the baseline data.

The following developments have been identified as potentially having a significant effect on air quality within Great Yarmouth:

- Third River Crossing, Great Yarmouth – planning granted and currently under construction.

All other developments which are required to assess air quality will use baseline air quality data that includes the Facility as it currently operates. Current baseline air quality data does not indicate any location within Great Yarmouth where there is a risk of the AQS objective values being exceeded, and current applications and permitted developments are unlikely to give rise to concentrations above the AQS objectives.

Where this assessment indicates that changes to the operation of the Facility may give rise to significant effects in isolation, the cumulative, or 'in combination', effects with other permitted developments will be considered.

Assumptions and Limitations

The following assumptions have been made within this assessment, and have been agreed upon with RWE:

- The RWE Continuous Emissions Monitoring Systems (CEMS) data does not include recorded moisture content in the flue gas during sampling. For the purpose of modelling, moisture content has been assumed to be 8.6% based on professional experience with similar facilities.
- Detailed design data and flue gas composition is not available for the Facility operating at 430 MW_e. The flue gas volumetric flow rate has, therefore, been assumed to be proportional to power generation, and the increase in volumetric flow has been based on a similar proportion. Emission temperature, oxygen content and moisture content have been assumed to remain the same.
- Detailed building plans are not available, and building layout has been based on aerial photography and mapping. Building heights have been provided.
- The Facility has been assessed as being operational for 8,760 hours per year (all year) to capture all possible meteorological conditions and provide a conservative assessment of predicted impacts due to the current and proposed operation of the Facility. In practice, the Facility requires downtime for maintenance and repairs, and it is unlikely that the Facility will operate every hour in a year.
- NO_x emissions have been assessed at the permitted Emission Limit Values (ELVs), as set out in the Environmental Permit for the facility. During normal operation, it is expected that the Facility will operate at levels below the permitted ELVs, and this assessment represents a conservative assessment of potential emissions from the Facility. Both hourly and annual mean ELVs as set out in the Facility's permit have been used to capture the short-term and long-term PCs.

Baseline Air Quality

Baseline air quality conditions in the vicinity of the Facility have been evaluated through a review of local authority air quality annual status reports (ASR's), Defra published mapped background data and the APIS has been used to determine appropriate background concentrations and deposition rates at ecological receptors. As described, the key pollutants of concern resulting from the operation of the Facility are oxides of nitrogen, NO_2 and CO, therefore the assessment of baseline conditions considers these pollutants only.

Great Yarmouth Borough Council (GYBC) do not currently have any declared Air Quality Management Areas (AQMAs) within their jurisdiction. GYBC undertakes both automatic (continuous) and non-automatic (passive) monitoring of NO_2. A summary of the latest GYBC air quality monitoring data for NO_2 in the vicinity of the Facility, obtained from GYBC's latest published Air Quality ASR[8], is presented in Table 8 and their locations illustrated in Figure 1.

Table 8. Annual Mean NO_2 Results in the Vicinity of the Facility

Site ID	OS Grid Ref (X,Y)	Site Type	Distance to Site (km)	NO_2 Annual Mean Concentration (µg/m^3)				
				2015	2016	2017	2018	2019
CM2	652983,305658	Urban Background	0.6	N/A*	N/A*	N/A*	15	15
DT1	652054,308187	Roadside	3.2	21.9	21.1	25.6	22.5	19.6
DT2	652079,307828	Roadside	2.9	22.5	21.2	20.9	19.4	19.5
DT3	652105,307664	Roadside	2.7	25.4	24.4	21.8	22.2	20.1
DT5	652518,306863	Roadside	1.9	23.8	22.9	21.7	18.9	18.9
DT6	652569,306536	Roadside	1.5	24.4	22.2	22.3	19.8	19.0
DT7	652611,306224	Roadside	1.2	20.9	20.3	19	18.1	17.1
DT4	652045,307417	Roadside	2.6	37.4	33.2	36.7	30.3	30.8
DT9	652069,307871	Roadside	2.9	19.9	18.5	18.8	17.0	15.4
DT10	652321,307321	Roadside	2.4	32.8	33.7	33.2	29.8	28.1
DT11	652421,307184	Roadside	2.2	31.6	27.4	27.9	21.6	22.1
DT12	651993,307370	Roadside	2.5	N/A	24.9	23.3	21.0	18.4
DT13a	652983,305658	Urban Background	0.6	N/A*	N/A*	N/A*	14.0	14.3
DT13b			0.6	N/A*	N/A*	N/A*	14.0	14.9
DT13c			0.6	N/A*	N/A*	N/A*	13.6	15.4

*Note: * Monitor moved at the end of 2017/ start of 2018*

The greatest concentration of NO_2 recorded in 2019, i.e. before the Covid pandemic and subsequent travel restrictions, was 30.8 µg/m^3, recorded at DT4 located approximately 2.6 km north-west of the Facility. DT4 is located on the A1243/Pasteur Road, a main road into Great Yarmouth and is representative of locations near to main roads. Background concentrations recorded at CM2 and DT13 (a triplicate diffusion tube site collocated with the CM2 automatic monitor), are approximately 15 µg/m^3. All recorded concentrations in 2019 are well within the EAL of 40 µg/m^3, with concentrations showing a gradual decline since 2015 at the majority of sites. GYBC does not undertake any monitoring of CO, therefore it is not possible to determine a baseline CO concentration for the area.

Defra produces maps of background pollutant concentrations covering the whole of the UK[9] for use by local authorities and consultants in the completion of LAQM reports and Air Quality Assessments where local background monitoring is unavailable or inappropriate for use. The maps provided background pollutant concentrations for each 1-km grid square within the UK for all years between 2018 and 2030.

A comparison between the 2018 Defra mapped background concentrations and monitored NO_2 concentrations at the council's CM2 urban background monitoring location is presented in Table 9. This comparison shows that the Defra mapped background concentrations are much more conservative than the background urban monitoring undertaken by GYBC.

[8] Great Yarmouth Borough Council, 2019, 2019 Air Quality Annual Status Report, December 2019
[9] Defra, 2022, Background Mapping data for local authorities, url: https://uk-air.defra.gov.uk/data/laqm-background-maps, accessed: 16/12/2022

Table 9. Defra Mapped Background VS Monitored Urban Background NO_2 Concentrations (µg/m³)

Defra Grid Square Correspondent to the CM2 Monitoring Location	Defra Mapped Annual Mean Concentration (µg/m³)		CM2 Monitored Annual Mean Concentration (µg/m³)	
	2018	2019	2018	2019
652500,305500	29.4	28.9	15	15

The Facility is located within OS grid square centred upon 653500, 305500. The average background concentrations for this grid square and the surrounding grid squares have been determined from the Defra mapped values in 2018 and 2023 are given in Table 10. The latest background maps published by Defra for CO are from 2001. The Defra mapped background CO concentrations from 2001 have therefore these have been used in this assessment which is considered to be conservative.

Table 10. Defra Mapped Background Pollutant Concentrations at the Facility

Pollutant	Annual Mean Concentration (µg/m³)		
	2001	2018	2023
NO_2	N/A	22.0	15.9
NO_x	N/A	34.3	20.2
CO	287.7	N/A	N/A

Background concentrations of oxides of nitrogen and nitrogen/acid deposition at the ecological receptors considered in this assessment have been sourced from the APIS database for the 2019 mid-year concentrations[3]. Background concentrations of the 24-hour mean oxides of nitrogen have been calculated from the annual mean by applying a factor of 1.5, in line with published guidance[2]. The maximum reported background concentrations for each ecological receptor reported on APIS are shown in Table 11.

Table 11. Background Concentrations and Deposition Rates at Ecological Receptors

Ecology site	Background NO_x Concentration (µg/m³)		Background Nitrogen Deposition (kgN/ha/yr)	Background Acid Deposition (keq/ha/yr)
	Annual Mean	24-hour Mean*		
Breydon Water	40.1	60.2	38.8	2.5
Great Yarmouth North Denes	15.8	23.7	16.2	1.2
Broadland	22.5	33.8	39.2	2.9

Source: APIS

Note: * daily mean background concentrations have been derived by multiplying the annual concentration by 1.5.

Modelled Results

Human Health Receptors

Predicted annual mean PC of NO_2, 99.79th percentile of NO_2, 1-Hour Max CO and 8-Hour Rolling Mean at the modelled receptor locations and the point of maximum impact on land in Scenario 1 (the Facility currently operating as permitted) are displayed in Table 12 to Table 15.

Table 12. Scenario 1 – Annual Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1%
R3	652647	305270	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1%
R4	653041	305798	0.3	0.4	0.3	0.4	0.3	0.4	0.9%
R5	653133	305763	0.4	0.5	0.5	0.5	0.4	0.5	1.2%
R6	652798	305988	0.1	0.2	0.1	0.1	0.1	0.2	0.4%
R7	652890	304431	0.1	0.1	0.1	0.1	0.1	0.1	0.2%
R8	652927	304164	0.1	0.1	0.1	0.1	0.1	0.1	0.4%
Grid Max	-	-	0.6	0.7	0.7	0.8	0.6	0.8	2.0%
EAL					**40**				

The Facility operating as currently permitted (420 MW_e generating capacity) is predicted to contribute up to 0.8 µg/m^3 (2%) of the EAL for annual mean NO_2 (40 µg/m^3). As this represents more than 1% of the EA stage 1 screening criteria it cannot be scoped out and the second stage screening criteria have to be considered. The 2023 Defra mapped annual mean background NO_2 concentration, for the grid square which encompasses the point of maximum impact (653500, 305500), is 14.1 µg/m^3. As such the maximum annual PEC is predicted to be 14.9 µg/m^3 (37.3% of the EAL), well below 70% of the EAL, and so can be considered insignificant in accordance with the EA stage 2 screening criteria. It should also be noted that the maximum PC occurs at a point which is located out to sea (north east of the Facility), and, therefore, there is no relevant exposure at this location, i.e. no receptor will be present for a period comparable to the annual mean EAL.

Table 13. Scenario 1 – 99.79th Percentile 1-hour Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	1.1	1.5	1.3	1.4	1.3	1.5	0.8%
R2	652719	304997	1.1	1.6	1.4	1.5	1.6	1.6	0.8%
R3	652647	305270	1.5	1.9	1.9	1.7	1.5	1.9	1.0%
R4	653041	305798	4.7	6.6	6.0	6.8	5.5	6.8	3.4%
R5	653133	305763	7.0	7.6	7.4	7.6	7.1	7.6	3.8%
R6	652798	305988	2.6	2.8	2.2	2.6	2.7	2.8	1.4%
R7	652890	304431	1.7	1.6	1.8	1.8	2.1	2.1	1.0%
R8	652927	304164	3.7	2.8	4.0	3.3	3.4	4.0	2.0%
Grid Max			8.5	8.6	8.4	8.7	8.1	8.7	4.3%
EAL					**200**				

The Facility operating as currently permitted (420 MW_e generating capacity) is predicted to contribute up to 8.7 µg/m^3 (4.3%) of the EAL for 1-hour mean NO_2 (200 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 14. Scenario 1 – Maximum 1-hour Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	20.4	20.8	20.2	19.1	22.4	22.4	0.1%
R2	652719	304997	21.0	21.1	20.6	20.0	20.0	21.1	0.1%
R3	652647	305270	23.3	22.6	21.8	22.2	19.6	23.3	0.1%
R4	653041	305798	63.7	64.4	63.8	63.7	62.9	64.4	0.2%
R5	653133	305763	67.6	69.0	68.0	67.2	66.3	69.0	0.2%
R6	652798	305988	26.2	28.3	27.8	27.4	26.0	28.3	0.1%
R7	652890	304431	26.9	22.0	26.4	26.3	25.3	26.9	0.1%
R8	652927	304164	42.0	40.5	43.5	44.1	43.4	44.1	0.1%
Grid Max			87.8	91.7	77.1	77.4	76.9	91.7	0.3%
EAL					**30,000**				

The Facility operating as currently permitted (420 MW_e generating capacity) is predicted to contribute up to 91.7 µg/m^3 (0.3%) of the 1-hour mean EAL for CO (30,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 15. Scenario 1 – Maximum 8-Hour Rolling Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	7.2	9.1	9.3	9.4	10.4	10.4	0.1%
R2	652719	304997	9.6	11.5	8.6	14.0	11.9	14.0	0.1%
R3	652647	305270	14.2	14.3	17.2	12.0	11.2	17.2	0.2%
R4	653041	305798	28.2	45.9	42.6	50.0	34.5	50.0	0.5%
R5	653133	305763	45.2	59.4	54.8	64.1	53.4	64.1	0.6%
R6	652798	305988	20.3	19.5	18.4	20.2	20.9	20.9	0.2%
R7	652890	304431	9.1	11.7	12.1	11.5	13.0	13.0	0.1%
R8	652927	304164	26.5	15.6	27.6	22.6	25.9	27.6	0.3%
Grid Max			75.0	73.9	72.2	75.6	73.1	75.6	0.8%
EAL					**10,000**				

The Facility operating as currently permitted (420 MW_e generating capacity) is predicted to contribute up to 75.6 µg/m^3 (0.8%) of the running 8-hour EAL for CO (10,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Ecological Receptors

Table 16. Scenario 1 – Annual Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of Critical Level
Breydon Water	652084	304990	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Great Yarmouth North Denes	652984	303390	0.2	0.2	0.2	0.1	0.1	0.2	0.5%
Broadland	644684	304810	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Kitchener Road Cemetery	652784	308210	0.2	0.2	0.2	0.1	0.1	0.2	0.6%
Critical Level					**30**				

The Facility operating as currently permitted (420 MW_e generating capacity) is predicted to contribute less than 1% of the Critical Level at any ecological receptor locations. As such, annual NO_x contributions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 17. Scenario 1 – Maximum 24-hour Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of Critical Level
Breydon Water	645084	304810	9.0	10.0	10.5	13.0	10.3	13.0	17.4%
Great Yarmouth North Denes	652884	311810	8.2	5.8	7.9	7.5	9.0	9.0	11.9%
Broadland	644684	304810	8.7	9.4	10.7	12.9	10.2	12.9	17.3%
Kitchener Road Cemetery	652784	308210	4.6	4.7	4.4	4.2	4.2	4.7	6.3%
Critical Level					**75**				

The Facility operating, as currently permitted, is predicted to contribute up to 13.0 µg/m^3 of NO_x at Breydon Water, which represents 17.4% of the maximum 24-hour mean Critical Level and so exceeds the EA short-term screening criteria of 100% of the Critical Level. The PC is also predicted to exceed 10% of the 24-hour mean Critical Level at Great Yarmouth North Denes and Broadland. As such, PC's from the Facility cannot be considered insignificant, in accordance with the EA stage 1 screening criteria, at Breydon Water, Great Yarmouth North Denes or Broadland.

PC's to Kitchener Road Cemetery, are below 10% of the Critical Level and, as it's a CWS, can be considered insignificant in accordance with the EA Stage 1 screening criteria.

The predicted maximum PEC at each ecological site (Breydon Water, Great Yarmouth North Denes and Broadland) is presented in Table 18.

Table 18. Scenario 1 – Maximum 24-hour Mean NO_x PEC (µg/m^3)

Receptor ID	X	Y	Max PC	Background NO_x	Max PEC	PC % of EAL*	PEC % of Critical Level
Breydon Water	645084	304810	13.0	60.2	73.2	87.7%	97.6%
Great Yarmouth North Denes	652884	311810	9.0	23.7	32.7	17.5%	43.5%
Broadland	644684	304810	12.9	33.8	46.7	31.4%	62.3%
Critical Level				**75**			

* PC as a % of the EAL minus two times the annual background NO_x concentration.

While the short-term PC represents more than 20% of the Critical Level (minus two times the annual background NO_x concentration) the PEC is not predicted to exceed the Critical Level at any of the ecological sites. It should be noted that this assumes that this is based on the worst-case short-term PC from the Facility as set out in the Assumptions and Limitations section and, as the Facility is currently in operation, the PC from the Facility is already included within the background concentrations.

The modelling demonstrates that there is no location within the assessed ecological sites where the short-term PEC is predicted to exceed the Critical Level. It should also be noted that the principal effect of NO_x on ecological sites is to increase nitrogen and acid deposition. Table 19 and Table 20 illustrate that annual PCs represent less than 1% of the applicable nitrogen Critical Load and acid CLF respectively. As such contributions of daily NO_x at ecological sites is not considered significant.

Table 19. Scenario 1 – Annual Mean Nitrogen Deposition (kgN/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of Min Critical Load
Breydon Water	652084	304990	0.01	0.02	0.02	0.02	0.02	0.02	0.1%
Great Yarmouth North Denes	652984	303390	0.02	0.02	0.02	0.02	0.02	0.02	0.3%
Broadland	644684	304810	0.01	0.02	0.01	0.02	0.02	0.02	N/A
Kitchener Road Cemetery	652784	308210	0.02	0.02	0.02	0.02	0.02	0.02	N/A
Critical Load					**See Table 5**				

The Scenario 1 maximum nitrogen deposition PC is predicted to represent less than 1% of the minimum Critical Load at any ecological receptor locations. As such, annual nitrogen deposition can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 20. Scenario 1 – Annual Mean Acid Deposition (keq/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	Max PC % of CLF
Breydon Water	652084	304990	0.001	0.001	0.001	0.002	0.001	0.002	<0.6%
Great Yarmouth North Denes	652984	303390	0.002	0.002	0.002	0.002	0.002	0.002	<0.6%
Broadland	644684	304810	0.001	0.001	0.001	0.001	0.001	0.001	N/A
Kitchener Road Cemetery	652784	308210	0.002	0.002	0.002	0.002	0.001	0.002	N/A
Critical Load					**See Table 5**				

The Scenario 1 maximum acid deposition PC is predicted to represent less than 1% of the acid deposition CLF at any ecological receptor locations. As such, annual acid deposition as a result of emissions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Scenario 2

Human Health Receptors

The predicted Process Contributions (PCs) at human health receptors due to the Facility in Scenario 2 (operating at 430 MW_e operating capacity) are shown in Table 21 to Table 24 while Table 25 to Table 28 present the change in PC's between Scenario 1 and Scenario 2 at modelled human health receptors.

Table 21. Scenario 2 – Annual Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.1%
R3	652647	305270	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1%
R4	653041	305798	0.3	0.4	0.3	0.4	0.3	0.4	0.9%
R5	653133	305763	0.3	0.5	0.5	0.5	0.4	0.5	1.2%
R6	652798	305988	0.1	0.2	0.1	0.1	0.1	0.2	0.4%
R7	652890	304431	0.1	0.1	0.1	0.1	0.1	0.1	0.2%
R8	652927	304164	0.1	0.1	0.1	0.1	0.1	0.1	0.4%
Grid Max			0.6	0.7	0.7	0.8	0.6	0.8	2.0%
EAL					**40**				

Assuming the Facility operated at 430 MW_e all year, the maximum PC at any location is predicted to be 0.8 µg/m^3 (2%) of the EAL for annual mean NO_2 (40 µg/m^3). As this represents more than 1% of the EA stage 1 screening criteria it cannot be scoped out and the second stage screening criteria have to be considered. The 2023 Defra mapped annual mean background NO_2 concentration, for the grid square which encompasses the point of maximum impact (653500, 305500), is 14.1 µg/m^3. As such the maximum annual PEC is predicted to be 14.9 µg/m^3 (37.3% of the EAL), well below 70% of the EAL, and so can be considered insignificant in accordance with the EA stage 2 screening criteria.

Table 22. Scenario 2 – 99.79th Percentile 1-hour Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	1.1	1.5	1.3	1.4	1.3	1.5	0.8%
R2	652719	304997	1.1	1.6	1.4	1.5	1.6	1.6	0.8%
R3	652647	305270	1.5	1.9	1.9	1.7	1.5	1.9	1.0%
R4	653041	305798	4.8	6.7	6.1	6.8	5.5	6.8	3.4%
R5	653133	305763	7.0	7.7	7.5	7.7	7.2	7.7	3.9%
R6	652798	305988	2.6	2.8	2.2	2.7	2.7	2.8	1.4%
R7	652890	304431	1.7	1.6	1.8	1.8	2.1	2.1	1.0%
R8	652927	304164	3.7	2.8	4.1	3.3	3.5	4.1	2.0%
Grid Max			8.6	8.6	8.5	8.7	8.2	8.7	4.4%
EAL					**200**				

Assuming the Facility operated at 430 MW_e all year, it is predicted to contribute up to 8.7 µg/m^3 (4.3%) of the EAL for 1-hour mean NO_2 (200 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 23. Scenario 2 – Maximum 1-hour Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	20.4	21.3	20.2	19.6	22.9	22.9	0.1%
R2	652719	304997	21.0	21.6	20.7	20.5	20.4	21.6	0.1%
R3	652647	305270	23.4	23.2	21.9	22.8	20.1	23.4	0.1%
R4	653041	305798	64.5	65.9	64.6	65.2	64.4	65.9	0.2%
R5	653133	305763	68.4	70.6	68.9	68.8	67.9	70.6	0.2%
R6	652798	305988	26.3	29.0	27.9	28.1	26.6	29.0	0.1%
R7	652890	304431	27.2	22.5	26.6	26.9	25.9	27.2	0.1%
R8	652927	304164	42.2	41.5	44.1	45.1	44.4	45.1	0.2%
Grid Max			89.8	93.9	77.8	79.2	78.7	93.9	0.3%
EAL					**30,000**				

Assuming the Facility operated at 430 MW_e all year, it is predicted to contribute up to 93.9 µg/m^3 (0.3%) of the EAL for 1-hour mean CO (30,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 24. Scenario 2 – Maximum 8-Hour Rolling Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	7.2	9.3	9.4	9.6	10.6	10.6	0.1%
R2	652719	304997	9.6	11.8	8.7	14.4	12.2	14.4	0.1%
R3	652647	305270	14.3	14.6	17.2	12.3	11.4	17.2	0.2%
R4	653041	305798	28.2	47.0	43.1	51.2	35.4	51.2	0.5%
R5	653133	305763	45.1	60.9	55.4	65.6	54.6	65.6	0.7%
R6	652798	305988	20.4	20.0	18.5	20.7	21.4	21.4	0.2%
R7	652890	304431	9.2	12.0	12.1	11.8	13.4	13.4	0.1%
R8	652927	304164	26.6	15.9	27.9	23.1	26.6	27.9	0.3%
Grid Max			75.7	75.7	72.5	77.4	74.8	77.4	0.8%
EAL					**10,000**				

Assuming the Facility operated at 430 MW_e all year, it is predicted to contribute up to 77.4 µg/m^3 (0.8%) of the running 8-hour EAL for CO (10,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Predicted Change

The predicted changes in PCs between Scenario 1 and Scenario 2 at modelled human health receptors are shown in Table 25 to Table 28.

Table 25. Scenario 2 – Change in Annual Mean NO_2 PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R5	653133	305763	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R8	652927	304164	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Grid Max			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
EAL					**40**				

Table 26. Scenario 2 – Change in 99.79th Percentile of 1-hour Mean NO_2 PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	<0.1	0.1	0.1	<0.1	<0.1	0.1	<0.1%
R5	653133	305763	<0.1	0.1	0.1	0.1	0.1	0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R8	652927	304164	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1%
Grid Max			0.1	0.1	0.1	0.1	0.1	0.1	<0.1%
Criteria					**200**				

Table 27. Scenario 2 – Change in Maximum 1-hour Mean CO PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	0.5	<0.1	0.5	0.5	0.5	<0.1%
R2	652719	304997	<0.1	0.5	<0.1	0.5	0.5	0.5	<0.1%
R3	652647	305270	0.1	0.5	<0.1	0.5	0.5	0.5	<0.1%
R4	653041	305798	0.8	1.5	0.8	1.5	1.5	1.5	<0.1%
R5	653133	305763	0.8	1.6	0.9	1.6	1.6	1.6	<0.1%
R6	652798	305988	0.1	0.7	0.1	0.7	0.6	0.7	<0.1%
R7	652890	304431	0.3	0.5	0.2	0.6	0.6	0.6	<0.1%
R8	652927	304164	0.3	1.0	0.5	1.0	1.0	1.0	<0.1%
Grid Max			2.0	2.2	0.7	1.8	1.8	2.2	<0.1%
Criteria					**30,000**				

Table 28. Scenario 2 – Change in Maximum 8-hour Rolling Mean CO PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	0.2	<0.1	0.2	0.2	0.2	<0.1%
R2	652719	304997	<0.1	0.3	<0.1	0.3	0.3	0.3	<0.1%
R3	652647	305270	0.1	0.3	<0.1	0.3	0.3	0.3	<0.1%
R4	653041	305798	0.1	1.1	0.5	1.2	0.8	1.2	<0.1%
R5	653133	305763	-0.1	1.4	0.6	1.5	1.3	1.5	<0.1%
R6	652798	305988	0.1	0.5	0.1	0.5	0.5	0.5	<0.1%
R7	652890	304431	0.1	0.3	<0.1	0.3	0.3	0.3	<0.1%
R8	652927	304164	0.1	0.4	0.3	0.5	0.6	0.6	<0.1%
Grid Max			0.7	1.8	0.3	1.8	1.7	1.8	<0.1%
Criteria					**10,000**				

All changes in PCs when comparing Scenarios 1 and 2 are less than 0.1% of the relevant EAL's at any location within the study area. There is predicted to be a slight increase in PCs of CO over 1-hour and 8-hours which is likely due to the increased emission volume when compared to Scenario 1, however, as the PC remains well below 10% of the applicable EAL this change is not considered significant.

Ecological Receptors

The predicted Process Contributions (PCs) at ecological receptors due to the Facility in Scenario 2 (operating at 430 MW_e operating capacity) are shown in Table 29 to Table 30.

Table 29. Scenario 2 – Annual Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	652084	304990	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Great Yarmouth North Denes	652984	303390	0.2	0.2	0.2	0.1	0.1	0.2	0.5%
Broadland	644684	304810	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Kitchener Road Cemetery	652784	308210	0.2	0.2	0.2	0.1	0.1	0.2	0.6%
Critical Level					**30**				

The Scenario 2 PC demonstrates that if the Facility were to operate at its maximum capacity (430 MW_e) all year the PC from the Facility would represent less than 1% of the Critical Level at any ecological receptor locations. As such, annual NO_x contributions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 30. Scenario 2 – Maximum 24-hour Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	645084	304810	9.1	10.1	10.6	13.1	10.3	13.1	17.5%
Great Yarmouth North Denes	652884	311810	8.3	5.9	8.0	7.5	9.0	9.0	12.1%
Broadland	644684	304810	8.8	9.5	10.9	13.1	10.3	13.1	17.4%
Kitchener Road Cemetery	652784	308210	4.6	4.7	4.4	4.3	4.2	4.7	6.3%
Critical Level					**75**				

The Scenario 2 maximum 24-hour Mean NO_x PC of 13.1 µg/m^3 is predicted to occur at Breydon Water, which represents 17.4% of the maximum 24-hour mean Critical Level and so exceeds the EA short-term screening criteria of 10% of the Critical Level. The PC is also predicted to exceed 10% of the 24-hour mean Critical Level at Great Yarmouth North Denes and Broadland. As such, PC's from the Facility cannot be considered insignificant, in accordance with the EA stage 1 screening criteria, at Breydon Water, Great Yarmouth North Denes or Broadland.

PC's to Kitchener Road Cemetery, are below 10% of the Critical Level and, as it's a CWS, can be considered insignificant in accordance with the EA Stage 1 screening criteria.

The predicted maximum Scenario 2 PEC at each ecological site (Breydon Water, Great Yarmouth North Denes and Broadland) is presented in Table 31.

Table 31. Scenario 2 – Maximum 24-hour Mean NO_x PEC (µg/m^3)

Receptor ID	X	Y	Max PC	Background NO_x	Max PEC	PC % of EAL*	PEC % of EAL
Breydon Water	645084	304810	13.1	60.2	73.3	88.3%	97.7%
Great Yarmouth North Denes	652884	311810	9.0	23.7	32.7	17.6%	43.7%
Broadland	644684	304810	13.1	33.8	46.8	31.7%	62.4%
Critical Level				**75**			

* PC as a % of the EAL minus two times the annual background NO_x concentration.

While the short-term PC represents more than 20% of the Critical Level (minus two times the annual background NO_x concentration) the PEC is not predicted to exceed the Critical Level at any of the ecological sites. It should be noted that this assumes that this is based on the worst-case short-term PC from the Facility and, as the Facility is currently in operation, the PC from the Facility is already included within the background concentrations.

The modelling demonstrates that there is no location within the assessed ecological sites where the short-term PEC is predicted to exceed the Critical Level. It should also be noted that the principal effect of NO_x on ecological sites is to increase nitrogen and acid deposition. Table 32Table 19 and Table 33 illustrates that annual PCs represent less than 1% of the applicable nitrogen Critical Load and acid CLF respectively. As such contributions of daily NO_x at ecological sites is not considered significant.

Table 32. Scenario 2 – Annual Mean Nitrogen Deposition (kgN/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of Min Critical Load
Breydon Water	652084	304990	0.01	0.02	0.02	0.02	0.02	0.02	0.1%
Great Yarmouth North Denes	652984	303390	0.02	0.02	0.02	0.02	0.02	0.02	0.3%
Broadland	644684	304810	0.01	0.02	0.01	0.02	0.02	0.02	N/A
Kitchener Road Cemetery	652784	308210	0.02	0.02	0.02	0.02	0.02	0.02	N/A
Critical Load					**See Table 5**				

The Scenario 2 maximum nitrogen deposition PC is predicted to represent less than 1% of the minimum Critical Load at any ecological receptor locations. As such, annual nitrogen deposition can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 33. Scenario 2 – Annual Mean Acid Deposition (keq/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	Max PC % of CLF
Breydon Water	652084	304990	0.001	0.001	0.001	0.002	0.001	0.002	<0.6%
Great Yarmouth North Denes	652984	303390	0.002	0.002	0.002	0.002	0.002	0.002	<0.6%
Broadland	644684	304810	0.001	0.001	0.001	0.001	0.001	0.001	N/A
Kitchener Road Cemetery	652784	308210	0.002	0.002	0.002	0.002	0.001	0.002	N/A
Critical Load					**See Table 5**				

The Scenario 2 maximum acid deposition PC is predicted to represent less than 1% of the of the acid deposition CLF at any ecological receptor locations. As such, annual acid deposition as a result of emissions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Predicted Change

The predicted changes in PCs at ecological receptors between Scenario 1 and Scenario 2 are shown in Table 34 to Table 35.

Table 34. Scenario 2 – Change in Annual Mean NO_x PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	652084	304990	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Great Yarmouth North Denes	652984	303390	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Broadland	644684	304810	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Kitchener Road Cemetery	652784	308210	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Critical Level					**30**				

Table 35. Scenario 2 – Change in Maximum 24-hour Mean NO_x PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	645084	304810	0.1	0.1	0.1	0.1	<0.1	0.1	0.1%
Great Yarmouth North Denes	652884	311810	<0.1	0.1	0.1	0.1	0.1	0.1	0.1%
Broadland	644684	304810	0.1	0.1	0.1	0.1	0.1	0.1	0.2%
Kitchener Road Cemetery	652784	308210	0.1	0.0	0.1	0.1	0.0	0.1	0.1%
Critical Level					**75**				

Scenario 3

Human Health Receptors

The predicted Process Contributions (PCs) at human health receptors due to the Facility in Scenario 3 (operating primarily at 420 MW_e operating capacity except when conditions are favourable and allow 430 MW_e operations) are shown in Table 36 to Table 39 while Table 40 to Table 43 present the change in PC's between Scenario 1 and Scenario 3 at modelled human health receptors.

Table 36. Scenario 3 – Annual Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.1%
R3	652647	305270	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1%
R4	653041	305798	0.3	0.4	0.3	0.4	0.3	0.4	0.9%
R5	653133	305763	0.4	0.5	0.5	0.5	0.4	0.5	1.2%
R6	652798	305988	0.1	0.2	0.1	0.1	0.1	0.2	0.4%
R7	652890	304431	0.1	0.1	0.1	0.1	0.1	0.1	0.2%
R8	652927	304164	0.1	0.1	0.1	0.1	0.1	0.1	0.4%
Grid Max			0.6	0.7	0.7	0.8	0.6	0.8	2.0%
Criteria					**40**				

Assuming the Facility operated at 430 MW_e when ambient temperatures are 5ºC or less, the maximum PC at any location is predicted to be 0.8 µg/m^3 (2%) of the EAL for annual mean NO_2 (40 µg/m^3). As this represents more than 1% of the EA stage 1 screening criteria it cannot be scoped out and the second stage screening criteria have to be considered. The 2023 Defra mapped annual mean background NO_2 concentration, for the grid square which encompasses the point of maximum impact (653500, 305500), is 14.1 µg/m^3. As such the

maximum annual PEC is predicted to be 14.9 µg/m^3 (37.3% of the EAL), well below 70% of the EAL, and so can be considered insignificant in accordance with the EA stage 2 screening criteria.

Table 37. Scenario 3 – 99.79th Percentile 1-hour Mean NO_2 PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	1.1	1.5	1.3	1.4	1.3	1.5	0.8%
R2	652719	304997	1.1	1.6	1.4	1.5	1.6	1.6	0.8%
R3	652647	305270	1.5	1.9	1.9	1.7	1.5	1.9	1.0%
R4	653041	305798	4.7	6.6	6.0	6.9	5.4	6.9	3.4%
R5	653133	305763	6.9	7.6	7.4	7.6	7.2	7.6	3.8%
R6	652798	305988	2.6	2.8	2.2	2.6	2.7	2.8	1.4%
R7	652890	304431	1.7	1.6	1.8	1.8	2.1	2.1	1.0%
R8	652927	304164	3.7	2.8	4.0	3.2	3.4	4.0	2.0%
Grid Max			8.5	8.6	8.4	8.6	8.1	8.6	4.3%
Criteria					**200**				

Assuming the Facility operated at 430 MW_e when ambient temperatures are 5ºC or less, the maximum PC at any location is predicted to be up to 8.6 µg/m^3 (4.3%) of the EAL for 1-hour mean NO_2 (200 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 38. Scenario 3 – Maximum 1-hour Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	6.8	6.9	6.7	6.4	7.5	22.4	0.1%
R2	652719	304997	7.0	7.0	6.9	6.7	6.6	21.1	0.1%
R3	652647	305270	7.7	7.5	7.3	7.4	6.5	23.2	0.1%
R4	653041	305798	21.2	21.4	21.2	21.2	20.9	64.3	0.2%
R5	653133	305763	22.5	22.9	22.6	22.3	22.1	68.9	0.2%
R6	652798	305988	8.7	9.4	9.2	9.1	8.6	28.3	0.1%
R7	652890	304431	9.1	7.3	8.8	8.7	8.4	27.2	0.1%
R8	652927	304164	14.0	13.5	14.5	14.7	14.5	44.0	0.1%
Grid Max			87.8	91.7	77.0	77.3	76.8	91.7	0.3%
Criteria					**30,000**				

Assuming the Facility operated at 430 MW_e when ambient temperatures are 5ºC or less, the maximum PC at any location is predicted to be up to 91.7 µg/m^3 (0.3%) of the EAL for 1-hour mean CO (30,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Table 39. Scenario 3 – Maximum 8-Hour Rolling Mean CO PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	2.4	3.0	3.1	3.1	3.5	10.4	0.1%
R2	652719	304997	3.2	3.8	2.9	4.7	3.9	14.0	0.1%
R3	652647	305270	4.7	4.8	5.7	4.0	3.7	17.2	0.2%
R4	653041	305798	9.4	15.3	14.2	16.6	11.7	50.0	0.5%
R5	653133	305763	15.0	19.8	18.2	21.3	17.7	64.0	0.6%
R6	652798	305988	6.8	6.5	6.1	6.7	7.0	20.9	0.2%
R7	652890	304431	3.0	3.9	4.0	3.9	4.3	13.0	0.1%
R8	652927	304164	8.9	5.2	9.2	7.5	8.7	27.6	0.3%
Grid Max			74.9	73.9	72.1	75.6	73.0	75.6	0.8%
Criteria					**10,000**				

Assuming the Facility operated at 430 MWe when ambient temperatures are 5ºC or less, the maximum PC at any location is predicted to be up to 75.6 µg/m^3 (0.8%) of the running 8-hour EAL for CO (10,000 µg/m^3). As this represents less than 10% of the EAL it is considered insignificant in accordance with the EA stage 1 screening criteria.

Predicted Change

The predicted changes in PCs between Scenario 1 and Scenario 3 at modelled human health receptors are shown in Table 40 to Table 43.

Table 40. Scenario 3 – Change in Annual Mean NO_2 PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R5	653133	305763	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R8	652927	304164	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Grid Max			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Criteria					**40**				

Table 41. Scenario 3 – Change in 99.79th Percentile of 1-hour Mean NO_2 PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1%
R5	653133	305763	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R8	652927	304164	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Grid Max			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Criteria					**200**				

Table 42. Scenario 3 – Change in Maximum 1-hour Mean CO PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	<0.1%
R5	653133	305763	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	0.3	<0.1	<0.1	<0.1	<0.1	0.3	<0.1%
R8	652927	304164	-0.1	-0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Grid Max			0.0	0.0	-0.1	-0.1	-0.1	0.0	<0.1%
Criteria					**30,000**				

Table 43. Scenario 3 – Change in Maximum 8-hour Rolling Mean CO PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
R1	652734	304914	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R2	652719	304997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R3	652647	305270	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R4	653041	305798	<0.1	-0.1	<0.1	<0.1	0.6	0.6	<0.1%
R5	653133	305763	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	<0.1%
R6	652798	305988	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R7	652890	304431	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
R8	652927	304164	0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1%
Grid Max			-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	<0.1%
Criteria					**10,000**				

All changes in PCs when comparing Scenarios 1 and 3 are less than 0.1% of the relevant EAL's at any location within the study area. There is predicted to be a slight decrease in PCs of carbon monoxide over 1 hour and

over 8 hours, likely due to slightly improved dispersion of the flue gases due to the increased emission volume in colder, more stable conditions when compared to Scenario 1.

Ecological Receptors

The predicted Process Contributions (PCs) at ecological receptors due to the Facility in Scenario 3 (operating primarily at 420 MW_e operating capacity except when conditions are favourable and allow the CCGT to operate at 430 MW_e) are shown in Table 44 to Table 45.

Table 44. Scenario 3 – Annual Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	652084	304990	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Great Yarmouth North Denes	652984	303390	0.2	0.2	0.2	0.1	0.1	0.2	0.5%
Broadland	644684	304810	0.1	0.1	0.1	0.1	0.1	0.1	0.5%
Kitchener Road Cemetery	652784	308210	0.2	0.2	0.2	0.1	0.1	0.2	0.6%
Critical Level					**30**				

The Scenario 3 PC demonstrates that the if the Facility were to operate at its maximum capacity (430 MW_e generating capacity) only during optimum conditions (an ambient temperature of 5ºC or less) the PC from the Facility would represent less than 1% of the Critical Level at any ecological receptor locations. As such, annual NO_x contributions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 45. Scenario 3 – Maximum 24-hour Mean NO_x PC (µg/m^3)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	645084	304810	9.0	10.0	10.5	13.0	10.3	13.0	17.3%
Great Yarmouth North Denes	652884	311810	8.2	5.8	7.9	7.5	8.9	8.9	11.9%
Broadland	644684	304810	8.7	9.4	10.7	12.9	10.2	12.9	17.2%
Kitchener Road Cemetery	652784	308210	4.6	4.7	4.3	4.2	4.2	4.7	6.2%
Critical Level					**75**				

The Scenario 3 maximum 24-hour Mean NO_x PC of 13.0 µg/m^3 is predicted to occur at Breydon Water, which represents 17.3% of the maximum 24-hour mean Critical Level and so exceeds the EA short-term screening criteria of 10% of the Critical Level. The PC is also predicted to exceed 10% of the 24-hour mean Critical Level at Great Yarmouth North Denes and Broadland. As such, PC's from the Facility cannot be considered insignificant, in accordance with the EA stage 1 screening criteria, at Breydon Water, Great Yarmouth North Denes or Broadland.

PC's to Kitchener Road Cemetery, are below 10% of the Critical Level and, as it's a CWS, can be considered insignificant in accordance with the EA Stage 1 screening criteria.

The predicted maximum Scenario 2 PEC at each ecological site (Breydon Water, Great Yarmouth North Denes and Broadland) is presented in Table 31.

Table 46. Scenario 3 – Maximum 24-hour Mean NO_x PEC (µg/m^3)

Receptor ID	X	Y	Max PC	Background NO_x	Max PEC	PC % of EAL*	PEC % of EAL
Breydon Water	645084	304810	13.0	60.2	73.2	87.6%	97.5%
Great Yarmouth North Denes	652884	311810	8.9	23.7	32.6	17.4%	43.5%
Broadland	644684	304810	12.9	33.8	46.7	31.3%	62.2%
Critical Level				**75**			

* PC as a % of the EAL minus two times the annual background NO_x concentration.

While the short-term PC represents more than 20% of the Critical Level (minus two times the annual background NO_x concentration) the PEC is not predicted to exceed the Critical Level at any of the ecological sites. It should be noted that this assumes that this is based on the worst-case short-term PC from the Facility and, as the Facility is currently in operation, the PC from the Facility is already included within the background concentrations.

The modelling demonstrates that there is no location within the assessed ecological sites where the short-term PEC is predicted to exceed the Critical Level. It should also be noted that the principal effect of NO_x on ecological sites is to increase nitrogen and acid deposition. Table 47 and Table 48 illustrates that annual PCs represent less than 1% of the applicable nitrogen Critical Load and acid CLF respectively. As such contributions of daily NO_x at ecological sites is not considered significant.

Table 47. Scenario 3 – Annual Mean Nitrogen Deposition (kgN/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC % of Min Critical Load
Breydon Water	652084	304990	0.01	0.02	0.02	0.02	0.02	0.02	0.1%
Great Yarmouth North Denes	652984	303390	0.02	0.02	0.02	0.02	0.02	0.02	0.3%
Broadland	644684	304810	0.01	0.02	0.01	0.02	0.02	0.02	N/A
Kitchener Road Cemetery	652784	308210	0.02	0.02	0.02	0.02	0.02	0.02	N/A
Critical Load					**See Table 5**				

The Scenario 3 maximum nitrogen deposition PC is predicted to represent less than 1% of the minimum Critical Load at any ecological receptor locations. As such, annual nitrogen deposition can be considered insignificant in accordance with the EA stage 1 screening criteria.

Table 48. Scenario 3 – Annual Mean Acid Deposition (keq/ha/yr)

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	Max PC % of CLF
Breydon Water	652084	304990	0.001	0.001	0.001	0.002	0.001	0.002	<0.6%
Great Yarmouth North Denes	652984	303390	0.002	0.002	0.002	0.002	0.002	0.002	<0.6%
Broadland	644684	304810	0.001	0.001	0.001	0.001	0.001	0.001	N/A
Kitchener Road Cemetery	652784	308210	0.002	0.002	0.002	0.002	0.001	0.002	N/A
Critical Load					**See Table 5**				

The Scenario 3 maximum acid deposition PC is predicted to represent less than 1% of the of the acid deposition CLF at any ecological receptor locations. As such, annual acid deposition as a result of emissions from the Facility can be considered insignificant in accordance with the EA stage 1 screening criteria.

Predicted Change

The predicted changes in PCs at ecological receptors between Scenario 1 and Scenario 3 are shown in Table 49 to Table 50.

Table 49. Scenario 3 – Change in Annual Mean NO_x PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	652084	304990	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Great Yarmouth North Denes	652984	303390	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Broadland	644684	304810	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Kitchener Road Cemetery	652784	308210	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Critical Level					**30**				

Table 50. Scenario 3 – Change in Maximum 24-hour Mean NO_x PC (µg/m^3) vs Scenario 1

Receptor ID	X	Y	2017	2018	2019	2020	2021	Max PC	PC %age of EAL
Breydon Water	645084	304810	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1%
Great Yarmouth North Denes	652884	311810	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Broadland	644684	304810	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Kitchener Road Cemetery	652784	308210	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1%
Critical Level					**75**				

All changes in PCs when comparing Scenarios 2 and 3 against the current operation in Scenario 1 are less than or equal to 0.1% of the relevant EAL's at any location within the study area. It is considered unlikely that the change in the maximum allowed generating capacity would give rise to any significant effects at any ecological receptor within the study area.

Conclusion

AECOM have been commissioned by RWE to prepare a technical note which quantifies the likely impact of the Facility operating with a maximum output of 430 MW_e. The operator currently does not take into account the impacts of ambient factors on the CCGT power generation capability and restricts the facility to a maximum gross generation output of 420 MWe. Unrestricted, the facility could generate up to 430 MWe when ambient conditions are favourable (i.e. external temperatures are 5°C or less) and assuming there is a demand from the National Grid for the Facility to generate the additional electrical output.

This assessment has been undertaken to determine the predicted changes in concentrations at nearby sensitive receptors associated with the proposed change in Facility operations. The assessment has considered the following scenarios:

- Scenario 1 – Current baseline; operating all year per RWE's strict application of the term 'about', i.e. 420 MW_e (gross);
- Scenario 2 – Worst Case; impacts if the power station were to operate at 430 MW_e (gross) all year; and
- Scenario 3 – Realistic Case: The power station operates at 420 MW_e (gross) for the majority of the year except when the ambient temperature is favourable, i.e. 5°C or less, at which time the Facility would operate at 430 MW_e (gross).

In terms of human health the modelling has demonstrated that the PC of the CCGT under all three operating scenarios short-term NO_2 and CO contributions will represent less than 10% of the applicable EAL and as such can be considered insignificant in accordance with EA stage 1 screening criteria. Annual mean NO_2 concentrations are predicted to exceed 1% of the EA stage 1 screening criteria, however, the maximum PEC predicted in all scenarios is 37.3% of the EAL, significantly below the EA stage 2 assessment criteria of 70%. As such, the existing CCGT emissions when operating at 420 MWe (gross) and proposed change in CCGT operations (operating at 420 MWe (gross) for the majority of the year except when the ambient temperature is 5°C or less, when it would operate at 430 MWe (gross)) are both predicted to have an insignificant impact at

all modelled human health receptor locations. The change in NO_2 and CO concentrations at all receptor locations, for both Scenarios 2 and 3, are predicted to represent less than 0.1% of their respective EALs and, therefore, the impact of the proposed change is considered to be insignificant in terms of local air quality.

Annual mean PCs at ecological receptor locations are predicted to represent less than 1% of the NO_x Critical Level, nitrogen deposition Critical Load and acid deposition CLF in all scenarios. As such annual impacts at ecological receptors can be screened out as insignificant. While maximum daily NO_x PC's are predicted to exceed 10% of the EAL, with the subsequent PEC exceeding 20% of the EAL (minus double the annual NO_x background) the PEC is predicted to represent less than 100% of the Critical Load at each ecological site assessed in all scenarios. Given that the principal effect of NO_x on ecological sites is to increase nitrogen and acid deposition and that annual deposition PCs are predicted to represent less than 1% of the applicable nitrogen Critical Load and acid CLF respectively. The predicted daily NO_x PCs at ecological sites is not considered significant.

In terms of NO_x, concentrations at ecological sites, the change in PCs due to the change in Facility operations (Scenario 2 or 3 when compared to Scenario 1) is predicted to represent an increase in annual mean and maximum 24-hour NO_x concentrations of less than 0.1% of their respective critical levels. This is considered to be a negligible change especially given that this is predicted at the point of maximum impact at each ecological site.

Overall the predicted magnitude of change at both human health receptors and ecological receptors is considered to be imperceptible. As such, it is considered unlikely that allowing the Facility to operate at 430 MW_e during periods when the ambient temperatures are 5ºC or less will give rise to significant effects on local air quality.